

Package ‘sf’

March 22, 2018

Version 0.6-1

Title Simple Features for R

Description Support for simple features, a standardized way to encode spatial vector data. Binds to 'GDAL' for reading and writing data, to 'GEOS' for geometrical operations, and to 'PROJ' for projection conversions and datum transformations.

Depends R (>= 3.3.0), methods

Imports utils, stats, tools, graphics, grDevices, grid, Rcpp, DBI (>= 0.5), units (>= 0.4-6), classInt, magrittr

Suggests lwgeom (>= 0.1-2), maps, rgdal, rgeos, sp (>= 1.2-4), raster, spatstat, tmap, maptools, RSQLite, RPostgreSQL, tibble (>= 1.4.1), pillar, rlang, dplyr (>= 0.7-0), tidyr (>= 0.7-2), tidymodels, ggplot2, mapview, testthat, knitr, covr, microbenchmark, rmarkdown

LinkingTo Rcpp

VignetteBuilder knitr

SystemRequirements GDAL (>= 2.0.0), GEOS (>= 3.3.0), PROJ.4 (>= 4.8.0)

License GPL-2 | MIT + file LICENSE

URL <https://github.com/r-spatial/sf/>

BugReports <https://github.com/r-spatial/sf/issues/>

Collate RcppExports.R init.R crs.R bbox.R read.R db.R sfc.R sfg.R sf.R
bind.R wkb.R wkt.R plot.R geom.R transform.R sp.R grid.R
arith.R tidyverse.R cast_sfg.R cast_sfc.R graticule.R
datasets.R aggregate.R agr.R maps.R join.R sample.R valid.R
collection_extract.R jitter.R sgbp.R spatstat.R stars.R
gdal_utils.R

RoxygenNote 6.0.1

NeedsCompilation yes

Author Edzer Pebesma [aut, cre] (<<https://orcid.org/0000-0001-8049-7069>>),
Roger Bivand [ctb] (<<https://orcid.org/0000-0003-2392-6140>>),
Ian Cook [ctb],

Tim Keitt [ctb],
 Michael Sumner [ctb],
 Robin Lovelace [ctb],
 Hadley Wickham [ctb],
 Jeroen Ooms [ctb] (<<https://orcid.org/0000-0002-4035-0289>>),
 Etienne Racine [ctb]

Maintainer Edzer Pebesma <edzer.pebesma@uni-muenster.de>

Repository CRAN

Date/Publication 2018-03-22 12:40:41 UTC

R topics documented:

aggregate.sf	3
as	5
bgMap	5
bind	6
db_drivers	7
dplyr	7
extension_map	10
gdal	11
gdal_utils	12
geos_binary_ops	13
geos_binary_pred	15
geos_combine	17
geos_measures	18
geos_query	20
geos_unary	21
internal	23
is_driver_available	24
is_driver_can	24
merge.sf	25
ops	25
plot	26
prefix_map	31
rawToHex	31
sf	32
sfc	33
sf_extSoftVersion	34
sf_project	35
sgbp	35
st	36
stars	39
st_agr	40
st_as_binary	40
st_as_grob	42
st_as_sf	42
st_as_sfc	44

st_as_text	46
st_bbox	47
st_cast	50
st_cast_sfc_default	52
st_collection_extract	53
st_coordinates	54
st_crs	55
st_drivers	57
st_geometry	58
st_geometry_type	59
st_graticule	60
st_interpolate_aw	61
st_is	62
st_is_longlat	63
st_jitter	63
st_join	64
st_layers	65
st_line_sample	66
st_make_grid	67
st_precision	67
st_read	68
st_relate	71
st_sample	72
st_transform	73
st_viewport	75
st_write	76
st_zm	78
summary.sfc	79
tibble	80

Index**81**

aggregate.sf	<i>aggregate an sf object</i>
--------------	-------------------------------

Description

aggregate an sf object, possibly union-ing geometries

Usage

```
## S3 method for class 'sf'
aggregate(x, by, FUN, ..., do_union = TRUE, simplify = TRUE,
          join = st_intersects)
```

Arguments

x	object of class sf
by	either a list of grouping vectors with length equal to <code>nrow(x)</code> (see aggregate), or an object of class <code>sf</code> or <code>sfc</code> with geometries that are used to generate groupings, using the binary predicate specified by the argument <code>join</code>
FUN	function passed on to aggregate , in case <code>ids</code> was specified and attributes need to be grouped
...	arguments passed on to FUN
do_union	logical; should grouped geometries be unioned using st_union ?
simplify	logical; see aggregate
join	logical spatial predicate function to use if <code>by</code> is a simple features object or geometry; see st_join

Value

an `sf` object with aggregated attributes and geometries; additional grouping variables having the names of `names(ids)` or are named `Group.i` for `ids[[i]]`; see [aggregate](#).

Note

Does not work using the formula notation involving `~` defined in [aggregate](#).

Examples

```

m1 = cbind(c(0, 0, 1, 0), c(0, 1, 1, 0))
m2 = cbind(c(0, 1, 1, 0), c(0, 0, 1, 0))
pol = st_sfc(st_polygon(list(m1)), st_polygon(list(m2)))
set.seed(1985)
d = data.frame(matrix(runif(15), ncol = 3))
p = st_as_sf(x = d, coords = 1:2)
plot(pol)
plot(p, add = TRUE)
(p_ag1 = aggregate(p, pol, mean))
plot(p_ag1) # geometry same as pol
# works when x overlaps multiple objects in 'by':
p_buff = st_buffer(p, 0.2)
plot(p_buff, add = TRUE)
(p_ag2 = aggregate(p_buff, pol, mean)) # increased mean of second
# with non-matching features
m3 = cbind(c(0, 0, -0.1, 0), c(0, 0.1, 0.1, 0))
pol = st_sfc(st_polygon(list(m3)), st_polygon(list(m1)), st_polygon(list(m2)))
(p_ag3 = aggregate(p, pol, mean))
plot(p_ag3)
# In case we need to pass an argument to the join function:
(p_ag4 = aggregate(p, pol, mean,
  join = function(x, y) st_is_within_distance(x, y, dist = 0.3)))

```

as *Methods to coerce simple feature geometries to corresponding Spatial* objects*

Description

Methods to coerce simple feature geometries to corresponding Spatial* objects

Usage

```
as_Spatial(from, cast = TRUE, IDs = paste0("ID", 1:length(from)))
```

Arguments

from	object of class sfc_POINT, sfc_MULTIPPOINT, sfc_LINestring, sfc_MULTILINESTRING, sfc_POLYGON, or sfc_MULTIPOLYGON.
cast	logical; if TRUE, <code>st_cast</code> from before converting, so that e.g. GEOMETRY objects with a mix of POLYGON and MULTIPOLYGON are cast to MULTIPOLYGON.
IDs	character vector with IDs for the Spatial* geometries

Value

geometry-only object deriving from Spatial, of the appropriate class

Examples

```
nc = st_read(system.file("shape/nc.shp", package="sf"))
as_Spatial(st_geometry(nc[1,]))
```

bgMap *This is data included in sf*

Description

This is data included in sf

bind	<i>Bind rows (features) of sf objects</i>
------	-------------------------------------------

Description

Bind rows (features) of sf objects

Bind columns (variables) of sf objects

Usage

```
## S3 method for class 'sf'
rbind(..., deparse.level = 1)

## S3 method for class 'sf'
cbind(..., deparse.level = 1, sf_column_name = NULL)

st_bind_cols(...)
```

Arguments

... objects to bind; note that for the rbind and cbind methods, all objects have to be of class sf; see [dotsMethods](#)

deparse.level integer; see [rbind](#)

sf_column_name character; specifies active geometry; passed on to [st_sf](#)

Details

both rbind and cbind have non-standard method dispatch (see [cbind](#)): the rbind or cbind method for sf objects is only called when all arguments to be binded are of class sf.

If you need to cbind e.g. a data.frame to an sf, use [data.frame](#) directly and use [st_sf](#) on its result, or use [bind_cols](#); see examples.

st_bind_cols is deprecated; use cbind instead.

Value

cbind called with multiple sf objects warns about multiple geometry columns present when the geometry column to use is not specified by using argument sf_column_name; see also [st_sf](#).

Examples

```
crs = st_crs(3857)
a = st_sf(a=1, geom = st_sfc(st_point(0:1)), crs = crs)
b = st_sf(a=1, geom = st_sfc(st_linestring(matrix(1:4,2))), crs = crs)
c = st_sf(a=4, geom = st_sfc(st_multilinestring(list(matrix(1:4,2)))), crs = crs)
rbind(a,b,c)
rbind(a,b)
```

```

rbind(a,b)
rbind(b,c)
cbind(a,b,c) # warns
if (require(dplyr))
  dplyr::bind_cols(a,b)
c = st_sf(a=4, geomc = st_sfc(st_multilinestring(list(matrix(1:4,2))))), crs = crs)
cbind(a,b,c, sf_column_name = "geomc")
df = data.frame(x=3)
st_sf(data.frame(c, df))
dplyr::bind_cols(c, df)

```

db_drivers	<i>Drivers for which update should be TRUE by default</i>
------------	-----------------------------------------------------------

Description

Drivers for which update should be TRUE by default

Usage

```
db_drivers
```

Format

An object of class character of length 12.

dplyr	<i>Dplyr verb methods for sf objects</i>
-------	------------------------------------------

Description

Dplyr verb methods for sf objects. Geometries are sticky, use [as.data.frame](#) to let dplyr's own methods drop them.

Usage

```

filter.sf(.data, ..., .dots)

arrange.sf(.data, ..., .dots)

group_by.sf(.data, ..., add = FALSE)

ungroup.sf(x, ...)

mutate.sf(.data, ..., .dots)

```

```
transmute.sf(.data, ..., .dots)

select.sf(.data, ...)

rename.sf(.data, ...)

slice.sf(.data, ..., .dots)

summarise.sf(.data, ..., .dots, do_union = TRUE)

distinct.sf(.data, ..., .keep_all = FALSE)

gather.sf(data, key, value, ..., na.rm = FALSE, convert = FALSE,
  factor_key = FALSE)

spread.sf(data, key, value, fill = NA, convert = FALSE, drop = TRUE,
  sep = NULL)

sample_n.sf(tbl, size, replace = FALSE, weight = NULL,
  .env = parent.frame())

sample_frac.sf(tbl, size = 1, replace = FALSE, weight = NULL,
  .env = parent.frame())

nest.sf(data, ..., .key = "data")

separate.sf(data, col, into, sep = "[^[:alnum:]]+", remove = TRUE,
  convert = FALSE, extra = "warn", fill = "warn", ...)

unite.sf(data, col, ..., sep = "_", remove = TRUE)

unnest.sf(data, ..., .preserve = NULL)

inner_join.sf(x, y, by = NULL, copy = FALSE, suffix = c(".x", ".y"), ...)

left_join.sf(x, y, by = NULL, copy = FALSE, suffix = c(".x", ".y"), ...)

right_join.sf(x, y, by = NULL, copy = FALSE, suffix = c(".x", ".y"), ...)

full_join.sf(x, y, by = NULL, copy = FALSE, suffix = c(".x", ".y"), ...)

semi_join.sf(x, y, by = NULL, copy = FALSE, ...)

anti_join.sf(x, y, by = NULL, copy = FALSE, ...)
```

Arguments

`.data` data object of class `sf`

...	other arguments
.dots	see corresponding function in package dplyr
add	see corresponding function in dplyr
x	see left_join
do_union	logical; should geometries be unioned by using st_union , or simply be combined using st_combine ? Using st_union resolves internal boundaries, but in case of unioning points may also change the order of the points.
.keep_all	see corresponding function in dplyr
data	see original function docs
key	see original function docs
value	see original function docs
na.rm	see original function docs
convert	see original function docs
factor_key	see original function docs
fill	see original function docs
drop	see original function docs
sep	see original function docs
tbl	see original function docs
size	see original function docs
replace	see original function docs
weight	see original function docs
.env	see original function docs
.key	see nest
col	see separate
into	see separate
remove	see separate
extra	see separate
.preserve	see unnest
y	see left_join
by	see left_join
copy	see left_join
suffix	see left_join

Details

`select` keeps the geometry regardless whether it is selected or not; to deselect it, first pipe through `as.data.frame` to let dplyr's own `select` drop it.

`distinct.sf` gives distinct records for which all attributes and geometries are distinct; [st_equals](#) is used to find out which geometries are distinct.

`nest.sf` assumes that a simple feature geometry list-column was among the columns that were nested.

Examples

```

library(dplyr)
nc = st_read(system.file("shape/nc.shp", package="sf"))
nc %>% filter(AREA > .1) %>% plot()
# plot 10 smallest counties in grey:
st_geometry(nc) %>% plot()
nc %>% select(AREA) %>% arrange(AREA) %>% slice(1:10) %>% plot(add = TRUE, col = 'grey')
title("the ten counties with smallest area")
nc$area_cl = cut(nc$AREA, c(0, .1, .12, .15, .25))
nc %>% group_by(area_cl) %>% class()
nc2 <- nc %>% mutate(area10 = AREA/10)
nc %>% transmute(AREA = AREA/10, geometry = geometry) %>% class()
nc %>% transmute(AREA = AREA/10) %>% class()
nc %>% select(SID74, SID79) %>% names()
nc %>% select(SID74, SID79, geometry) %>% names()
nc %>% select(SID74, SID79) %>% class()
nc %>% select(SID74, SID79, geometry) %>% class()
nc2 <- nc %>% rename(area = AREA)
nc %>% slice(1:2)
nc$area_cl = cut(nc$AREA, c(0, .1, .12, .15, .25))
nc.g <- nc %>% group_by(area_cl)
nc.g %>% summarise(mean(AREA))
nc.g %>% summarise(mean(AREA)) %>% plot(col = grey(3:6 / 7))
nc %>% as.data.frame %>% summarise(mean(AREA))
nc[c(1:100, 1:10), ] %>% distinct() %>% nrow()
library(tidyr)
nc %>% select(SID74, SID79) %>% gather(VAR, SID, -geometry) %>% summary()
library(tidyr)
nc$ncrow = 1:100 # needed for spread to work
nc %>% select(SID74, SID79, geometry, row) %>%
gather(VAR, SID, -geometry, -row) %>%
spread(VAR, SID) %>% head()
storms.sf = st_as_sf(storms, coords = c("long", "lat"), crs = 4326)
x <- storms.sf %>% group_by(name, year) %>% nest
trs = lapply(x$data, function(tr) st_cast(st_combine(tr), "LINESTRING")[[1]]) %>% st_sfc(crs = 4326)
trs.sf = st_sf(x[,1:2], trs)
plot(trs.sf["year"], axes = TRUE)

```

extension_map

Map extension to driver

Description

Map extension to driver

Usage

extension_map

Format

An object of class list of length 24.

gdal	<i>functions to interact with gdal not meant to be called directly by users (but e.g. by stars::st_stars)</i>
------	---------------------------------------------------------------------------------------------------------------

Description

functions to interact with gdal not meant to be called directly by users (but e.g. by stars::st_stars)

Usage

```
gdal_read(x, ..., options = character(0), driver = character(0),
  read_data = TRUE, NA_value = NA_real_)
```

```
gdal_write(x, ..., file, driver = "GTiff", options = character(0),
  type = "Float32", NA_value = NA_real_)
```

```
gdal_inv_geotransform(gt)
```

```
gdal_crs(file, options = character(0))
```

```
gdal_metadata(file, domain_item = character(0), options = character(0),
  parse = TRUE)
```

```
gdal_subdatasets(file, options = character(0), name = TRUE)
```

Arguments

x	character vector, possibly of length larger than 1 when more than one raster is read
...	ignored
options	character; raster layer read options
driver	character; when empty vector, driver is auto-detected.
read_data	logical; if FALSE, only the imagery metadata is returned
NA_value	(double) non-NA value to use for missing values; if NA, when writing missing values are not specially flagged in output dataset, when reading the default (dataset) missing values are used (if present / set).
file	character; file name
type	gdal write type
gt	double vector of length 6
domain_item	character vector of length 0, 1 (with domain), or 2 (with domain and item); use "" for the default domain, use NA_character_ to query the domain names.

parse	logical; should metadata be parsed into a named list (TRUE) or returned as character data?
name	logical; retrieve name of subdataset? If FALSE, retrieve description

Details

gdal_inv_geotransform returns the inverse geotransform

gdal_crs reads coordinate reference system from GDAL data set

get_metadata gets metadata of a raster layer

gdal_subdatasets returns the subdatasets of a gdal dataset

Value

object of class crs, see [st_crs](#).

named list with metadata items

gdal_subdatasets returns a zero-length list if file does not have subdatasets, and else a named list with subdatasets.

Examples

```
## Not run:
f = system.file("tif/L7_ETMs.tif", package="stars")
f = system.file("nc/avhrr-only-v2.19810901.nc", package = "stars")
gdal_metadata(f)
gdal_metadata(f, NA_character_)
try(gdal_metadata(f, "wrongDomain"))
gdal_metadata(f, c("", "AREA_OR_POINT"))

## End(Not run)
```

gdal_utils

Native interface to gdal utils

Description

Native interface to gdal utils

Usage

```
gdal_utils(util = "info", source, destination, options = character(0),
  quiet = FALSE, processing = character(0), colorfilename = character(0))
```

Arguments

util	character; one of info, warp, rasterize, translate, vectortranslate, buildvrt, demprocessing, nearblack, grid
source	character; name of input layer(s); for warp or buildvrt this can be more than one
destination	character; name of output layer
options	character; raster layer read options
quiet	logical; if TRUE, suppress printing of output for info
processing	character; processing options for demprocessing
colorfilename	character; name of color file for demprocessing (mandatory if processing="color-relief")

Value

info returns a character vector with the raster metadata; all other utils return (invisibly) a logical indicating success (i.e., TRUE); in case of failure, an error is raised.

 geos_binary_ops

Geometric operations on pairs of simple feature geometry sets

Description

Perform geometric set operations with simple feature geometry collections

Usage

```

st_intersection(x, y)

## S3 method for class 'sfc'
st_intersection(x, y)

## S3 method for class 'sf'
st_intersection(x, y)

st_difference(x, y)

## S3 method for class 'sfc'
st_difference(x, y)

st_sym_difference(x, y)

st_snap(x, y, tolerance)

```

Arguments

x	object of class sf, sfc or sfg
y	object of class sf, sfc or sfg
tolerance	tolerance values used for st_snap; numeric value or object of class units; may have tolerance values for each feature in x

Details

A spatial index is built on argument x; see <http://r-spatial.org/r/2017/06/22/spatial-index.html>. The reference for the STR tree algorithm is: Leutenegger, Scott T., Mario A. Lopez, and Jeffrey Edgington. "STR: A simple and efficient algorithm for R-tree packing." Data Engineering, 1997. Proceedings. 13th international conference on. IEEE, 1997. For the pdf, search Google Scholar.

When called with missing y, the sfc method for st_intersection returns all non-empty intersections of the geometries of x; an attribute idx contains a list-column with the indexes of contributing geometries.

when called with a missing y, the sf method for st_intersection returns an sf object with attributes taken from the contributing feature with lowest index; two fields are added: n.overlaps with the number of overlapping features in x, and a list-column origins with indexes of all overlapping features.

When st_difference is called with a single argument, overlapping areas are erased from geometries that are indexed at greater numbers in the argument to x; geometries that are empty or contained fully inside geometries with higher priority are removed entirely. The st_difference.sfc method with a single argument returns an object with an "idx" attribute with the original index for returned geometries.

Value

The intersection, difference or symmetric difference between two sets of geometries. The returned object has the same class as that of the first argument (x) with the non-empty geometries resulting from applying the operation to all geometry pairs in x and y. In case x is of class sf, the matching attributes of the original object(s) are added. The sfc geometry list-column returned carries an attribute idx, which is an n-by-2 matrix with every row the index of the corresponding entries of x and y, respectively.

See Also

[st_union](#) for the union of simple features collections; [intersect](#) and [setdiff](#) for the base R set operations.

Examples

```
set.seed(131)
library(sf)
m = rbind(c(0,0), c(1,0), c(1,1), c(0,1), c(0,0))
p = st_polygon(list(m))
n = 100
l = vector("list", n)
```

```

for (i in 1:n)
  l[[i]] = p + 10 * runif(2)
s = st_sfc(l)
plot(s, col = sf.colors(categorical = TRUE, alpha = .5))
title("overlapping squares")
d = st_difference(s) # sequential differences: s1, s2-s1, s3-s2-s1, ...
plot(d, col = sf.colors(categorical = TRUE, alpha = .5))
title("non-overlapping differences")
i = st_intersection(s) # all intersections
plot(i, col = sf.colors(categorical = TRUE, alpha = .5))
title("non-overlapping intersections")
summary(lengths(st_overlaps(s, s))) # includes self-counts!
summary(lengths(st_overlaps(d, d)))
summary(lengths(st_overlaps(i, i)))
sf = st_sf(s)
i = st_intersection(sf) # all intersections
plot(i["n.overlaps"])
summary(i$n.overlaps - lengths(i$origins))
# A helper function that erases all of y from x:
st_erase = function(x, y) st_difference(x, st_union(st_combine(y)))

```

geos_binary_pred

Geometric binary predicates on pairs of simple feature geometry sets

Description

Geometric binary predicates on pairs of simple feature geometry sets

Usage

```

st_intersects(x, y, sparse = TRUE, prepared = TRUE)

st_disjoint(x, y = x, sparse = TRUE, prepared = TRUE)

st_touches(x, y, sparse = TRUE, prepared = TRUE)

st_crosses(x, y, sparse = TRUE, prepared = TRUE)

st_within(x, y, sparse = TRUE, prepared = TRUE)

st_contains(x, y, sparse = TRUE, prepared = TRUE)

st_contains_properly(x, y, sparse = TRUE, prepared = TRUE)

st_overlaps(x, y, sparse = TRUE, prepared = TRUE)

st_equals(x, y, sparse = TRUE, prepared = FALSE)

st_covers(x, y, sparse = TRUE, prepared = TRUE)

```

```
st_covered_by(x, y, sparse = TRUE, prepared = TRUE)
```

```
st_equals_exact(x, y, par, sparse = TRUE, prepared = FALSE)
```

```
st_is_within_distance(x, y, dist, sparse = TRUE)
```

Arguments

x	object of class sf, sfc or sfg
y	object of class sf, sfc or sfg; if missing, x is used
sparse	logical; should a sparse index list be returned (TRUE) or a dense logical matrix? See below.
prepared	logical; prepare geometry for x, before looping over y?
par	numeric; parameter used for "equals_exact" (margin);
dist	distance threshold; geometry indexes with distances smaller or equal to this value are returned; numeric value or units value having distance units.

Details

For most predicates, a spatial index is built on argument x; see <http://r-spatial.org/r/2017/06/22/spatial-index.html>. Specifically, `st_intersects`, `st_disjoint`, `st_touches`, `st_crosses`, `st_within`, `st_contains`, `st_contains_properly`, `st_overlaps`, `st_equals`, `st_covers` and `st_covered_by` all build spatial indexes for more efficient geometry calculations. `st_relate`, `st_equals_exact`, and `st_is_within_distance` do not.

If y is missing, `'st_predicate(x, x)'` is effectively called, and a square matrix is returned with diagonal elements `'st_predicate(x[i], x[i])'`.

Sparse geometry binary predicate (sgbp) lists have the following attributes: `region.id` with the row.names of x (if any, else 1:n), `ncol` with the number of features in y, and `predicate` with the name of the predicate used.

`'st_contains_properly(A,B)'` is true if A intersects B's interior, but not its edges or exterior; A contains A, but A does not properly contain A.

See also [st_relate](#) and <https://en.wikipedia.org/wiki/DE-9IM> for a more detailed description of the underlying algorithms.

`st_equals_exact` returns true for two geometries of the same type and their vertices corresponding by index are equal up to a specified tolerance.

Value

If `sparse=FALSE`, `st_predicate` (with predicate e.g. "intersects") returns a dense logical matrix with element `i, j` TRUE when `predicate(x[i], y[j])` (e.g., when geometry of feature `i` and `j` intersect); if `sparse=TRUE`, an object of class `sgbp` with a sparse list representation of the same matrix, with list element `i` an integer vector with all indices `j` for which `predicate(x[i], y[j])` is TRUE (and hence `integer(0)` if none of them is TRUE). From the dense matrix, one can find out if one or more elements intersect by `apply(mat, 1, any)`, and from the sparse list by `lengths(lst) > 0`, see examples below.

Examples

```
pts = st_sfc(st_point(c(.5,.5)), st_point(c(1.5, 1.5)), st_point(c(2.5, 2.5)))
pol = st_polygon(list(rbind(c(0,0), c(2,0), c(2,2), c(0,2), c(0,0))))
(lst = st_intersects(pts, pol))
(mat = st_intersects(pts, pol, sparse = FALSE))
# which points fall inside a polygon?
apply(mat, 1, any)
lengths(lst) > 0
# which points fall inside the first polygon?
st_intersects(pol, pts)[[1]]
```

geos_combine

*Combine or union feature geometries***Description**

Combine several feature geometries into one, with or without resolving internal boundaries

Usage

```
st_combine(x)

st_union(x, y, ..., by_feature = FALSE)
```

Arguments

x	object of class sf, sfc or sfg
y	object of class sf, sfc or sfg (optional)
...	ignored
by_feature	logical; if TRUE, union each feature, if FALSE return a single feature that is the geometric union of the set of features

Details

st_combine combines geometries without resolving borders, using [c.sfg](#) (analogous to [c](#) for ordinary vectors).

If st_union is called with a single argument, x, (with y missing) and by_feature is FALSE all geometries are unioned together and an sfg or single-geometry sfc object is returned. If by_feature is TRUE each feature geometry is unioned. This can for instance be used to resolve internal boundaries after polygons were combined using st_combine. If y is provided, all elements of x and y are unioned, pairwise (and by_feature is ignored). The former corresponds to [gUnaryUnion](#), the latter to [gUnion](#).

Unioning a set of overlapping polygons has the effect of merging the areas (i.e. the same effect as iteratively unioning all individual polygons together). Unioning a set of LineStrings has the effect of fully nodding and dissolving the input linework. In this context "fully nodded" means that there will be a node or endpoint in the output for every endpoint or line segment crossing in the input.

"Dissolved" means that any duplicate (e.g. coincident) line segments or portions of line segments will be reduced to a single line segment in the output. Unioning a set of Points has the effect of merging all identical points (producing a set with no duplicates).

Value

st_combine returns a single, combined geometry, with no resolved boundaries.

If y is missing, st_union(x) returns a single geometry with resolved boundaries, else the geometries for all unioned pairs of x[i] and y[j].

See Also

[st_intersection](#), [st_difference](#), [st_sym_difference](#)

Examples

```
nc = st_read(system.file("shape/nc.shp", package="sf"))
st_combine(nc)
plot(st_union(nc))
```

geos_measures

Compute geometric measurements

Description

Compute Euclidian or great circle distance between pairs of geometries; compute, the area or the length of a set of geometries.

Usage

```
st_area(x)
```

```
st_length(x)
```

```
st_distance(x, y, ..., dist_fun, by_element = FALSE, which = "distance",
  par = 0, tolerance = 0)
```

Arguments

x	object of class sf, sfc or sfg
y	object of class sf, sfc or sfg, defaults to x
...	ignored
dist_fun	deprecated
by_element	logical; if TRUE, return a vector with distance between the first elements of x and y, the second, etc. if FALSE, return the dense matrix with all pairwise distances.

which	character; if equal to Hausdorff or Frechet, Hausdorff resp. Frechet distances are returned
par	for which equal to Hausdorff or Frechet, use a positive value this to densify the geometry
tolerance	ignored if <code>st_is_longlat(x)</code> is FALSE; otherwise, if set to a positive value, the first distance smaller than <code>tolerance</code> will be returned, and true distance may be smaller; this may speed up computation. In meters, or a <code>units</code> object convertible to meters.

Details

great circle distance calculations use function `geod_inverse` from `proj.4` if `proj.4` is at version larger than 4.8.0, or else the Vincenty method implemented in `liblwgeom` (this should correspond to what PostGIS does).

Value

If the coordinate reference system of `x` was set, these functions return values with unit of measurement; see [set_units](#).

`st_area` returns the area of a geometry, in the coordinate reference system used; in case `x` is in degrees longitude/latitude, [st_geod_area](#) is used for area calculation.

`st_length` returns the length of a `LINestring` or `MULTILINestring` geometry, using the coordinate reference system. `POINT`, `MULTIPOINT`, `POLYGON` or `MULTIPOLYGON` geometries return zero.

If `by_element` is FALSE `st_distance` returns a dense numeric matrix of dimension `length(x)` by `length(y)`; otherwise it returns a numeric vector of length `x` or `y`, the shorter one being recycled.

See Also

[st_dimension](#), [st_cast](#) to convert geometry types

Examples

```
b0 = st_polygon(list(rbind(c(-1,-1), c(1,-1), c(1,1), c(-1,1), c(-1,-1))))
b1 = b0 + 2
b2 = b0 + c(-0.2, 2)
x = st_sfc(b0, b1, b2)
st_area(x)
line = st_sfc(st_linestring(rbind(c(30,30), c(40,40))), crs = 4326)
st_length(line)

outer = matrix(c(0,0,10,0,10,10,0,0,0), ncol=2, byrow=TRUE)
hole1 = matrix(c(1,1,1,2,2,2,2,1,1,1), ncol=2, byrow=TRUE)
hole2 = matrix(c(5,5,5,6,6,6,6,5,5,5), ncol=2, byrow=TRUE)

poly = st_polygon(list(outer, hole1, hole2))
mpoly = st_multipolygon(list(
  list(outer, hole1, hole2),
  list(outer + 12, hole1 + 12)
))
```

```

st_length(st_sfc(poly, mpoly))
p = st_sfc(st_point(c(0,0)), st_point(c(0,1)), st_point(c(0,2)))
st_distance(p, p)
st_distance(p, p, by_element = TRUE)

```

geos_query	<i>Dimension, simplicity, validity or is_empty queries on simple feature geometries</i>
------------	-----------------------------------------------------------------------------------------

Description

Dimension, simplicity, validity or is_empty queries on simple feature geometries

Usage

```

st_dimension(x, NA_if_empty = TRUE)

st_is_simple(x)

st_is_empty(x)

st_is_valid(x, NA_on_exception = TRUE, reason = FALSE)

```

Arguments

x	object of class sf, sfc or sfg
NA_if_empty	logical; if TRUE, return NA for empty geometries
NA_on_exception	logical; if TRUE, for polygons that would otherwise raise a GEOS error (exception, e.g. for a POLYGON having more than zero but less than 4 points, or a LINESTRING having one point) return an NA rather than raising an error, and suppress warning messages (e.g. about self-intersection); if FALSE, regular GEOS errors and warnings will be emitted.
reason	logical; if TRUE, return a character with, for each geometry, the reason for invalidity, NA on exception, or "Valid Geometry" otherwise.

Value

st_dimension returns a numeric vector with 0 for points, 1 for lines, 2 for surfaces, and, if NA_if_empty is TRUE, NA for empty geometries.

st_is_simple returns a logical vector, indicating for each geometry whether it is simple (e.g., not self-intersecting)

st_is_empty returns for each geometry whether it is empty

st_is_valid returns a logical vector indicating for each geometries of x whether it is valid.

Examples

```

x = st_sfc(
  st_point(0:1),
  st_linestring(rbind(c(0,0),c(1,1))),
  st_polygon(list(rbind(c(0,0),c(1,0),c(0,1),c(0,0)))),
  st_multipoint(),
  st_linestring(),
  st_geometrycollection())
st_dimension(x)
st_dimension(x, FALSE)
ls = st_linestring(rbind(c(0,0), c(1,1), c(1,0), c(0,1)))
st_is_simple(st_sfc(ls, st_point(c(0,0))))
ls = st_linestring(rbind(c(0,0), c(1,1), c(1,0), c(0,1)))
st_is_empty(st_sfc(ls, st_point(), st_linestring()))
p1 = st_as_sfc("POLYGON((0 0, 0 10, 10 0, 10 10, 0 0))")
st_is_valid(p1)
st_is_valid(st_sfc(st_point(0:1), p1[[1]]), reason = TRUE)

```

geos_unary

Geometric unary operations on simple feature geometry sets

Description

Geometric unary operations on simple feature geometry sets. These are all generics, with methods for sfg, sfc and sf objects, returning an object of the same class.

Usage

```

st_buffer(x, dist, nQuadSegs = 30)

st_boundary(x)

st_convex_hull(x)

st_simplify(x, preserveTopology = FALSE, dTolerance = 0)

st_triangulate(x, dTolerance = 0, bOnlyEdges = FALSE)

st_voronoi(x, envelope, dTolerance = 0, bOnlyEdges = FALSE)

st_polygonize(x)

st_line_merge(x)

st_centroid(x, ..., of_largest_polygon = FALSE)

st_point_on_surface(x)

```

`st_node(x)`

`st_segmentize(x, dfMaxLength, ...)`

Arguments

<code>x</code>	object of class <code>sfg</code> , <code>sfg</code> or <code>sf</code>
<code>dist</code>	numeric; buffer distance for all, or for each of the elements in <code>x</code> ; in case <code>dist</code> is a <code>units</code> object, it should be convertible to <code>arc_degree</code> if <code>x</code> has geographic coordinates, and to <code>st_crs(x)\$units</code> otherwise
<code>nQuadSegs</code>	integer; number of segments per quadrant (fourth of a circle)
<code>preserveTopology</code>	logical; carry out topology preserving simplification?
<code>dTolerance</code>	numeric; tolerance parameter
<code>bOnlyEdges</code>	logical; if <code>TRUE</code> , return lines, else return polygons
<code>envelope</code>	object of class <code>sfc</code> or <code>sfg</code> containing a <code>POLYGON</code> with the envelope for a voronoi diagram; this only takes effect when it is larger than the default envelope, chosen when <code>envelope</code> is an empty polygon
<code>...</code>	ignored
<code>of_largest_polygon</code>	logical; for <code>st_centroid</code> : if <code>TRUE</code> , return centroid of the largest (sub)polygon of a <code>MULTIPOLYGON</code> rather than of the whole <code>MULTIPOLYGON</code>
<code>dfMaxLength</code>	maximum length of a line segment. If <code>x</code> has geographical coordinates (long/lat), <code>dfMaxLength</code> is either a numeric expressed in meter, or an object of class <code>units</code> with length units or unit <code>rad</code> or <code>degree</code> ; segmentation takes place along the great circle, using <code>st_geod_segmentize</code> .

Details

`st_triangulate` requires GEOS version 3.4 or above

`st_voronoi` requires GEOS version 3.5 or above

in case of `st_polygonize`, `x` must be an object of class `LINestring` or `MULTILINESTRING`, or an `sfc` geometry list-column object containing these

in case of `st_line_merge`, `x` must be an object of class `MULTILINESTRING`, or an `sfc` geometry list-column object containing these

`st_point_on_surface` returns a point guaranteed to be on the (multi)surface.

`st_node` adds nodes to linear geometries at intersections without a node, and only works on individual linear geometries

Value

an object of the same class of `x`, with manipulated geometry.

Examples

```

nc = st_read(system.file("shape/nc.shp", package="sf"))
plot(st_convex_hull(nc))
plot(nc, border = grey(.5))
set.seed(1)
x = st_multipoint(matrix(runif(10),,2))
box = st_polygon(list(rbind(c(0,0),c(1,0),c(1,1),c(0,1),c(0,0))))
if (sf_extSoftVersion()["GEOS"] >= "3.5.0") {
  v = st_sfc(st_voronoi(x, st_sfc(box)))
  plot(v, col = 0, border = 1, axes = TRUE)
  plot(box, add = TRUE, col = 0, border = 1) # a larger box is returned, as documented
  plot(x, add = TRUE, col = 'red', cex=2, pch=16)
  plot(st_intersection(st_cast(v), box)) # clip to smaller box
  plot(x, add = TRUE, col = 'red', cex=2, pch=16)
}
mls = st_multilinestring(list(matrix(c(0,0,0,1,1,1,0,0),,2,byrow=TRUE)))
st_polygonize(st_sfc(mls))
mls = st_multilinestring(list(rbind(c(0,0), c(1,1)), rbind(c(2,0), c(1,1))))
st_line_merge(st_sfc(mls))
plot(nc, axes = TRUE)
plot(st_centroid(nc), add = TRUE, pch = 3)
mp = st_combine(st_buffer(st_sfc(lapply(1:3, function(x) st_point(c(x,x))), 0.2 * 1:3)))
plot(mp)
plot(st_centroid(mp), add = TRUE, col = 'red') # centroid of combined geometry
plot(st_centroid(mp, of_largest_polygon = TRUE), add = TRUE, col = 'blue', pch = 3)
plot(nc, axes = TRUE)
plot(st_point_on_surface(nc), add = TRUE, pch = 3)
(l = st_linestring(rbind(c(0,0), c(1,1), c(0,1), c(1,0), c(0,0))))
st_polygonize(st_node(l))
st_node(st_multilinestring(list(rbind(c(0,0), c(1,1), c(0,1), c(1,0), c(0,0)))))
sf = st_sf(a=1, geom=st_sfc(st_linestring(rbind(c(0,0),c(1,1)))))
seg = st_segmentize(sf, units::set_units(100, km))
seg = st_segmentize(sf, units::set_units(0.01, rad))
nrow(seg$geom[[1]])

```

 internal

Internal functions

Description

Internal functions

Usage

```
.stop_geos(msg)
```

Arguments

msg error message

is_driver_available *Check if driver is available*

Description

Search through the driver table if driver is listed

Usage

```
is_driver_available(drv, drivers = st_drivers())
```

Arguments

drv	character. Name of driver
drivers	data.frame. Table containing driver names and support. Default is from st_drivers

is_driver_can *Check if a driver can perform an action*

Description

Search through the driver table to match a driver name with an action (e.g. "write") and check if the action is supported.

Usage

```
is_driver_can(drv, drivers = st_drivers(), operation = "write")
```

Arguments

drv	character. Name of driver
drivers	data.frame. Table containing driver names and support. Default is from st_drivers
operation	character. What action to check

merge.sf	<i>merge method for sf and data.frame object</i>
----------	--------------------------------------------------

Description

merge method for sf and data.frame object

Usage

```
## S3 method for class 'sf'
merge(x, y, ...)
```

Arguments

x	object of class sf
y	object of class data.frame
...	arguments passed on to merge.data.frame

Examples

```
a = data.frame(a = 1:3, b = 5:7)
st_geometry(a) = st_sfc(st_point(c(0,0)), st_point(c(1,1)), st_point(c(2,2)))
b = data.frame(x = c("a", "b", "c"), b = c(2,5,6))
merge(a, b)
merge(a, b, all = TRUE)
```

ops	<i>S3 Ops Group Generic Functions (multiply and add/subtract) for affine transformation</i>
-----	---------------------------------------------------------------------------------------------

Description

Ops functions for simple feature geometry objects (constrained to multiplication and addition)

Usage

```
## S3 method for class 'sfg'
Ops(e1, e2)

## S3 method for class 'sfc'
Ops(e1, e2)
```

Arguments

- e1 object of class `sfg`
- e2 numeric or object of class `sfg`; in case of multiplication an $n \times n$ matrix, in case of addition or subtraction a vector of length n , with n the number of dimensions of the geometry; if e2 is an `sfg` object, `+`, `-`, `*` and `/` will result in the geometric union, difference, intersection and symmetric difference respectively; for other operators will lead to e2 being converted to a numeric.

Value

object of class `sfg`

Examples

```
st_point(c(1,2,3)) + 4
st_point(c(1,2,3)) * 3 + 4
m = matrix(0, 2, 2)
diag(m) = c(1, 3)
# affine:
st_point(c(1,2)) * m + c(2,5)
# world in 0-360 range:
library(maps)
w = st_as_sf(map('world', plot = FALSE, fill = TRUE))
w2 = (st_geometry(w) + c(360,90)) %% c(360) - c(0,90)
w3 = st_wrap_dateline(st_set_crs(w2 - c(180,0), 4326)) + c(180,0)
plot(st_set_crs(w3, 4326), axes = TRUE)
(mp <- st_point(c(1,2)) + st_point(c(3,4))) # MULTIPOINT (1 2, 3 4)
mp - st_point(c(3,4)) # POINT (1 2)
opar = par(mfrow = c(2,2), mar = c(0, 0, 1, 0))
a = st_buffer(st_point(c(0,0)), 2)
b = a + c(2, 0)
p = function(m) { plot(c(a,b)); plot(eval(parse(text=m)), col=grey(.9), add = TRUE); title(m) }
lapply(c('a + b', 'a - b', 'a * b', 'a / b'), p)
par(opar)
nc = st_transform(st_read(system.file("gpkg/nc.gpkg", package="sf")), 32119) # nc state plane, m
b = st_buffer(st_centroid(st_union(nc)), units::set_units(50, km)) # shoot a hole in nc:
plot(st_geometry(nc) - b, col = grey(.9))
```

plot

Plot sf object

Description

Plot sf object

blue-pink-yellow color scale

Usage

```

## S3 method for class 'sf'
plot(x, y, ..., col = NULL, main, pal = NULL, nbreaks = 10,
     breaks = "pretty", max.plot = if (is.null(n <-
     options("sf_max.plot")[[1]])) 9 else n, key.pos = get_key_pos(x, ...),
     key.size = lcm(1.8), reset = TRUE)

get_key_pos(x, ...)

## S3 method for class 'sfc_POINT'
plot(x, y, ..., pch = 1, cex = 1, col = 1, bg = 0,
     lwd = 1, lty = 1, type = "p", add = FALSE)

## S3 method for class 'sfc_MULTIPPOINT'
plot(x, y, ..., pch = 1, cex = 1, col = 1,
     bg = 0, lwd = 1, lty = 1, type = "p", add = FALSE)

## S3 method for class 'sfc_LINestring'
plot(x, y, ..., lty = 1, lwd = 1, col = 1,
     pch = 1, type = "l", add = FALSE)

## S3 method for class 'sfc_CIRCULARSTRING'
plot(x, y, ...)

## S3 method for class 'sfc_MULTILINestring'
plot(x, y, ..., lty = 1, lwd = 1, col = 1,
     pch = 1, type = "l", add = FALSE)

## S3 method for class 'sfc_POLYGON'
plot(x, y, ..., lty = 1, lwd = 1, col = NA,
     cex = 1, pch = NA, border = 1, add = FALSE, rule = "evenodd")

## S3 method for class 'sfc_MULTIPOLYGON'
plot(x, y, ..., lty = 1, lwd = 1, col = NA,
     border = 1, add = FALSE, rule = "evenodd")

## S3 method for class 'sfc_GEOMETRYCOLLECTION'
plot(x, y, ..., pch = 1, cex = 1, bg = 0,
     lty = 1, lwd = 1, col = 1, border = 1, add = FALSE)

## S3 method for class 'sfc_GEOMETRY'
plot(x, y, ..., pch = 1, cex = 1, bg = 0,
     lty = 1, lwd = 1, col = 1, border = 1, add = FALSE)

## S3 method for class 'sfg'
plot(x, ...)

plot_sf(x, xlim = NULL, ylim = NULL, asp = NA, axes = FALSE,

```

```
bgc = par("bg"), ..., xaxs, yaxs, lab, setParUsrBB = FALSE,
bgMap = NULL, expandBB = c(0, 0, 0, 0), graticule = NA_crs_,
col_graticule = "grey")
```

```
sf.colors(n = 10, cutoff.tails = c(0.35, 0.2), alpha = 1,
categorical = FALSE)
```

Arguments

<code>x</code>	object of class <code>sf</code>
<code>y</code>	ignored
<code>...</code>	further specifications, see plot_sf and plot
<code>col</code>	color
<code>main</code>	title for plot (NULL to remove)
<code>pal</code>	palette function, similar to rainbow ; if omitted, sf.colors is used
<code>nbreaks</code>	number of colors breaks (ignored for factor or character variables)
<code>breaks</code>	either a numeric vector with the actual breaks, or a name of a method accepted by the <code>style</code> argument of classIntervals
<code>max.plot</code>	integer; lower boundary to maximum number of attributes to plot; the default value (9) can be overridden by setting the global option <code>sf_max.plot</code> , e.g. <code>options(sf_max.plot=2)</code>
<code>key.pos</code>	integer; side to plot a color key: 1 bottom, 2 left, 3 top, 4 right; set to NULL to omit key. Ignored if multiple columns are plotted in a single function call. Default depends on plot size, map aspect, and, if set, parameter <code>asp</code> .
<code>key.size</code>	amount of space reserved for the key (labels)
<code>reset</code>	logical; if FALSE, keep the plot in a mode that allows adding further map elements; if TRUE restore original mode after plotting; see details.
<code>pch</code>	plotting symbol
<code>cex</code>	symbol size
<code>bg</code>	symbol background color
<code>lwd</code>	line width
<code>lty</code>	line type
<code>type</code>	plot type: 'p' for points, 'l' for lines, 'b' for both
<code>add</code>	logical; add to current plot?
<code>border</code>	color of polygon border
<code>rule</code>	see polypath ; for winding, exterior ring direction should be opposite that of the holes; with <code>evenodd</code> , plotting is robust against misspecified ring directions
<code>xlim</code>	see plot.window
<code>ylim</code>	see plot.window
<code>asp</code>	see below, and see par
<code>axes</code>	logical; should axes be plotted? (default FALSE)
<code>bgc</code>	background color

xaxs	see par
yaxs	see par
lab	see par
setParUsrBB	default FALSE; set the par “usr” bounding box; see below
bgMap	object of class ggmap, or returned by function <code>RgoogleMaps::GetMap</code>
expandBB	numeric; fractional values to expand the bounding box with, in each direction (bottom, left, top, right)
graticule	logical, or object of class crs (e.g., <code>st_crs(4326)</code> for a WGS84 graticule), or object created by st_graticule ; TRUE will give the WGS84 graticule or object returned by st_graticule
col_graticule	color to used for the graticule (if present)
n	integer; number of colors
cutoff.tails	numeric, in [0,0.5] start and end values
alpha	numeric, in [0,1], transparency
categorical	logical; do we want colors for a categorical variable? (see details)

Details

`plot.sf` maximally plots `max.plot` maps with colors following from attribute columns, one map per attribute. It uses `sf.colors` for default colors. For more control over individual maps, set parameter `mfrow` with `par` prior to plotting, and plot single maps one by one.

`plot.sfc` plots the geometry, additional parameters can be passed on to control color, lines or symbols.

When setting `reset` to FALSE, the original device parameters are lost, and the device must be reset using `dev.off()` in order to reset it.

`plot_sf` sets up the plotting area, axes, graticule, or webmap background; it is called by all `plot` methods before anything is drawn.

The argument `setParUsrBB` may be used to pass the logical value TRUE to functions within `plot.Spatial`. When set to TRUE, `par(“usr”)` will be overwritten with `c(xlim, ylim)`, which defaults to the bounding box of the spatial object. This is only needed in the particular context of graphic output to a specified device with given width and height, to be matched to the spatial object, when using `par(“xaxs”)` and `par(“yaxs”)` in addition to `par(mar=c(0, 0, 0, 0))`.

The default aspect for map plots is 1; if however data are not projected (coordinates are long/lat), the aspect is by default set to $1/\cos(My * \pi)/180$ with `My` the y coordinate of the middle of the map (the mean of `ylim`, which defaults to the y range of bounding box). This implies an **Equirectangular projection**.

non-categorical colors from `sf.colors` were taken from [bpy.colors](#), with modified `cutoff.tails` defaults. If `categorical` is TRUE, default colors are from <http://www.colorbrewer2.org/> (if `n < 9`, Set2, else Set3).

Examples

```

# plot linestrings:
l1 = st_linestring(matrix(runif(6)-0.5,,2))
l2 = st_linestring(matrix(runif(6)-0.5,,2))
l3 = st_linestring(matrix(runif(6)-0.5,,2))
s = st_sf(a=2:4, b=st_sfc(l1,l2,l3))
plot(s, col = s$a, axes = FALSE)
plot(s, col = s$a)
l1 = "+init=epsg:4326 +proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0"
st_crs(s) = l1
plot(s, col = s$a, axes = TRUE)
plot(s, col = s$a, lty = s$a, lwd = s$a, pch = s$a, type = 'b')
l4 = st_linestring(matrix(runif(6),,2))
plot(st_sf(a=1,b=st_sfc(l4)), add = TRUE)
# plot multilinestrings:
m1 = st_multilinestring(list(l1, l2))
m2 = st_multilinestring(list(l3, l4))
m1 = st_sf(a = 2:3, b = st_sfc(m1, m2))
plot(m1, col = m1$a, lty = m1$a, lwd = m1$a, pch = m1$a, type = 'b')
# plot points:
p1 = st_point(c(1,2))
p2 = st_point(c(3,3))
p3 = st_point(c(3,0))
p = st_sf(a=2:4, b=st_sfc(p1,p2,p3))
plot(p, col = s$a, axes = TRUE)
plot(p, col = s$a)
plot(p, col = p$a, pch = p$a, cex = p$a, bg = s$a, lwd = 2, lty = 2, type = 'b')
p4 = st_point(c(2,2))
plot(st_sf(a=1, st_sfc(p4)), add = TRUE)
# multipoints:
mp1 = st_multipoint(matrix(1:4,2))
mp2 = st_multipoint(matrix(5:8,2))
mp = st_sf(a = 2:3, b = st_sfc(mp1, mp2))
plot(mp)
plot(mp, col = mp$a, pch = mp$a, cex = mp$a, bg = mp$a, lwd = mp$a, lty = mp$a, type = 'b')
# polygon:
outer = matrix(c(0,0,10,0,10,10,0,10,0,0),ncol=2, byrow=TRUE)
hole1 = matrix(c(1,1,1,2,2,2,2,1,1,1),ncol=2, byrow=TRUE)
hole2 = matrix(c(5,5,5,6,6,6,6,5,5,5),ncol=2, byrow=TRUE)
p1 = st_polygon(list(outer, hole1, hole2))
p2 = st_polygon(list(outer+10, hole1+10, hole2+10))
po = st_sf(a = 2:3, st_sfc(p1,p2))
plot(po, col = po$a, border = rev(po$a), lwd=3)
# multipolygon
r10 = matrix(rep(c(0,10),each=5),5)
p1 = list(outer, hole1, hole2)
p2 = list(outer+10, hole1+10, hole2+10)
p3 = list(outer+r10, hole1+r10, hole2+r10)
mpo1 = st_multipolygon(list(p1,p2))
mpo2 = st_multipolygon(list(p3))
mpo = st_sf(a=2:3, b=st_sfc(mpo1,mpo2))
plot(mpo, col = mpo$a, border = rev(mpo$a), lwd = 2)

```

```
# geometrycollection:
gc1 = st_geometrycollection(list(mpo1, st_point(c(21,21)), 11 * 2 + 21))
gc2 = st_geometrycollection(list(mpo2, 12 - 2, 13 - 2, st_point(c(-1,-1))))
gc = st_sf(a=2:3, b = st_sfc(gc1,gc2))
plot(gc, cex = gc$a, col = gc$a, border = rev(gc$a) + 2, lwd = 2)
sf.colors(10)
```

```
prefix_map
```

```
Map prefix to driver
```

Description

Map prefix to driver

Usage

```
prefix_map
```

Format

An object of class `list` of length 10.

```
rawToHex
```

```
Convert raw vector(s) into hexadecimal character string(s)
```

Description

Convert raw vector(s) into hexadecimal character string(s)

Usage

```
rawToHex(x)
```

Arguments

`x` raw vector, or list with raw vectors

 sf *Create sf object*

Description

Create sf, which extends data.frame-like objects with a simple feature list column

Usage

```
st_sf(..., agr = NA_agr_, row.names,
      stringsAsFactors = default.stringsAsFactors(), crs, precision,
      sf_column_name = NULL, check_ring_dir = FALSE)

## S3 method for class 'sf'
x[i, j, ..., drop = FALSE, op = st_intersects]

## S3 method for class 'sf'
print(x, ..., n = getOption("sf_max_print", default = 10))
```

Arguments

...	column elements to be binded into an sf object or a single list or data.frame with such columns; at least one of these columns shall be a geometry list-column of class sfc or be a list-column that can be converted into an sfc by st_as_sfc .
agr	character vector; see details below.
row.names	row.names for the created sf object
stringsAsFactors	logical; logical: should character vectors be converted to factors? The ‘factory-fresh’ default is TRUE, but this can be changed by setting options(stringsAsFactors = FALSE).
crs	coordinate reference system: integer with the EPSG code, or character with proj4string
precision	numeric; see st_as_binary
sf_column_name	character; name of the active list-column with simple feature geometries; in case there is more than one and sf_column_name is NULL, the first one is taken.
check_ring_dir	see st_read
x	object of class sf
i	record selection, see [.data.frame]
j	variable selection, see [.data.frame]
drop	logical, default FALSE; if TRUE drop the geometry column and return a data.frame, else make the geometry sticky and return a sf object.
op	function; geometrical binary predicate function to apply when i is a simple feature object
n	maximum number of features to print; can be set globally by options(sf_max_print=...)

Details

`agr`, attribute-geometry-relationship, specifies for each non-geometry attribute column how it relates to the geometry, and can have one of following values: "constant", "aggregate", "identity". "constant" is used for attributes that are constant throughout the geometry (e.g. land use), "aggregate" where the attribute is an aggregate value over the geometry (e.g. population density or population count), "identity" when the attributes uniquely identifies the geometry of particular "thing", such as a building ID or a city name. The default value, `NA_agr_`, implies we don't know.

When confronted with a `data.frame`-like object, `'st_sf'` will try to find a geometry column of class `'sfc'`, and otherwise try to convert list-columns when available into a geometry column, using [st_as_sfc](#).

`[.sf]` will return a `data.frame` or vector if the geometry column (of class `sfc`) is dropped (`drop=TRUE`), an `sfc` object if only the geometry column is selected, and otherwise return an `sf` object; see also [\[.data.frame\]](#); for `[.sf ...]` arguments are passed to `op`.

Examples

```
g = st_sfc(st_point(1:2))
st_sf(a=3,g)
st_sf(g, a=3)
st_sf(a=3, st_sfc(st_point(1:2))) # better to name it!
# create empty structure with preallocated empty geometries:
nrows <- 10
geometry = st_sfc(lapply(1:nrows, function(x) st_geometrycollection()))
df <- st_sf(id = 1:nrows, geometry = geometry)
g = st_sfc(st_point(1:2), st_point(3:4))
s = st_sf(a=3:4, g)
s[1,]
class(s[1,])
s[,1]
class(s[,1])
s[,2]
class(s[,2])
g = st_sf(a=2:3, g)
pol = st_sfc(st_polygon(list(cbind(c(0,3,3,0,0),c(0,0,3,3,0)))))
h = st_sf(r = 5, pol)
g[h,]
h[g,]
```

sfc

Create simple feature geometry list column

Description

Create simple feature geometry list column, set class, and add coordinate reference system and precision

Usage

```
st_sfc(..., crs = NA_crs_, precision = 0, check_ring_dir = FALSE)
```

Arguments

... zero or more simple feature geometries (objects of class `sfg`), or a single list of such objects; NULL values will get replaced by empty geometries.

crs coordinate reference system: integer with the EPSG code, or character with proj4string

precision numeric; see [st_as_binary](#)

check_ring_dir see [st_read](#)

Details

A simple feature geometry list-column is a list of class `c("stc_TYPE", "sfc")` which most often contains objects of identical type; in case of a mix of types or an empty set, TYPE is set to the superclass GEOMETRY.

Value

an object of class `sfc`, which is a classed list-column with simple feature geometries.

Examples

```
pt1 = st_point(c(0,1))
pt2 = st_point(c(1,1))
(sfc = st_sfc(pt1, pt2))
d = st_sf(data.frame(a=1:2, geom=sfc))
```

sf_extSoftVersion *Provide the external dependencies versions of the libraries linked to sf*

Description

Provide the external dependencies versions of the libraries linked to sf

Usage

```
sf_extSoftVersion()
```

sf_project	<i>directly transform a set of coordinates</i>
------------	------------------------------------------------

Description

directly transform a set of coordinates

Usage

```
sf_project(from, to, pts)
```

Arguments

from	character; proj4string of pts
to	character; target coordinate reference system
pts	two-column numeric matrix, or object that can be coerced into a matrix

sgbp	<i>Methods for dealing with sparse geometry binary predicate lists</i>
------	------------------------------------------------------------------------

Description

Methods for dealing with sparse geometry binary predicate lists

Usage

```
## S3 method for class 'sgbp'
print(x, ..., n = 10, max_nb = 10)

## S3 method for class 'sgbp'
t(x)

## S3 method for class 'sgbp'
as.matrix(x, ...)

## S3 method for class 'sgbp'
dim(x)
```

Arguments

x	object of class sgbp
...	ignored
n	integer; maximum number of items to print
max_nb	integer; maximum number of neighbours to print for each item

Details

sgbp are sparse matrices, stored as a list with integer vectors holding the ordered TRUE indices of each row. This means that for a dense, $m \times n$ matrix Q and a list L , if $Q[i, j]$ is TRUE then j is an element of $L[[i]]$. Reversed: when k is the value of $L[[i]][j]$, then $Q[i, k]$ is TRUE.

st	<i>Create simple feature from a numeric vector, matrix or list</i>
----	--------------------------------------------------------------------

Description

Create simple feature from a numeric vector, matrix or list

Usage

```
st_point(x = c(NA_real_, NA_real_), dim = "XYZ")
st_multipoint(x = matrix(numeric(0), 0, 2), dim = "XYZ")
st_linestring(x = matrix(numeric(0), 0, 2), dim = "XYZ")
st_polygon(x = list(), dim = if (length(x)) "XYZ" else "XY")
st_multilinestring(x = list(), dim = if (length(x)) "XYZ" else "XY")
st_multipolygon(x = list(), dim = if (length(x)) "XYZ" else "XY")
st_geometrycollection(x = list(), dims = "XY")

## S3 method for class 'sfg'
print(x, ..., width = 0)

## S3 method for class 'sfg'
head(x, n = 10L, ...)

## S3 method for class 'sfg'
format(x, ..., width = 30)

## S3 method for class 'sfg'
c(..., recursive = FALSE, flatten = TRUE)

## S3 method for class 'sfg'
as.matrix(x, ...)
```

Arguments

x	for <code>st_point</code> , numeric vector (or one-row-matrix) of length 2, 3 or 4; for <code>st_linestring</code> and <code>st_multipoint</code> , numeric matrix with points in rows; for <code>st_polygon</code> and <code>st_multilinestring</code> , list with numeric matrices with points in rows; for <code>st_multipolygon</code> , list of lists with numeric matrices; for <code>st_geometrycollection</code> list with (non- <code>geometrycollection</code>) simple feature objects
dim	character, indicating dimensions: "XY", "XYZ", "XYM", or "XYZM"; only really needed for three-dimensional points (which can be either XYZ or XYM) or empty geometries; see details
dims	character; specify dimensionality in case of an empty (NULL) <code>geometrycollection</code> , in which case x is the empty <code>list()</code> .
...	objects to be pasted together into a single simple feature
width	integer; number of characters to be printed (max 30; 0 means print everything)
n	integer; number of elements to be selected
recursive	logical; ignored
flatten	logical; if TRUE, try to simplify results; if FALSE, return <code>geometrycollection</code> containing all objects

Details

"XYZ" refers to coordinates where the third dimension represents altitude, "XYM" refers to three-dimensional coordinates where the third dimension refers to something else ("M" for measure); checking of the sanity of x may be only partial.

When `flatten=TRUE`, this method may merge points into a multipoint structure, and may not preserve order, and hence cannot be reverted. When given fish, it returns fish soup.

Value

object of the same nature as x, but with appropriate class attribute set

`as.matrix` returns the set of points that form a geometry as a single matrix, where each point is a row; use `unlist(x, recursive = FALSE)` to get sets of matrices.

Examples

```
(p1 = st_point(c(1,2)))
class(p1)
st_bbox(p1)
(p2 = st_point(c(1,2,3)))
class(p2)
(p3 = st_point(c(1,2,3), "XYM"))
pts = matrix(1:10, , 2)
(mp1 = st_multipoint(pts))
pts = matrix(1:15, , 3)
(mp2 = st_multipoint(pts))
(mp3 = st_multipoint(pts, "XYM"))
pts = matrix(1:20, , 4)
(mp4 = st_multipoint(pts))
```

```

pts = matrix(1:10, , 2)
(ls1 = st_linestring(pts))
pts = matrix(1:15, , 3)
(ls2 = st_linestring(pts))
(ls3 = st_linestring(pts, "XYM"))
pts = matrix(1:20, , 4)
(ls4 = st_linestring(pts))
outer = matrix(c(0,0,10,0,10,10,0,10,0,0),ncol=2, byrow=TRUE)
hole1 = matrix(c(1,1,1,2,2,2,2,1,1,1),ncol=2, byrow=TRUE)
hole2 = matrix(c(5,5,5,6,6,6,6,5,5,5),ncol=2, byrow=TRUE)
pts = list(outer, hole1, hole2)
(ml1 = st_multilinestring(pts))
pts3 = lapply(pts, function(x) cbind(x, 0))
(ml2 = st_multilinestring(pts3))
(ml3 = st_multilinestring(pts3, "XYM"))
pts4 = lapply(pts3, function(x) cbind(x, 0))
(ml4 = st_multilinestring(pts4))
outer = matrix(c(0,0,10,0,10,10,0,10,0,0),ncol=2, byrow=TRUE)
hole1 = matrix(c(1,1,1,2,2,2,2,1,1,1),ncol=2, byrow=TRUE)
hole2 = matrix(c(5,5,5,6,6,6,6,5,5,5),ncol=2, byrow=TRUE)
pts = list(outer, hole1, hole2)
(pl1 = st_polygon(pts))
pts3 = lapply(pts, function(x) cbind(x, 0))
(pl2 = st_polygon(pts3))
(pl3 = st_polygon(pts3, "XYM"))
pts4 = lapply(pts3, function(x) cbind(x, 0))
(pl4 = st_polygon(pts4))
pol1 = list(outer, hole1, hole2)
pol2 = list(outer + 12, hole1 + 12)
pol3 = list(outer + 24)
mp = list(pol1,pol2,pol3)
(mp1 = st_multipolygon(mp))
pts3 = lapply(mp, function(x) lapply(x, function(y) cbind(y, 0)))
(mp2 = st_multipolygon(pts3))
(mp3 = st_multipolygon(pts3, "XYM"))
pts4 = lapply(mp2, function(x) lapply(x, function(y) cbind(y, 0)))
(mp4 = st_multipolygon(pts4))
(gc = st_geometrycollection(list(p1, ls1, pl1, mp1)))
st_geometrycollection() # empty geometry
c(st_point(1:2), st_point(5:6))
c(st_point(1:2), st_multipoint(matrix(5:8,2)))
c(st_multipoint(matrix(1:4,2)), st_multipoint(matrix(5:8,2)))
c(st_linestring(matrix(1:6,3)), st_linestring(matrix(11:16,3)))
c(st_multilinestring(list(matrix(1:6,3))), st_multilinestring(list(matrix(11:16,3))))
pl = list(rbind(c(0,0), c(1,0), c(1,1), c(0,1), c(0,0)))
c(st_polygon(pl), st_polygon(pl))
c(st_polygon(pl), st_multipolygon(list(pl)))
c(st_linestring(matrix(1:6,3)), st_point(1:2))
c(st_geometrycollection(list(st_point(1:2), st_linestring(matrix(1:6,3))),
  st_geometrycollection(list(st_multilinestring(list(matrix(11:16,3))))))
c(st_geometrycollection(list(st_point(1:2), st_linestring(matrix(1:6,3))),
  st_multilinestring(list(matrix(11:16,3))), st_point(5:6),
  st_geometrycollection(list(st_point(10:11))))

```

stars *functions only exported to be used internally by stars*

Description

functions only exported to be used internally by stars

Usage

```
.get_layout(bb, n, total_size, key.pos, key.size)

.degAxis(side, at, labels, ..., lon, lat, ndiscr, reset)

.image_scale(z, col, breaks = NULL, key.pos, add.axis = TRUE, at = NULL,
            ..., axes = FALSE)

.image_scale_factor(z, col, breaks = NULL, key.pos, add.axis = TRUE,
                  at = NULL, ..., axes = FALSE, key.size)
```

Arguments

bb	ignore
n	ignore
total_size	ignore
key.pos	ignore
key.size	ignore
side	ignore
at	ignore
labels	ignore
...	ignore
lon	ignore
lat	ignore
ndiscr	ignore
reset	ignore
z	ignore
col	ignore
breaks	ignore
add.axis	ignore
axes	ignore

st_agr	<i>get or set relation_to_geometry attribute of an sf object</i>
--------	------------------------------------------------------------------

Description

get or set relation_to_geometry attribute of an sf object

Usage

```
NA_agr_
st_agr(x, ...)
st_agr(x) <- value
st_set_agr(x, value)
```

Arguments

x	object of class sf
...	ignored
value	character, or factor with appropriate levels; if named, names should correspond to the non-geometry list-column columns of x

Format

An object of class factor of length 1.

Details

NA_agr_ is the agr object with a missing value.

st_as_binary	<i>Convert sfc object to an WKB object</i>
--------------	--------------------------------------------

Description

Convert sfc object to an WKB object

Usage

```

st_as_binary(x, ...)

## S3 method for class 'sfc'
st_as_binary(x, ..., EWKB = FALSE, endian = .Platform$endian,
  pureR = FALSE, precision = attr(x, "precision"), hex = FALSE)

## S3 method for class 'sfg'
st_as_binary(x, ..., endian = .Platform$endian, EWKB = FALSE,
  pureR = FALSE, hex = FALSE)

```

Arguments

x	object to convert
...	ignored
EWKB	logical; use EWKB (PostGIS), or (default) ISO-WKB?
endian	character; either "big" or "little"; default: use that of platform
pureR	logical; use pure R solution, or C++?
precision	numeric; if zero, do not modify; to reduce precision: negative values convert to float (4-byte real); positive values convert to round(x*precision)/precision. See details.
hex	logical; return as (unclassed) hexadecimal encoded character vector?

Details

st_as_binary is called on sfc objects on their way to the GDAL or GEOS libraries, and hence does rounding (if requested) on the fly before e.g. computing spatial predicates like [st_intersects](#). The examples show a round-trip of an sfc to and from binary.

For the precision model used, see also <https://locationtech.github.io/jts/javadoc/org/locationtech/jts/geom/PrecisionModel.html>. There, it is written that: "... to specify 3 decimal places of precision, use a scale factor of 1000. To specify -3 decimal places of precision (i.e. rounding to the nearest 1000), use a scale factor of 0.001.". Note that ALL coordinates, so also Z or M values (if present) are affected.

Examples

```

x = st_sfc(st_point(c(1/3, 1/6)), precision = 1000)
st_as_sfc(st_as_binary(x)) # rounds

```

st_as_grob	<i>Convert sf* object to a grob</i>
------------	-------------------------------------

Description

Convert sf* object to an grid graphics object (grob)

Usage

```
st_as_grob(x, ..., units = "native")
```

Arguments

x	object to be converted into an object class grob
...	passed on to the xxxGrob function, e.g. gp = gpar(col = 'red')
units	units; see unit

st_as_sf	<i>Convert foreign object to an sf object</i>
----------	-----------------------------------------------

Description

Convert foreign object to an sf object

Usage

```
st_as_sf(x, ...)

## S3 method for class 'data.frame'
st_as_sf(x, ..., agr = NA_agr_, coords, wkt,
  dim = "XYZ", remove = TRUE, na.fail = TRUE, sf_column_name = NULL)

## S3 method for class 'sf'
st_as_sf(x, ...)

## S3 method for class 'Spatial'
st_as_sf(x, ...)

## S3 method for class 'map'
st_as_sf(x, ...)

## S3 method for class 'ppp'
st_as_sf(x, ...)

## S3 method for class 'psp'
```

```
st_as_sf(x, ...)

## S3 method for class 'lpp'
st_as_sf(x, ...)
```

Arguments

x	object to be converted into an object class sf
...	passed on to st_sf , might included named arguments crs or precision
agr	character vector; see details section of st_sf
coords	in case of point data: names or numbers of the numeric columns holding coordinates
wkt	name or number of the character column that holds WKT encoded geometries
dim	passed on to st_point (only when argument coords is given)
remove	logical; when coords or wkt is given, remove these columns from data.frame?
na.fail	logical; if TRUE, raise an error if coordinates contain missing values
sf_column_name	character; name of the active list-column with simple feature geometries; in case there is more than one and sf_column_name is NULL, the first one is taken.

Details

setting argument wkt annihilates the use of argument coords. If x contains a column called "geometry", coords will result in overwriting of this column by the [sfc](#) geometry list-column. Setting wkt will replace this column with the geometry list-column, unless remove_coordinates is FALSE.

Examples

```
pt1 = st_point(c(0,1))
pt2 = st_point(c(1,1))
st_sfc(pt1, pt2)
d = data.frame(a = 1:2)
d$geom = st_sfc(pt1, pt2)
df = st_as_sf(d)
d$geom = c("POINT(0 0)", "POINT(0 1)")
df = st_as_sf(d, wkt = "geom")
d$geom2 = st_sfc(pt1, pt2)
st_as_sf(d) # should warn
data(meuse, package = "sp")
meuse_sf = st_as_sf(meuse, coords = c("x", "y"), crs = 28992, agr = "constant")
meuse_sf[1:3,]
summary(meuse_sf)
library(sp)
x = rbind(c(-1,-1), c(1,-1), c(1,1), c(-1,1), c(-1,-1))
x1 = 0.1 * x + 0.1
x2 = 0.1 * x + 0.4
x3 = 0.1 * x + 0.7
y = x + 3
y1 = x1 + 3
y3 = x3 + 3
```

```

m = matrix(c(3, 0), 5, 2, byrow = TRUE)
z = x + m
z1 = x1 + m
z2 = x2 + m
z3 = x3 + m
p1 = Polygons(list( Polygon(x[5:1,]), Polygon(x2), Polygon(x3),
  Polygon(y[5:1,]), Polygon(y1), Polygon(x1), Polygon(y3)), "ID1")
p2 = Polygons(list( Polygon(z[5:1,]), Polygon(z2), Polygon(z3), Polygon(z1)),
  "ID2")
if (require("rgeos")) {
  r = createSPComment(SpatialPolygons(list(p1,p2)))
  comment(r)
  comment(r@polygons[[1]])
  scan(text = comment(r@polygons[[1]]), quiet = TRUE)
  library(sf)
  a = st_as_sf(r)
  summary(a)
}
demo(meuse, ask = FALSE, echo = FALSE)
summary(st_as_sf(meuse))
summary(st_as_sf(meuse.grid))
summary(st_as_sf(meuse.area))
summary(st_as_sf(meuse.riv))
summary(st_as_sf(as(meuse.riv, "SpatialLines")))
pol.grd = as(meuse.grid, "SpatialPolygonsDataFrame")
summary(st_as_sf(pol.grd))
summary(st_as_sf(as(pol.grd, "SpatialLinesDataFrame")))
## Not run:
  require(spatstat)
  g = st_as_sf(gorillas)
  # select only the points:
  g[st_is(g, "POINT"),]

## End(Not run)
## Not run: # because of spatstat interfering with units
if (require(spatstat)) {
  data(chicago)
  plot(st_as_sf(chicago)["label"])
  plot(st_as_sf(chicago)[-1,"label"])
}

## End(Not run)

```

st_as_sfc

Convert foreign geometry object to an sfc object

Description

Convert foreign geometry object to an sfc object

Usage

```
## S3 method for class 'list'
st_as_sfc(x, ..., crs = NA_crs_)

## S3 method for class 'blob'
st_as_sfc(x, ...)

## S3 method for class 'bbox'
st_as_sfc(x, ...)

## S3 method for class 'WKB'
st_as_sfc(x, ..., EWKB = FALSE, spatialite = FALSE,
  pureR = FALSE, crs = NA_crs_)

## S3 method for class 'raw'
st_as_sfc(x, ...)

## S3 method for class 'character'
st_as_sfc(x, crs = NA_integer_, ..., GeoJSON = FALSE)

## S3 method for class 'factor'
st_as_sfc(x, ...)

st_as_sfc(x, ...)

## S3 method for class 'SpatialPoints'
st_as_sfc(x, ..., precision = 0)

## S3 method for class 'SpatialPixels'
st_as_sfc(x, ..., precision = 0)

## S3 method for class 'SpatialMultiPoints'
st_as_sfc(x, ..., precision = 0)

## S3 method for class 'SpatialLines'
st_as_sfc(x, ..., precision = 0, forceMulti = FALSE)

## S3 method for class 'SpatialPolygons'
st_as_sfc(x, ..., precision = 0,
  forceMulti = FALSE)

## S3 method for class 'map'
st_as_sfc(x, ...)
```

Arguments

x	object to convert
...	further arguments

crs	integer or character; coordinate reference system for the
EWKB	logical; if TRUE, parse as EWKB (extended WKB; PostGIS: ST_AsEWKB), otherwise as ISO WKB (PostGIS: ST_AsBinary)
spatialite	logical; if TRUE, WKB is assumed to be in the spatialite dialect, see https://www.gaia-gis.it/gaia-sins/BLOB-Geometry.html ; this is only supported in native endian-ness (i.e., files written on system with the same endian-ness as that on which it is being read).
pureR	logical; if TRUE, use only R code, if FALSE, use compiled (C++) code; use TRUE when the endian-ness of the binary differs from the host machine (.Platform\$endian).
GeoJSON	logical; if TRUE, try to read geometries from GeoJSON text strings geometry, see st_crs()
precision	precision value; see st_as_binary
forceMulti	logical; if TRUE, force coercion into MULTIPOLYGON or MULTILINE objects, else autodetect

Details

When converting from WKB, the object `x` is either a character vector such as typically obtained from PostGIS (either with leading "0x" or without), or a list with raw vectors representing the features in binary (raw) form.

If `x` is a character vector, it should be a vector containing [well-known-text](#), or [Postgis EWKT](#) or [GeoJSON](#) representations of a single geometry for each vector element.

If `x` is a factor, it is converted to character.

Examples

```
wkb = structure(list("010100002040710000000000000801A064100000000AC5C1441"), class = "WKB")
st_as_sfc(wkb, EWKB = TRUE)
wkb = structure(list("0x010100002040710000000000000801A064100000000AC5C1441"), class = "WKB")
st_as_sfc(wkb, EWKB = TRUE)
st_as_sfc(st_as_binary(st_sfc(st_point(0:1)))[[1]], crs = 4326)
st_as_sfc("SRID=3978;LINESTRING(1663106 -105415,1664320 -104617)")
```

st_as_text	<i>Return Well-known Text representation of simple feature geometry or coordinate reference system</i>
------------	--------------------------------------------------------------------------------------------------------

Description

Return Well-known Text representation of simple feature geometry or coordinate reference system

Usage

```

## S3 method for class 'crs'
st_as_text(x, ..., pretty = FALSE)

st_as_text(x, ...)

## S3 method for class 'sfg'
st_as_text(x, ...)

## S3 method for class 'sfc'
st_as_text(x, ..., EWKT = FALSE)

```

Arguments

x	object of class sfg, sfc or crs
...	modifiers; in particular digits can be passed to control the number of digits used
pretty	logical; if TRUE, print human-readable well-known-text representation of a coordinate reference system
EWKT	logical; if TRUE, print SRID=xxx; before the WKT string if epsg is available

Details

The returned WKT representation of simple feature geometry conforms to the [simple features access](#) specification and extensions, [known as EWKT](#), supported by PostGIS and other simple features implementations for addition of SRID to a WKT string.

Examples

```

st_as_text(st_point(1:2))
st_as_text(st_sfc(st_point(c(-90,40))), crs = 4326), EWKT = TRUE)

```

st_bbox

Return bounding of a simple feature or simple feature set

Description

Return bounding of a simple feature or simple feature set

Usage

```

## S3 method for class 'bbox'
is.na(x)

st_bbox(obj, ...)

```

```
## S3 method for class 'POINT'  
st_bbox(obj, ...)  
  
## S3 method for class 'MULTIPOINT'  
st_bbox(obj, ...)  
  
## S3 method for class 'LINESTRING'  
st_bbox(obj, ...)  
  
## S3 method for class 'POLYGON'  
st_bbox(obj, ...)  
  
## S3 method for class 'MULTILINESTRING'  
st_bbox(obj, ...)  
  
## S3 method for class 'MULTIPOLYGON'  
st_bbox(obj, ...)  
  
## S3 method for class 'GEOMETRYCOLLECTION'  
st_bbox(obj, ...)  
  
## S3 method for class 'MULTISURFACE'  
st_bbox(obj, ...)  
  
## S3 method for class 'MULTICURVE'  
st_bbox(obj, ...)  
  
## S3 method for class 'CURVEPOLYGON'  
st_bbox(obj, ...)  
  
## S3 method for class 'COMPOUNDCURVE'  
st_bbox(obj, ...)  
  
## S3 method for class 'POLYHEDRALSURFACE'  
st_bbox(obj, ...)  
  
## S3 method for class 'TIN'  
st_bbox(obj, ...)  
  
## S3 method for class 'TRIANGLE'  
st_bbox(obj, ...)  
  
## S3 method for class 'CIRCULARSTRING'  
st_bbox(obj, ...)  
  
## S3 method for class 'sfc'  
st_bbox(obj, ...)
```



```
## S3 method for class 'sf'  
st_bbox(obj, ...)  
  
## S3 method for class 'Spatial'  
st_bbox(obj, ...)  
  
## S3 method for class 'Raster'  
st_bbox(obj, ...)  
  
## S3 method for class 'numeric'  
st_bbox(obj, ..., crs = NA_crs_)  
  
NA_bbox_
```

Arguments

x	object of class bbox
obj	object to compute the bounding box from
...	ignored
crs	object of class crs, or argument to st_crs , specifying the CRS of this bounding box.

Format

An object of class bbox of length 4.

Details

NA_bbox_ represents the missing value for a bbox object

Value

a numeric vector of length four, with xmin, ymin, xmax and ymax values; if obj is of class sf, sfc, Spatial or Raster, the object returned has a class bbox, an attribute crs and a method to print the bbox and an st_crs method to retrieve the coordinate reference system corresponding to obj (and hence the bounding box). [st_as_sfc](#) has a methods for bbox objects to generate a polygon around the four bounding box points.

Examples

```
a = st_sf(a = 1:2, geom = st_sfc(st_point(0:1), st_point(1:2)), crs = 4326)  
st_bbox(a)  
st_as_sfc(st_bbox(a))  
st_bbox(c(xmin = 16.1, xmax = 16.6, ymax = 48.6, ymin = 47.9), crs = st_crs(4326))
```

st_cast	<i>Cast geometry to another type: either simplify, or cast explicitly</i>
---------	---------------------------------------------------------------------------

Description

Cast geometry to another type: either simplify, or cast explicitly

Usage

```
## S3 method for class 'MULTIPOLYGON'  
st_cast(x, to, ...)  
  
## S3 method for class 'MULTILINESTRING'  
st_cast(x, to, ...)  
  
## S3 method for class 'MULTIPOINT'  
st_cast(x, to, ...)  
  
## S3 method for class 'POLYGON'  
st_cast(x, to, ...)  
  
## S3 method for class 'LINESTRING'  
st_cast(x, to, ...)  
  
## S3 method for class 'POINT'  
st_cast(x, to, ...)  
  
## S3 method for class 'GEOMETRYCOLLECTION'  
st_cast(x, to, ...)  
  
## S3 method for class 'CIRCULARSTRING'  
st_cast(x, to, ...)  
  
## S3 method for class 'MULTISURFACE'  
st_cast(x, to, ...)  
  
## S3 method for class 'COMPOUNDCURVE'  
st_cast(x, to, ...)  
  
## S3 method for class 'CURVE'  
st_cast(x, to, ...)  
  
st_cast(x, to, ...)  
  
## S3 method for class 'sfc'  
st_cast(x, to, ..., ids = seq_along(x), group_or_split = TRUE)
```

```
## S3 method for class 'sf'
st_cast(x, to, ..., warn = TRUE, do_split = TRUE)

## S3 method for class 'sfc_CIRCULARSTRING'
st_cast(x, to, ...)
```

Arguments

x	object of class sfg, sfc or sf
to	character; target type, if missing, simplification is tried; when x is of type sfg (i.e., a single geometry) then to needs to be specified.
...	ignored
ids	integer vector, denoting how geometries should be grouped (default: no grouping)
group_or_split	logical; if TRUE, group or split geometries; if FALSE, carry out a 1-1 per-geometry conversion.
warn	logical; if TRUE, warn if attributes are assigned to sub-geometries
do_split	logical; if TRUE, allow splitting of geometries in sub-geometries

Details

the `st_cast` method for `sf` objects can only split geometries, e.g. cast `MULTIPOINT` into multiple `POINT` features. In case of splitting, attributes are repeated and a warning is issued when non-constant attributes are assigned to sub-geometries. To merge feature geometries and attribute values, use [aggregate](#) or [summarise](#).

Value

object of class `to` if successful, or unmodified object if unsuccessful. If information gets lost while type casting, a warning is raised.

In case `to` is missing, `st_cast.sfc` will coerce combinations of `"POINT"` and `"MULTIPOINT"`, `"LINESTRING"` and `"MULTILINESTRING"`, `"POLYGON"` and `"MULTIPOLYGON"` into their `"MULTI..."` form, or in case all geometries are `"GEOMETRYCOLLECTION"` will return a list of all the contents of the `"GEOMETRYCOLLECTION"` objects, or else do nothing. In case `to` is specified, if `to` is `"GEOMETRY"`, geometries are not converted, else, `st_cast` will try to coerce all elements into `to`; `ids` may be specified to group e.g. `"POINT"` objects into a `"MULTIPOINT"`, if not specified no grouping takes place. If e.g. a `"sfc_MULTIPOINT"` is cast to a `"sfc_POINT"`, the objects are split, so no information gets lost, unless `group_or_split` is `FALSE`.

Examples

```
example(st_read)
mpl <- nc$geometry[[4]]
#st_cast(x) ## error 'argument "to" is missing, with no default'
cast_all <- function(xg) {
  lapply(c("MULTIPOLYGON", "MULTILINESTRING", "MULTIPOINT", "POLYGON", "LINESTRING", "POINT"),
         function(x) st_cast(xg, x))
}
```

```

st_sfc(cast_all(mpl))
## no closing coordinates should remain for multipoint
any(duplicated(unclass(st_cast(mpl, "MULTIPOINT")))) ## should be FALSE
## number of duplicated coordinates in the linestrings should equal the number of polygon rings
## (... in this case, won't always be true)
sum(duplicated(do.call(rbind, unclass(st_cast(mpl, "MULTILINESTRING"))))
    ) == sum(unlist(lapply(mpl, length))) ## should be TRUE

p1 <- structure(c(0, 1, 3, 2, 1, 0, 0, 0, 2, 4, 4, 0), .Dim = c(6L, 2L))
p2 <- structure(c(1, 1, 2, 1, 1, 2, 2, 1), .Dim = c(4L, 2L))
st_polygon(list(p1, p2))
m1s <- st_cast(nc$geometry[[4]], "MULTILINESTRING")
st_sfc(cast_all(m1s))
mpt <- st_cast(nc$geometry[[4]], "MULTIPOINT")
st_sfc(cast_all(mpt))
p1 <- st_cast(nc$geometry[[4]], "POLYGON")
st_sfc(cast_all(p1))
ls <- st_cast(nc$geometry[[4]], "LINESTRING")
st_sfc(cast_all(ls))
pt <- st_cast(nc$geometry[[4]], "POINT")
## st_sfc(cast_all(pt)) ## Error: cannot create MULTIPOLYGON from POINT
st_sfc(lapply(c("POINT", "MULTIPOINT"), function(x) st_cast(pt, x)))
s = st_multipoint(rbind(c(1,0)))
st_cast(s, "POINT")

```

st_cast_sfc_default *Coerce geometry to MULTI* geometry*

Description

Mixes of POINTS and MULTIPOINTS, LINESTRING and MULTILINESTRING, POLYGON and MULTIPOLYGON are returned as MULTIPOINTS, MULTILINESTRING and MULTIPOLYGONS respectively

Usage

```
st_cast_sfc_default(x)
```

Arguments

x list of geometries or simple features

Details

Geometries that are already MULTI* are left unchanged. Features that can't be cast to a single MULTI* geometry are return as a GEOMETRYCOLLECTION

`st_collection_extract` *Given an object with geometries of type GEOMETRY or GEOMETRYCOLLECTION, return an object consisting only of elements of the specified type.*

Description

Similar to ST_CollectionExtract in PostGIS. If there are no sub-geometries of the specified type, an empty geometry is returned.

Usage

```
st_collection_extract(x, type = c("POLYGON", "POINT", "LINESTRING"),
  warn = FALSE)

## S3 method for class 'sfg'
st_collection_extract(x, type = c("POLYGON", "POINT",
  "LINESTRING"), warn = FALSE)

## S3 method for class 'sfc'
st_collection_extract(x, type = c("POLYGON", "POINT",
  "LINESTRING"), warn = FALSE)

## S3 method for class 'sf'
st_collection_extract(x, type = c("POLYGON", "POINT",
  "LINESTRING"), warn = FALSE)
```

Arguments

<code>x</code>	an object of class <code>sf</code> , <code>sfc</code> or <code>sfg</code> that has mixed geometry (GEOMETRY or GEOMETRYCOLLECTION).
<code>type</code>	character; one of "POLYGON", "POINT", "LINESTRING"
<code>warn</code>	logical; if TRUE, warn if attributes are assigned to sub-geometries when casting (see st_cast)

Value

An object having the same class as `x`, with geometries consisting only of elements of the specified type. For `sfg` objects, an `sfg` object is returned if there is only one geometry of the specified type, otherwise the geometries are combined into an `sfc` object of the relevant type. If any subgeometries in the input are MULTI, then all of the subgeometries in the output will be MULTI.

Examples

```
pt <- st_point(c(1, 0))
ls <- st_linestring(matrix(c(4, 3, 0, 0), ncol = 2))
poly1 <- st_polygon(list(matrix(c(5.5, 7, 7, 6, 5.5, 0, 0, -0.5, -0.5, 0), ncol = 2)))
poly2 <- st_polygon(list(matrix(c(6.6, 8, 8, 7, 6.6, 1, 1, 1.5, 1.5, 1), ncol = 2)))
```

```

multipoly <- st_multipolygon(list(poly1, poly2))

i <- st_geometrycollection(list(pt, ls, poly1, poly2))
j <- st_geometrycollection(list(pt, ls, poly1, poly2, multipoly))

st_collection_extract(i, "POLYGON")
st_collection_extract(i, "POINT")
st_collection_extract(i, "LINESTRING")

## A GEOMETRYCOLLECTION
aa <- rbind(st_sf(a=1, geom = st_sfc(i)),
st_sf(a=2, geom = st_sfc(j)))

## With sf objects
st_collection_extract(aa, "POLYGON")
st_collection_extract(aa, "LINESTRING")
st_collection_extract(aa, "POINT")

## With sfc objects
st_collection_extract(st_geometry(aa), "POLYGON")
st_collection_extract(st_geometry(aa), "LINESTRING")
st_collection_extract(st_geometry(aa), "POINT")

## A GEOMETRY of single types
bb <- rbind(
st_sf(a = 1, geom = st_sfc(pt)),
st_sf(a = 2, geom = st_sfc(ls)),
st_sf(a = 3, geom = st_sfc(poly1)),
st_sf(a = 4, geom = st_sfc(multipoly))
)

st_collection_extract(bb, "POLYGON")

## A GEOMETRY of mixed single types and GEOMETRYCOLLECTIONS
cc <- rbind(aa, bb)

st_collection_extract(cc, "POLYGON")

```

st_coordinates

retrieve coordinates in matrix form

Description

retrieve coordinates in matrix form

Usage

```
st_coordinates(x, ...)
```

Arguments

x object of class sf, sfc or sfg
 ... ignored

Value

matrix with coordinates (X, Y, possibly Z and/or M) in rows, possibly followed by integer indicators L1,...,L3 that point out to which structure the coordinate belongs; for POINT this is absent (each coordinate is a feature), for LINESTRING L1 refers to the feature, for MULTIPOLYGON L1 refers to the main ring or holes, L2 to the ring id in the MULTIPOLYGON, and L3 to the simple feature.

st_crs	<i>Retrieve coordinate reference system from object</i>
--------	---------------------------------------------------------

Description

Retrieve coordinate reference system from sf or sfc object
 Set or replace retrieve coordinate reference system from object

Usage

```
st_crs(x, ...)  
  
## S3 method for class 'sf'  
st_crs(x, ...)  
  
## S3 method for class 'numeric'  
st_crs(x, ...)  
  
## S3 method for class 'character'  
st_crs(x, ..., wkt)  
  
## S3 method for class 'sfc'  
st_crs(x, ..., parameters = FALSE)  
  
## S3 method for class 'bbox'  
st_crs(x, ...)  
  
## S3 method for class 'crs'  
st_crs(x, ...)  
  
st_crs(x) <- value  
  
## S3 replacement method for class 'sf'  
st_crs(x) <- value
```

```
## S3 replacement method for class 'sfc'
st_crs(x) <- value

st_set_crs(x, value)

NA_crs_

## S3 method for class 'crs'
is.na(x)

## S3 method for class 'crs'
x$name
```

Arguments

x	numeric, character, or object of class <code>sf</code> or <code>sfc</code>
...	ignored
wkt	character well-known-text representation of the crs
parameters	logical; FALSE by default; if TRUE return a list of coordinate reference system parameters, with named elements <code>SemiMajor</code> , <code>InvFlattening</code> , <code>units_gdal</code> , <code>IsVertical</code> , <code>WktPretty</code> , and <code>Wkt</code>
value	one of (i) character: a valid proj4string (ii) integer, a valid EPSG value (numeric), or (iii) a list containing named elements <code>proj4string</code> (character) and/or <code>epsg</code> (integer) with (i) and (ii).
name	element name; <code>epsg</code> or <code>proj4string</code> , or one of <code>proj4strings</code> named components without the +; see examples

Format

An object of class `crs` of length 2.

Details

The `*crs` functions create, get, set or replace the `crs` attribute of a simple feature geometry list-column. This attribute is of class `crs`, and is a list consisting of `epsg` (integer EPSG code) and `proj4string` (character). Two objects of class `crs` are semantically identical when: (1) they are completely identical, or (2) they have identical `proj4string` but one of them has a missing EPSG ID. As a consequence, equivalent but different `proj4strings`, e.g. `"+proj=longlat +datum=WGS84"` and `"+datum=WGS84 +proj=longlat"`, are considered different. The operators `==` and `!=` are overloaded for `crs` objects to establish semantical identity.

In case a coordinate reference system is replaced, no transformation takes place and a warning is raised to stress this. EPSG values are either read from `proj4strings` that contain `+init=epsg:...` or set to 4326 in case the `proj4string` contains `+proj=longlat` and `+datum=WGS84`, literally.

If both `epsg` and `proj4string` are provided, they are assumed to be consistent. In processing them, the EPSG code, if not missing valued, is used and the `proj4string` is derived from it by a call to GDAL (which in turn will call PROJ.4). Warnings are raised when `epsg` is not consistent with a `proj4string` that is already present.

NA_crs_ is the crs object with missing values for epsg and proj4string.

Value

If x is numeric, return crs object for SRID x; if x is character, return crs object for proj4string x; if wkt is given, return crs object for well-known-text representation wkt; if x is of class sf or sfc, return its crs object.

Object of class crs, which is a list with elements epsg (length-1 integer) and proj4string (length-1 character).

Examples

```
sfc = st_sfc(st_point(c(0,0)), st_point(c(1,1)))
sf = st_sf(a = 1:2, geom = sfc)
st_crs(sf) = 4326
st_geometry(sf)
sfc = st_sfc(st_point(c(0,0)), st_point(c(1,1)))
st_crs(sfc) = 4326
sfc
sfc = st_sfc(st_point(c(0,0)), st_point(c(1,1)))
library(dplyr)
x = sfc %>% st_set_crs(4326) %>% st_transform(3857)
x
st_crs("+init=epsg:3857")$epsg
st_crs("+init=epsg:3857")$proj4string
st_crs("+init=epsg:3857 +units=km")$b      # numeric
st_crs("+init=epsg:3857 +units=km")$units # character
```

st_drivers

Get GDAL drivers

Description

Get a list of the available GDAL drivers

Usage

```
st_drivers(what = "vector")
```

Arguments

what character: "vector" or "raster", anything else will return all drivers.

Details

The drivers available will depend on the installation of GDAL/OGR, and can vary; the st_drivers() function shows which are available, and which may be written (but all are assumed to be readable). Note that stray files in data source directories (such as *.dbf) may lead to spurious errors that accompanying *.shp are missing.

field vsi refers to the driver's capability to read/create datasets through the VSI*L API.

Value

a `data.frame` with driver metadata

Examples

```
st_drivers()
```

st_geometry	<i>Get, set, or replace geometry from an sf object</i>
-------------	--------------------------------------------------------

Description

Get, set, or replace geometry from an sf object

Usage

```
## S3 method for class 'sfc'  
st_geometry(obj, ...)  
  
st_geometry(obj, ...)  
  
## S3 method for class 'sf'  
st_geometry(obj, ...)  
  
## S3 method for class 'sfc'  
st_geometry(obj, ...)  
  
## S3 method for class 'sfg'  
st_geometry(obj, ...)  
  
st_geometry(x) <- value  
  
st_set_geometry(x, value)
```

Arguments

obj	object of class sf or sfc
...	ignored
x	object of class data.frame
value	object of class sfc, or character

Details

when applied to a `data.frame` and when `value` is an object of class `sfc`, `st_set_geometry` and `st_geometry<-` will first check for the existence of an attribute `sf_column` and overwrite that, or else look for list-columns of class `sfc` and overwrite the first of that, or else write the geometry list-column to a column named `geometry`. In case `value` is character and `x` is of class `sf`, the "active" geometry column is set to `x[[value]]`.

the replacement function applied to `sf` objects will overwrite the geometry list-column, if `value` is `NULL`, it will remove it and coerce `x` to a `data.frame`.

Value

`st_geometry` returns an object of class `sfc`, a list-column with geometries

`st_geometry` returns an object of class `sfc`. Assigning geometry to a `data.frame` creates an `sf` object, assigning it to an `sf` object replaces the geometry list-column.

Examples

```
df = data.frame(a = 1:2)
sfc = st_sfc(st_point(c(3,4)), st_point(c(10,11)))
st_geometry(sfc)
st_geometry(df) <- sfc
class(df)
st_geometry(df)
st_geometry(df) <- sfc # replaces
st_geometry(df) <- NULL # remove geometry, coerce to data.frame
sf <- st_set_geometry(df, sfc) # set geometry, return sf
st_set_geometry(sf, NULL) # remove geometry, coerce to data.frame
```

<code>st_geometry_type</code>	<i>Return geometry type of an object</i>
-------------------------------	------------------------------------------

Description

Return geometry type of an object, as a factor

Usage

```
st_geometry_type(x)
```

Arguments

`x` object of class `sf` or `sfc`

Value

a factor with the geometry type of each simple feature in `x`

st_graticule

Compute graticules and their parameters

Description

Compute graticules and their parameters

Usage

```
st_graticule(x = c(-180, -90, 180, 90), crs = st_crs(x),
  datum = st_crs(4326), ..., lon = NULL, lat = NULL, ndiscr = 100,
  margin = 0.001)
```

Arguments

x	object of class <i>sf</i> , <i>sfc</i> or <i>sfg</i> or numeric vector with bounding box given as (minx, miny, maxx, maxy).
crs	object of class <i>crs</i> , with the display coordinate reference system
datum	either an object of class <i>crs</i> with the coordinate reference system for the graticules, or NULL in which case a grid in the coordinate system of x is drawn, or NA, in which case an empty <i>sf</i> object is returned.
...	ignored
lon	numeric; degrees east for the meridians
lat	numeric; degrees north for the parallels
ndiscr	integer; number of points to discretize a parallel or meridian
margin	numeric; small number to trim a longlat bounding box that touches or crosses +/-180 long or +/-90 latitude.

Value

an object of class *sf* with additional attributes describing the type (E: meridian, N: parallel) degree value, label, start and end coordinates and angle; see example.

Use of graticules

In cartographic visualization, the use of graticules is not advised, unless the graphical output will be used for measurement or navigation, or the direction of North is important for the interpretation of the content, or the content is intended to display distortions and artifacts created by projection. Unnecessary use of graticules only adds visual clutter but little relevant information. Use of coastlines, administrative boundaries or place names permits most viewers of the output to orient themselves better than a graticule.

Examples

```

library(sf)
library(maps)

usa = st_as_sf(map('usa', plot = FALSE, fill = TRUE))
laea = st_crs("+proj=laea +lat_0=30 +lon_0=-95") # Lambert equal area
usa <- st_transform(usa, laea)

bb = st_bbox(usa)
bbox = st_linestring(rbind(c( bb[1],bb[2]),c( bb[3],bb[2]),
  c( bb[3],bb[4]),c( bb[1],bb[4]),c( bb[1],bb[2])))

g = st_graticule(usa)
plot(usa, xlim = 1.2 * c(-2450853.4, 2186391.9))
plot(g[1], add = TRUE, col = 'grey')
plot(bbox, add = TRUE)
points(g$x_start, g$y_start, col = 'red')
points(g$x_end, g$y_end, col = 'blue')

invisible(lapply(seq_len(nrow(g)), function(i) {
  if (g$type[i] == "N" && g$x_start[i] - min(g$x_start) < 1000)
    text(g[i,"x_start"], g[i,"y_start"], labels = parse(text = g[i,"degree_label"]),
    srt = g$angle_start[i], pos = 2, cex = .7)
  if (g$type[i] == "E" && g$y_start[i] - min(g$y_start) < 1000)
    text(g[i,"x_start"], g[i,"y_start"], labels = parse(text = g[i,"degree_label"]),
    srt = g$angle_start[i] - 90, pos = 1, cex = .7)
  if (g$type[i] == "N" && g$x_end[i] - max(g$x_end) > -1000)
    text(g[i,"x_end"], g[i,"y_end"], labels = parse(text = g[i,"degree_label"]),
    srt = g$angle_end[i], pos = 4, cex = .7)
  if (g$type[i] == "E" && g$y_end[i] - max(g$y_end) > -1000)
    text(g[i,"x_end"], g[i,"y_end"], labels = parse(text = g[i,"degree_label"]),
    srt = g$angle_end[i] - 90, pos = 3, cex = .7)
}))
plot(usa, graticule = st_crs(4326), axes = TRUE, lon = seq(-60,-130,by=-10))

```

st_interpolate_aw

Areal-weighted interpolation of polygon data

Description

Areal-weighted interpolation of polygon data

Usage

```
st_interpolate_aw(x, to, extensive)
```

Arguments

x	object of class sf, for which we want to aggregate attributes
to	object of class sf or sfc, with the target geometries
extensive	logical; if TRUE, the attribute variables are assumed to be spatially extensive (like population) and the sum is preserved, otherwise, spatially intensive (like population density) and the mean is preserved.

Examples

```
nc = st_read(system.file("shape/nc.shp", package="sf"))
g = st_make_grid(nc, n = c(20,10))
a1 = st_interpolate_aw(nc["BIR74"], g, extensive = FALSE)
sum(a1$BIR74) / sum(nc$BIR74) # not close to one: property is assumed spatially intensive
a2 = st_interpolate_aw(nc["BIR74"], g, extensive = TRUE)
sum(a2$BIR74) / sum(nc$BIR74)
a1$intensive = a1$BIR74
a1$extensive = a2$BIR74
plot(a1[c("intensive", "extensive")])
```

st_is

test equality between the geometry type and a class or set of classes

Description

test equality between the geometry type and a class or set of classes

Usage

```
st_is(x, type)
```

Arguments

x	object of class sf, sfc or sfg
type	character; class, or set of classes, to test against

Examples

```
st_is(st_point(0:1), "POINT")
sfc = st_sfc(st_point(0:1), st_linestring(matrix(1:6,,2)))
st_is(sfc, "POINT")
st_is(sfc, "POLYGON")
st_is(sfc, "LINESTRING")
st_is(st_sf(a = 1:2, sfc), "LINESTRING")
st_is(sfc, c("POINT", "LINESTRING"))
```

st_is_longlat	<i>Assert whether simple feature coordinates are longlat degrees</i>
---------------	----------------------------------------------------------------------

Description

Assert whether simple feature coordinates are longlat degrees

Usage

```
st_is_longlat(x)
```

Arguments

x object of class [sf](#) or [sfc](#)

Value

TRUE if +proj=longlat is part of the proj4string, NA if this string is missing, FALSE otherwise

st_jitter	<i>jitter geometries</i>
-----------	--------------------------

Description

jitter geometries

Usage

```
st_jitter(x, amount, factor = 0.002)
```

Arguments

x object of class [sf](#) or [sfc](#)

amount numeric; amount of jittering applied; if missing, the amount is set to factor * the bounding box diagonal; units of coordinates.

factor numeric; fractional amount of jittering to be applied

Details

jitters coordinates with an amount such that `codorunif(1, -amount, amount)` is added to the coordinates. x- and y-coordinates are jittered independently but all coordinates of a single geometry are jittered with the same amount, meaning that the geometry shape does not change. For longlat data, a latitude correction is made such that jittering in East and North directions are identical in distance in the center of the bounding box of x.

Examples

```
nc = read_sf(system.file("gpkg/nc.gpkg", package="sf"))
pts = st_centroid(st_geometry(nc))
plot(pts)
plot(st_jitter(pts, .05), add = TRUE, col = 'red')
plot(st_geometry(nc))
plot(st_jitter(st_geometry(nc), factor = .01), add = TRUE, col = '#ff8888')
```

st_join	<i>spatial left or inner join</i>
---------	-----------------------------------

Description

spatial left or inner join

Usage

```
st_join(x, y, join = st_intersects, FUN, suffix = c(".x", ".y"), ...,
        left = TRUE, largest = FALSE)
```

Arguments

x	object of class sf
y	object of class sf
join	geometry predicate function with the same profile as st_intersects ; see details
FUN	deprecated;
suffix	length 2 character vector; see merge
...	arguments passed on to the join function (e.g. prepared, or a pattern for st_relate)
left	logical; if TRUE carry out left join, else inner join; see also left_join
largest	logical; if TRUE, return x features augmented with the fields of y that have the largest overlap with each of the features of x; see https://github.com/r-spatial/sf/issues/578

Details

alternative values for argument join are: [st_disjoint](#) [st_touches](#) [st_crosses](#) [st_within](#) [st_contains](#) [st_overlaps](#) [st_covers](#) [st_covered_by](#) [st_equals](#) or [st_equals_exact](#), or user-defined functions of the same profile

Value

an object of class sf, joined based on geometry

Examples

```

a = st_sf(a = 1:3,
  geom = st_sfc(st_point(c(1,1)), st_point(c(2,2)), st_point(c(3,3))))
b = st_sf(a = 11:14,
  geom = st_sfc(st_point(c(10,10)), st_point(c(2,2)), st_point(c(2,2)), st_point(c(3,3))))
st_join(a, b)
st_join(a, b, left = FALSE)
# two ways to aggregate y's attribute values outcome over x's geometries:
st_join(a, b) %>% aggregate(list(. $a.x), mean)
library(dplyr)
st_join(a, b) %>% group_by(a.x) %>% summarise(mean(a.y))
# example of largest = TRUE:
nc <- st_transform(st_read(system.file("shape/nc.shp", package="sf")), 2264)
gr = st_sf(
  label = apply(expand.grid(1:10, LETTERS[10:1])[,2:1], 1, paste0, collapse = " "),
  geom = st_make_grid(nc))
gr$col = sf.colors(10, categorical = TRUE, alpha = .3)
# cut, to check, NA's work out:
gr = gr[-(1:30),]
nc_j <- st_join(nc, gr, largest = TRUE)
# the two datasets:
opar = par(mfrow = c(2,1), mar = rep(0,4))
plot(st_geometry(nc_j))
plot(st_geometry(gr), add = TRUE, col = gr$col)
text(st_coordinates(st_centroid(gr)), labels = gr$label)
# the joined dataset:
plot(st_geometry(nc_j), border = 'black', col = nc_j$col)
text(st_coordinates(st_centroid(nc_j)), labels = nc_j$label, cex = .8)
plot(st_geometry(gr), border = 'green', add = TRUE)
par(opar)

```

st_layers

List layers in a datasource

Description

List layers in a datasource

Usage

```
st_layers(dsn, options = character(0), do_count = FALSE)
```

Arguments

dsn	data source name (interpretation varies by driver - for some drivers, dsn is a file name, but may also be a folder, or contain the name and access credentials of a database)
options	character; driver dependent dataset open options, multiple options supported.

do_count	logical; if TRUE, count the features by reading them, even if their count is not reported by the driver
----------	---------------------------------------------------------------------------------------------------------

st_line_sample	<i>Sample points on a linear geometry</i>
----------------	-------------------------------------------

Description

Sample points on a linear geometry

Usage

```
st_line_sample(x, n, density, type = "regular", sample = NULL)
```

Arguments

x	object of class sf, sfc or sfg
n	integer; number of points to choose per geometry; if missing, n will be computed as <code>round(density * st_length(geom))</code> .
density	numeric; density (points per distance unit) of the sampling, possibly a vector of length equal to the number of features (otherwise recycled); density may be of class units.
type	character; indicate the sampling type, either "regular" or "random"
sample	numeric; a vector of numbers between 0 and 1 indicating the points to sample - if defined sample overrules n, density and type.

Examples

```
ls = st_sfc(st_linestring(rbind(c(0,0),c(0,1))),
st_linestring(rbind(c(0,0),c(10,0))))
st_line_sample(ls, density = 1)
ls = st_sfc(st_linestring(rbind(c(0,0),c(0,1))),
st_linestring(rbind(c(0,0),c(.1,0))), crs = 4326)
try(st_line_sample(ls, density = 1/1000)) # error
st_line_sample(st_transform(ls, 3857), n = 5) # five points for each line
st_line_sample(st_transform(ls, 3857), n = c(1, 3)) # one and three points
st_line_sample(st_transform(ls, 3857), density = 1/1000) # one per km
st_line_sample(st_transform(ls, 3857), density = c(1/1000, 1/10000)) # one per km, one per 10 km
st_line_sample(st_transform(ls, 3857), density = units::set_units(1, 1/km)) # one per km
# five equidistant points including start and end:
st_line_sample(st_transform(ls, 3857), sample = c(0, 0.25, 0.5, 0.75, 1))
```

st_make_grid	<i>Make a rectangular grid over the bounding box of a sf or sfc object</i>
--------------	----------------------------------------------------------------------------

Description

Make a rectangular grid over the bounding box of a sf or sfc object

Usage

```
st_make_grid(x, cellsize = c(diff(st_bbox(x)[c(1, 3)]), diff(st_bbox(x)[c(2,
4)]))/n, offset = st_bbox(x)[1:2], n = c(10, 10), crs = if (missing(x))
NA_crs_ else st_crs(x), what = "polygons")
```

Arguments

x	object of class sf or sfc
cellsize	target cellsize
offset	numeric of length 2; lower left corner coordinates (x, y) of the grid
n	integer of length 1 or 2, number of grid cells in x and y direction (columns, rows)
crs	object of class crs
what	character; one of: "polygons", "corners", or "centers"

Value

Object of class sfc (simple feature geometry list column) with, depending on what, rectangular polygons, corner points of these polygons, or center points of these polygons.

Examples

```
plot(st_make_grid(what = "centers"), axes = TRUE)
plot(st_make_grid(what = "corners"), add = TRUE, col = 'green', pch=3)
```

st_precision	<i>Get precision</i>
--------------	----------------------

Description

Get precision

Set precision

Usage

```

st_precision(x)

st_set_precision(x, precision)

st_precision(x) <- value

```

Arguments

x	object of class sfc or sf
precision	numeric; see st_as_binary for how to do this.
value	precision value

Details

Setting a precision has no direct effect on coordinates of geometries, but merely set an attribute tag to an sfc object. The effect takes place in [st_as_binary](#) or, more precise, in the C++ function `CPL_write_wkb`, where simple feature geometries are being serialized to well-known-binary (WKB). This happens always when routines are called in GEOS library (geometrical operations or predicates), for writing geometries using [st_write](#), [write_sf](#) or [st_write_db](#), [st_make_valid](#) in package `lwgeom`; also [aggregate](#) and [summarise](#) by default union geometries, which calls a GEOS library function. Routines in these libraries receive rounded coordinates, and possibly return results based on them. [st_as_binary](#) contains an example of a roundtrip of sfc geometries through WKB, in order to see the rounding happening to R data.

The reason to support precision is that geometrical operations in GEOS or `liblwgeom` may work better at reduced precision. For writing data from R to external resources it is harder to think of a good reason to limiting precision.

Examples

```

x <- st_sfc(st_point(c(pi, pi)))
st_precision(x)
st_precision(x) <- 0.01
st_precision(x)

```

st_read

Read simple features or layers from file or database

Description

Read simple features from file or database, or retrieve layer names and their geometry type(s)

Read PostGIS table directly through DBI and RPostgreSQL interface, converting binary

Usage

```

st_read(dsn, layer, ...)

## Default S3 method:
st_read(dsn, layer, ..., options = NULL, quiet = FALSE,
        geometry_column = 1L, type = 0, promote_to_multi = TRUE,
        stringsAsFactors = default.stringsAsFactors(), int64_as_string = FALSE,
        check_ring_dir = FALSE)

read_sf(..., quiet = TRUE, stringsAsFactors = FALSE)

st_read_db(conn = NULL, table = NULL, query = NULL, geom_column = NULL,
           EWKB, ...)

```

Arguments

dsn	data source name (interpretation varies by driver - for some drivers, dsn is a file name, but may also be a folder, or contain the name and access credentials of a database); in case of GeoJSON, dsn may be the character string holding the geojson data
layer	layer name (varies by driver, may be a file name without extension); in case layer is missing, st_read will read the first layer of dsn, give a warning and (unless quiet = TRUE) print a message when there are multiple layers, or give an error if there are no layers in dsn.
...	parameter(s) passed on to st_as_sf
options	character; driver dependent dataset open options, multiple options supported.
quiet	logical; suppress info on name, driver, size and spatial reference, or signaling no or multiple layers
geometry_column	integer or character; in case of multiple geometry fields, which one to take?
type	integer; ISO number of desired simple feature type; see details. If left zero, and promote_to_multi is TRUE, in case of mixed feature geometry types, conversion to the highest numeric type value found will be attempted. A vector with different values for each geometry column can be given.
promote_to_multi	logical; in case of a mix of Point and MultiPoint, or of LineString and Multi-LineString, or of Polygon and MultiPolygon, convert all to the Multi variety; defaults to TRUE
stringsAsFactors	logical; logical: should character vectors be converted to factors? The 'factory-fresh' default is TRUE, but this can be changed by setting options(stringsAsFactors = FALSE).
int64_as_string	logical; if TRUE, Int64 attributes are returned as string; if FALSE, they are returned as double and a warning is given when precision is lost (i.e., values are larger than 2 ⁵³).

check_ring_dir	logical; if TRUE, polygon ring directions are checked and if necessary corrected (when seen from above: exterior ring counter clockwise, holes clockwise)
conn	open database connection
table	table name
query	SQL query to select records; see details
geom_column	character or integer: indicator of name or position of the geometry column; if not provided, the last column of type character is chosen
EWKB	logical; is the WKB is of type EWKB? if missing, defaults to TRUE if conn is of class codePostgreSQLConnection or PqConnection, and to FALSE otherwise

Details

for geometry_column, see also https://trac.osgeo.org/gdal/wiki/rfc41_multiple_geometry_fields

for values for type see https://en.wikipedia.org/wiki/Well-known_text#Well-known_binary, but note that not every target value may lead to successful conversion. The typical conversion from POLYGON (3) to MULTIPOLYGON (6) should work; the other way around (type=3), secondary rings from MULTIPOLYGONS may be dropped without warnings. promote_to_multi is handled on a per-geometry column basis; type may be specified for each geometry column.

In case of problems reading shapefiles from USB drives on OSX, please see <https://github.com/r-spatial/sf/issues/252>.

read_sf and write_sf are aliases for st_read and st_write, respectively, with some modified default arguments. read_sf and write_sf are quiet by default: they do not print information about the data source. read_sf returns an sf-tibble rather than an sf-data.frame. write_sf delete layers by default: it overwrites existing files without asking or warning.

if table is not given but query is, the spatial reference system (crs) of the table queried is only available in case it has been stored into each geometry record (e.g., by PostGIS, when using EWKB)

in case geom_column is missing: if table is missing, this function will try to read the name of the geometry column from table geometry_columns, in other cases, or when this fails, the geom_column is assumed to be the last column of mode character. If table is missing, the SRID cannot be read and resolved into a proj4string by the database, and a warning will be given.

Value

object of class sf when a layer was successfully read; in case argument layer is missing and data source dsn does not contain a single layer, an object of class sf_layers is returned with the layer names, each with their geometry type(s). Note that the number of layers may also be zero.

Note

The use of system.file in examples make sure that examples run regardless where R is installed: typical users will not use system.file but give the file name directly, either with full path or relative to the current working directory (see [getwd](#)). "Shapefiles" consist of several files with the same basename that reside in the same directory, only one of them having extension .shp.

Examples

```

nc = st_read(system.file("shape/nc.shp", package="sf"))
summary(nc) # note that AREA was computed using Euclidian area on lon/lat degrees

## Not run:
library(sp)
example(meuse, ask = FALSE, echo = FALSE)
try(st_write(st_as_sf(meuse), "PG:dbname=postgis", "meuse",
  layer_options = "OVERWRITE=true"))
try(st_meuse <- st_read("PG:dbname=postgis", "meuse"))
if (exists("st_meuse"))
  summary(st_meuse)

## End(Not run)
# read geojson from string:
geojson_txt <- paste("{\"type\":\"MultiPoint\",\"coordinates\":",
  "[[[3.2,4],[3,4.6],[3.8,4.4],[3.5,3.8],[3.4,3.6],[3.9,4.5]]]")
x = read_sf(geojson_txt)
x
## Not run:
library(RPostgreSQL)
try(conn <- dbConnect(PostgreSQL(), dbname = "postgis"))
if (exists("conn") && !inherits(conn, "try-error")) {
  x = st_read_db(conn, "meuse", query = "select * from meuse limit 3;")
  x = st_read_db(conn, table = "public.meuse")
  print(st_crs(x)) # SRID resolved by the database, not by GDAL!
  dbDisconnect(conn)
}

## End(Not run)

```

st_relate	<i>Compute DE9-IM relation between pairs of geometries, or match it to a given pattern</i>
-----------	--------------------------------------------------------------------------------------------

Description

Compute DE9-IM relation between pairs of geometries, or match it to a given pattern

Usage

```
st_relate(x, y, pattern = NA_character_, sparse = !is.na(pattern))
```

Arguments

x	object of class sf, sfc or sfg
y	object of class sf, sfc or sfg
pattern	character; define the pattern to match to, see details.
sparse	logical; should a sparse matrix be returned (TRUE) or a dense matrix?

Value

In case `pattern` is not given, `st_relate` returns a dense character matrix; element `[i,j]` has nine characters, referring to the DE9-IM relationship between `x[i]` and `y[j]`, encoded as `IxIy,IxBx,IxEy,BxIy,BxBx,BxEy,ExIy,ExBx` where `I` refers to interior, `B` to boundary, and `E` to exterior, and e.g. `BxIy` the dimensionality of the intersection of the the boundary of `x[i]` and the interior of `y[j]`, which is one of 0,1,2,F, digits denoting dimensionality, `F` denoting not intersecting. When `pattern` is given, a dense logical matrix or sparse index list returned with matches to the given pattern; see [st_intersection](#) for a description of the returned matrix or list. See also <https://en.wikipedia.org/wiki/DE-9IM> for further explanation.

Examples

```
p1 = st_point(c(0,0))
p2 = st_point(c(2,2))
pol1 = st_polygon(list(rbind(c(0,0),c(1,0),c(1,1),c(0,1),c(0,0)))) - 0.5
pol2 = pol1 + 1
pol3 = pol1 + 2
st_relate(st_sfc(p1, p2), st_sfc(pol1, pol2, pol3))
sfc = st_sfc(st_point(c(0,0)), st_point(c(3,3)))
grd = st_make_grid(sfc, n = c(3,3))
st_intersects(grd)
st_relate(grd, pattern = "****1****") # sides, not corners, internals
st_relate(grd, pattern = "****0****") # only corners touch
st_rook = function(a, b = a) st_relate(a, b, pattern = "F***1****")
st_rook(grd)
# queen neighbours, see \url{https://github.com/r-spatial/sf/issues/234#issuecomment-300511129}
st_queen <- function(a, b = a) st_relate(a, b, pattern = "F***T****")
```

st_sample

sample points on or in (sets of) spatial features

Description

sample points on or in (sets of) spatial features

Usage

```
st_sample(x, size, ..., type = "random")
```

Arguments

<code>x</code>	object of class <code>sf</code> or <code>sfc</code>
<code>size</code>	sample size(s) requested; either total size, or a numeric vector with sample sizes for each feature geometry. When sampling polygons, the returned sampling size may differ from the requested size, as the bounding box is sampled, and sampled points intersecting the polygon are returned.
<code>...</code>	ignored, or passed on to sample for multipoint sampling
<code>type</code>	character; indicates the spatial sampling type; only <code>random</code> is implemented right now

Details

if `x` has dimension 2 (polygons) and geographical coordinates (long/lat), uniform random sampling on the sphere is applied, see e.g. <http://mathworld.wolfram.com/SpherePointPicking.html>

Examples

```
x = st_sfc(st_polygon(list(rbind(c(0,0),c(90,0),c(90,90),c(0,90),c(0,0))))) # NOT long/lat:
plot(x, axes = TRUE, graticule = TRUE)
if (sf_extSoftVersion()["proj.4"] >= "4.9.0")
  plot(p <- st_sample(x, 1000), add = TRUE)
x2 = st_transform(st_segmentize(x, 1e4), st_crs("+proj=ortho +lat_0=30 +lon_0=45"))
g = st_transform(st_graticule(), st_crs("+proj=ortho +lat_0=30 +lon_0=45"))
plot(x2, graticule = g)
if (sf_extSoftVersion()["proj.4"] >= "4.9.0") {
  p2 = st_transform(p, st_crs("+proj=ortho +lat_0=30 +lon_0=45"))
  plot(p2, add = TRUE)
}
x = st_sfc(st_polygon(list(rbind(c(0,0),c(90,0),c(90,90),c(0,90),c(0,0))))) # NOT long/lat:
plot(x)
plot(st_sample(x, 1000), add = TRUE)
x = st_sfc(st_polygon(list(rbind(c(-180,-90),c(180,-90),c(180,90),c(-180,90),c(-180,-90))))) # NOT long/lat:
crs=st_crs(4326)
if (sf_extSoftVersion()["proj.4"] >= "4.9.0") {
  p = st_sample(x, 1000)
  st_sample(p, 3)
}
pt = st_multipoint(matrix(1:20,,2))
ls = st_sfc(st_linestring(rbind(c(0,0),c(0,1))),
  st_linestring(rbind(c(0,0),c(.1,0))),
  st_linestring(rbind(c(0,1),c(.1,1))),
  st_linestring(rbind(c(2,2),c(2,2.00001))))
st_sample(ls, 80)
```

st_transform

Transform or convert coordinates of simple feature

Description

Transform or convert coordinates of simple feature

Usage

```
st_transform(x, crs, ...)

## S3 method for class 'sfc'
st_transform(x, crs, ..., partial = TRUE, check = FALSE,
  use_gdal = TRUE)

## S3 method for class 'sf'
```

```

st_transform(x, crs, ...)

## S3 method for class 'sfg'
st_transform(x, crs, ...)

st_proj_info(type = "proj")

st_wrap_dateline(x, options, quiet)

## S3 method for class 'sfc'
st_wrap_dateline(x, options = "WRAPDATELINE=YES",
  quiet = TRUE)

## S3 method for class 'sf'
st_wrap_dateline(x, options = "WRAPDATELINE=YES", quiet = TRUE)

## S3 method for class 'sfg'
st_wrap_dateline(x, options = "WRAPDATELINE=YES",
  quiet = TRUE)

```

Arguments

x	object of class sf, sfc or sfg
crs	coordinate reference system: integer with the EPSG code, or character with proj4string
...	ignored
partial	logical; allow for partial projection, if not all points of a geometry can be projected (corresponds to setting environment variable OGR_ENABLE_PARTIAL_REPROJECTION to TRUE)
check	logical; perform a sanity check on resulting polygons?
use_gdal	logical; this parameter is deprecated. For transformations using PROJ.4 directly rather than indirectly through GDAL, use st_transform_proj of package lwgeom (see Details)
type	character; one of proj, ellps, datum or units
options	character; should have "WRAPDATELINE=YES" to function; another parameter that is used is "DATELINEOFFSET=10" (where 10 is the default value)
quiet	logical; print options after they have been parsed?

Details

Transforms coordinates of object to new projection. Features that cannot be transformed are returned as empty geometries.

st_transform uses GDAL for coordinate transformations; internally, GDAL converts the proj4string into a well-known-text representation, before passing that on to PROJ.4. In this process, some information can get lost. Adding parameter +wktext to the proj4string definition may resolve this; see <https://github.com/edzer/sp/issues/42>.

Some PROJ.4 projections are not supported by GDAL, e.g. "+proj=wintri" because it does not have an inverse projection. Projecting to unsupported projections can be done by `st_transform_proj`, part of package `lwgeom`. Note that the unsupported proj4string cannot be passed as argument to `st_crs`, but has to be given as character string.

The `st_transform` method for `sfg` objects assumes that the CRS of the object is available as an attribute of that name.

`st_proj_info` lists the available projections, ellipses, datums or units supported by the Proj.4 library

For a discussion of using options, see <https://github.com/r-spatial/sf/issues/280> and <https://github.com/r-spatial/sf/issues/541>

Examples

```
p1 = st_point(c(7,52))
p2 = st_point(c(-30,20))
sfc = st_sfc(p1, p2, crs = 4326)
sfc
st_transform(sfc, 3857)
st_transform(st_sf(a=2:1, geom=sfc), "+init=epsg:3857")
nc = st_read(system.file("shape/nc.shp", package="sf"))
st_area(nc[1,]) # area from long/lat
st_area(st_transform(nc[1,], 32119)) # NC state plane, m
st_area(st_transform(nc[1,], 2264)) # NC state plane, US foot
library(units)
set_units(st_area(st_transform(nc[1,], 2264)), m^2)
st_transform(structure(p1, proj4string = "+init=epsg:4326"), "+init=epsg:3857")
st_proj_info("datum")
st_wrap_dateline(st_sfc(st_linestring(rbind(c(-179,0),c(179,0)))), crs = 4326))
library(maps)
wrlld <- st_as_sf(maps::map("world", fill = TRUE, plot = FALSE))
wrlld_wrap <- st_wrap_dateline(wrlld, options = c("WRAPDATELINE=YES", "DATELINEOFFSET=180"),
  quiet = TRUE)
wrlld_moll <- st_transform(wrlld_wrap, "+proj=moll")
plot(st_geometry(wrlld_moll), col = "transparent")
```

st_viewport

Create viewport from sf, sfc or sfg object

Description

Create viewport from sf, sfc or sfg object

Usage

```
st_viewport(x, ..., bbox = st_bbox(x), asp)
```

Arguments

x	object of class sf, sfc or sfg object
...	parameters passed on to viewport
bbox	the bounding box used for aspect ratio
asp	numeric; target aspect ratio (y/x), see Details

Details

parameters width, height, xscale and yscale are set such that aspect ratio is honoured and plot size is maximized in the current viewport; others can be passed as ...

If asp is missing, it is taken as 1, except when isTRUE(st_is_longlat(x)), in which case it is set to $1.0 / \cos(y)$, with y the middle of the latitude bounding box.

Value

The output of the call to [viewport](#)

Examples

```
library(grid)
nc = st_read(system.file("shape/nc.shp", package="sf"))
grid.newpage()
pushViewport(viewport(width = 0.8, height = 0.8))
pushViewport(st_viewport(nc))
invisible(lapply(st_geometry(nc), function(x) grid.draw(st_as_grob(x, gp = gpar(fill = 'red')))))
```

st_write

Write simple features object to file or database

Description

Write simple features object to file or database

Write simple feature table to a spatial database

Usage

```
st_write(obj, dsn, layer, ...)
```

```
## S3 method for class 'sfc'
st_write(obj, dsn, layer, ...)
```

```
## S3 method for class 'sf'
st_write(obj, dsn, layer = file_path_sans_ext(basename(dsn)),
  ..., driver = guess_driver_can_write(dsn), dataset_options = NULL,
  layer_options = NULL, quiet = FALSE, factorsAsCharacter = TRUE,
  update = driver %in% db_drivers, delete_dsn = FALSE,
```

```

delete_layer = FALSE)

write_sf(..., quiet = TRUE, delete_layer = TRUE)

st_write_db(conn = NULL, obj, table = deparse(substitute(obj)),
  geom_name = "wkb_geometry", ..., drop = FALSE, debug = FALSE,
  binary = TRUE, append = FALSE)

```

Arguments

obj	object of class sf or sfc
dsn	data source name (interpretation varies by driver - for some drivers, dsn is a file name, but may also be a folder or contain a database name)
layer	layer name (varies by driver, may be a file name without extension); if layer is missing, the basename of dsn is taken.
...	ignored for st_write, for st_write_db arguments passed on to dbWriteTable
driver	character; driver name to be used, if missing, a driver name is guessed from dsn; st_drivers() returns the drivers that are available with their properties; links to full driver documentation are found at http://www.gdal.org/ogr_formats.html .
dataset_options	character; driver dependent dataset creation options; multiple options supported.
layer_options	character; driver dependent layer creation options; multiple options supported.
quiet	logical; suppress info on name, driver, size and spatial reference
factorsAsCharacter	logical; convert factor objects into character strings (default), else into numbers by as.numeric.
update	logical; FALSE by default for single-layer drivers but TRUE by default for database drivers as defined by db_drivers. For database-type drivers (e.g. GPKG) TRUE values will make GDAL try to update (append to) the existing data source, e.g. adding a table to an existing database.
delete_dsn	logical; delete data source dsn before attempting to write?
delete_layer	logical; delete layer layer before attempting to write? (not yet implemented)
conn	open database connection
table	character; name for the table in the database, possibly of length 2, c("schema", "name"); default schema is public
geom_name	name of the geometry column in the database
drop	logical; should table be dropped first?
debug	logical; print SQL statements to screen before executing them.
binary	logical; use well-known-binary for transfer?
append	logical; append to table? (NOTE: experimental, might not work)

Details

columns (variables) of a class not supported are dropped with a warning. When deleting layers or data sources is not successful, no error is emitted. `delete_dsn` and `delete_layers` should be handled with care; the former may erase complete directories or databases.

`st_write_db` was written with help of Josh London, see <https://github.com/r-spatial/sf/issues/285>

See Also

[st_drivers](#)

Examples

```
nc = st_read(system.file("shape/nc.shp", package="sf"))
st_write(nc, "nc.shp")
st_write(nc, "nc.shp", delete_layer = TRUE) # overwrites
data(meuse, package = "sp") # loads data.frame from sp
meuse_sf = st_as_sf(meuse, coords = c("x", "y"), crs = 28992)
st_write(meuse_sf, "meuse.csv", layer_options = "GEOMETRY=AS_XY") # writes X and Y as columns
st_write(meuse_sf, "meuse.csv", layer_options = "GEOMETRY=AS_WKT", delete_dsn=TRUE) # overwrites
## Not run:
library(sp)
example(meuse, ask = FALSE, echo = FALSE)
try(st_write(st_as_sf(meuse), "PG:dbname=postgis", "meuse_sf",
  layer_options = c("OVERWRITE=yes", "LAUNDER=true")))
demo(nc, ask = FALSE)
try(st_write(nc, "PG:dbname=postgis", "sids", layer_options = "OVERWRITE=true"))

## End(Not run)
## Not run:
library(sp)
data(meuse)
sf = st_as_sf(meuse, coords = c("x", "y"), crs = 28992)
library(RPostgreSQL)
try(conn <- dbConnect(PostgreSQL(), dbname = "postgis"))
if (exists("conn") && !inherits(conn, "try-error"))
  st_write_db(conn, sf, "meuse_tbl", drop = FALSE)

## End(Not run)
```

st_zm

Drop or add Z and/or M dimensions from feature geometries

Description

Drop Z and/or M dimensions from feature geometries, resetting classes appropriately

Usage

```
st_zm(x, ..., drop = TRUE, what = "ZM")
```

Arguments

x	object of class sfg, sfc or sf
...	ignored
drop	logical; drop, or (FALSE) add?
what	character which dimensions to drop or add

Details

Only combinations drop=TRUE, what = "ZM", and drop=FALSE, what="Z" are supported so far. In case add=TRUE, x should have XY geometry, and zero values are added for Z.

Examples

```
st_zm(st_linestring(matrix(1:32,8)))
x = st_sfc(st_linestring(matrix(1:32,8)), st_linestring(matrix(1:8,2)))
st_zm(x)
a = st_sf(a = 1:2, geom=x)
st_zm(a)
```

summary.sfc

Summarize simple feature column

Description

Summarize simple feature column

Usage

```
## S3 method for class 'sfc'
summary(object, ..., maxsum = 7L, maxp4s = 10L)
```

Arguments

object	object of class sfc
...	ignored
maxsum	maximum number of classes to summarize the simple feature column to
maxp4s	maximum number of characters to print from the PROJ.4 string

tibble	<i>Summarize simple feature type for tibble</i>
--------	-------------------------------------------------

Description

Summarize simple feature type for tibble

Summarize simple feature item for tibble

Usage

```
type_sum.sfc(x, ...)
```

```
obj_sum.sfc(x)
```

```
pillar_shaft.sfc(x, ...)
```

Arguments

x object of class sfc

... ignored

Details

see [type_sum](#)

Index

*Topic **datasets**

- db_drivers, 7
- extension_map, 10
- prefix_map, 31
- st_agr, 40
- st_bbox, 47
- st_crs, 55

*Topic **data**

- bgMap, 5
- .degAxis (stars), 39
- .get_layout (stars), 39
- .image_scale (stars), 39
- .image_scale_factor (stars), 39
- .stop_geos (internal), 23
- [.data.frame, 32, 33
- [.sf (sf), 32
- \$.crs (st_crs), 55

- aggregate, 4, 51, 68
- aggregate (aggregate.sf), 3
- aggregate.sf, 3
- anti_join.sf (dplyr), 7
- arrange.sf (dplyr), 7
- as, 5
- as.data.frame, 7
- as.matrix.sfg (st), 36
- as.matrix.sgbp (sgbp), 35
- as_Spatial (as), 5

- basename, 77
- bgMap, 5
- bind, 6
- bind_cols, 6
- bpy.colors, 29

- c, 17
- c.sfg, 17
- c.sfg (st), 36
- cbind, 6
- cbind.sf (bind), 6

- classIntervals, 28
- coerce, sf, Spatial-method (as), 5
- coerce, sfc, Spatial-method (as), 5
- coerce, Spatial, sf-method (as), 5
- coerce, Spatial, sfc-method (as), 5

- data.frame, 6
- db_drivers, 7
- dim.sgbp (sgbp), 35
- distinct.sf (dplyr), 7
- dotsMethods, 6
- dplyr, 7

- extension_map, 10
- filter.sf (dplyr), 7
- format.sfg (st), 36
- full_join.sf (dplyr), 7

- g (bgMap), 5
- gather.sf (dplyr), 7
- gdal, 11
- gdal_crs (gdal), 11
- gdal_inv_geotransform (gdal), 11
- gdal_metadata (gdal), 11
- gdal_read (gdal), 11
- gdal_subdatasets (gdal), 11
- gdal_utils, 12
- gdal_write (gdal), 11
- geos_binary_ops, 13
- geos_binary_pred, 15
- geos_combine, 17
- geos_measures, 18
- geos_query, 20
- geos_unary, 21
- get_key_pos (plot), 26
- getwd, 70
- group_by.sf (dplyr), 7
- gUnaryUnion, 17
- gUnion, 17

- head.sfg (st), 36
- inner_join.sf (dplyr), 7
- internal, 23
- intersect, 14
- is.na.bbox (st_bbox), 47
- is.na.crs (st_crs), 55
- is_driver_available, 24
- is_driver_can, 24
- left_join, 9, 64
- left_join.sf (dplyr), 7
- merge, 64
- merge.sf, 25
- mutate.sf (dplyr), 7
- NA_agr_ (st_agr), 40
- NA_bbox_ (st_bbox), 47
- NA_crs_ (st_crs), 55
- nest, 9
- nest.sf (dplyr), 7
- obj_sum.sfc (tibble), 80
- ops, 25
- Ops.sfc (ops), 25
- Ops.sfg (ops), 25
- par, 28, 29
- pillar_shaft.sfc (tibble), 80
- plot, 26, 28
- plot.window, 28
- plot_sf, 28
- plot_sf (plot), 26
- polypath, 28
- prefix_map, 31
- print.sf (sf), 32
- print.sfg (st), 36
- print.sgbp (sgbp), 35
- rainbow, 28
- rawToHex, 31
- rbind, 6
- rbind.sf (bind), 6
- read_sf (st_read), 68
- rename.sf (dplyr), 7
- right_join.sf (dplyr), 7
- sample, 72
- sample_frac.sf (dplyr), 7
- sample_n.sf (dplyr), 7
- select.sf (dplyr), 7
- semi_join.sf (dplyr), 7
- separate, 9
- separate.sf (dplyr), 7
- set_units, 19
- setdiff, 14
- sf, 4, 8, 32, 56, 59, 63, 67, 70
- sf.colors, 28
- sf.colors (plot), 26
- sf_extSoftVersion, 34
- sf_project, 35
- sfc, 33, 43, 56, 59, 63, 67
- sgbp, 35
- slice.sf (dplyr), 7
- spread.sf (dplyr), 7
- st, 36
- st_agr, 40
- st_agr<- (st_agr), 40
- st_area (geos_measures), 18
- st_as_binary, 32, 34, 40, 46, 68
- st_as_grob, 42
- st_as_sf, 42, 69
- st_as_sfc, 32, 33, 44, 49
- st_as_text, 46
- st_bbox, 47
- st_bind_cols (bind), 6
- st_boundary (geos_unary), 21
- st_buffer (geos_unary), 21
- st_cast, 5, 19, 50, 53
- st_cast_sfc_default, 52
- st_centroid (geos_unary), 21
- st_collection_extract, 53
- st_combine, 9
- st_combine (geos_combine), 17
- st_contains, 64
- st_contains (geos_binary_pred), 15
- st_contains_properly (geos_binary_pred), 15
- st_convex_hull (geos_unary), 21
- st_coordinates, 54
- st_covered_by, 64
- st_covered_by (geos_binary_pred), 15
- st_covers, 64
- st_covers (geos_binary_pred), 15
- st_crosses, 64
- st_crosses (geos_binary_pred), 15
- st_crs, 12, 49, 55, 75

st_crs(), 46
 st_crs<- (st_crs), 55
 st_difference, 18
 st_difference (geos_binary_ops), 13
 st_dimension, 19
 st_dimension (geos_query), 20
 st_disjoint, 64
 st_disjoint (geos_binary_pred), 15
 st_distance (geos_measures), 18
 st_drivers, 24, 57, 78
 st_equals, 9, 64
 st_equals (geos_binary_pred), 15
 st_equals_exact, 64
 st_equals_exact (geos_binary_pred), 15
 st_geod_area, 19
 st_geod_segmentize, 22
 st_geometry, 58
 st_geometry<- (st_geometry), 58
 st_geometry_type, 59
 st_geometrycollection (st), 36
 st_graticule, 29, 60
 st_interpolate_aw, 61
 st_intersection, 18, 72
 st_intersection (geos_binary_ops), 13
 st_intersects, 41, 64
 st_intersects (geos_binary_pred), 15
 st_is, 62
 st_is_empty (geos_query), 20
 st_is_longlat, 63
 st_is_simple (geos_query), 20
 st_is_valid (geos_query), 20
 st_is_within_distance
 (geos_binary_pred), 15
 st_jitter, 63
 st_join, 4, 64
 st_layers, 65
 st_length (geos_measures), 18
 st_line_merge (geos_unary), 21
 st_line_sample, 66
 st_linestring (st), 36
 st_make_grid, 67
 st_multilinestring (st), 36
 st_multipoint (st), 36
 st_multipolygon (st), 36
 st_node (geos_unary), 21
 st_overlaps, 64
 st_overlaps (geos_binary_pred), 15
 st_point, 43
 st_point (st), 36
 st_point_on_surface (geos_unary), 21
 st_polygon (st), 36
 st_polygonize (geos_unary), 21
 st_precision, 67
 st_precision<- (st_precision), 67
 st_proj_info (st_transform), 73
 st_read, 32, 34, 68
 st_read_db (st_read), 68
 st_relate, 16, 64, 71
 st_sample, 72
 st_segmentize (geos_unary), 21
 st_set_agr (st_agr), 40
 st_set_crs (st_crs), 55
 st_set_geometry (st_geometry), 58
 st_set_precision (st_precision), 67
 st_sf, 6, 43
 st_sf (sf), 32
 st_sfc (sfc), 33
 st_simplify (geos_unary), 21
 st_snap (geos_binary_ops), 13
 st_sym_difference, 18
 st_sym_difference (geos_binary_ops), 13
 st_touches, 64
 st_touches (geos_binary_pred), 15
 st_transform, 73
 st_transform_proj, 74, 75
 st_triangulate (geos_unary), 21
 st_union, 4, 9, 14
 st_union (geos_combine), 17
 st_viewport, 75
 st_voronoi (geos_unary), 21
 st_within, 64
 st_within (geos_binary_pred), 15
 st_wrap_dateline (st_transform), 73
 st_write, 68, 76
 st_write_db, 68
 st_write_db (st_write), 76
 st_zm, 78
 stars, 39
 summarise, 51, 68
 summarise (dplyr), 7
 summary.sfc, 79

 t.sgbp (sgbp), 35
 tibble, 80
 transmute.sf (dplyr), 7
 type_sum, 80
 type_sum.sfc (tibble), 80

`ungroup.sf (dplyr)`, [7](#)
`unit`, [42](#)
`unite.sf (dplyr)`, [7](#)
`unnest`, [9](#)
`unnest.sf (dplyr)`, [7](#)

`viewport`, [76](#)

`write_sf`, [68](#)
`write_sf (st_write)`, [76](#)