

# Package ‘Triangulation’

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**Type** Package  
**Title** Triangulation for 2D domain  
**Version** 1.0.0  
**Author** Ming-Jun Lai, Li Wang  
**Maintainer** Guannan Wang <gwang01@wm.edu>  
**Imports** pracma,  
tripack  
**Depends** R (>= 2.10)  
**Description** This package can help create triangle mesh by using Delaunay triangulation.  
**License** GPL (>= 2)  
**Encoding** UTF-8  
**LazyData** true  
**RoxygenNote** 7.1.2

## R topics documented:

BMP . . . . .	1
shape . . . . .	2
TriMesh . . . . .	2
TriPlot . . . . .	4
USbb . . . . .	5
weird . . . . .	5
<b>Index</b>	<b>6</b>

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BMP	<i>Bandiagara Domain Boundary Data</i>
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### Description

A list of coordinates of the boundary vertices of Bandiagara

### Usage

```
data('BMP')
```

**Format**

BMP is a list of three dataframes including vertices information of external and internal boundaries of Bandiagara.

**bound** The coordinates of external boundaries.

**H1** The coordinates of an internal hole in the region.

**H2** The coordinates of an internal hole in the region.

**References**

Data courtesy by Jean Gaudart, 2012.

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shape	<i>Example from Distmesh (MATLAB)</i>
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**Description**

A dataframe of coordinates of the external boundary of a polygon region developed.

**Usage**

```
data('shape')
```

**Format**

shape is a dataframe with vertices of the boundary of a polygon region.

**v1** The latitudes of the external boundary.

**v2** The longitudes of the external boundary.

**References**

This example is from a triangulation software called distmesh.

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TriMesh	<i>Create Triangles Mesh in 2D Domains</i>
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**Description**

This function triangulates the polygonal domain by using Delaunay Triangulation.

**Usage**

```
TriMesh(Pt, n, H = NULL)
```

## Arguments

Pt	A two by N matrix which indicates the outer boundary points of a 2D region.
n	An integer parameter controlling the fineness of the triangulation and subsequent triangulation. As n increases the fineness increases. Usually, n = 8 seems to be a good choice.
H	A list of vertices that are the inner boundary points, default set to 'NULL' if there is no holes.

## Details

In the function, we firstly get grid points inside and on the boundary of the polygon with extreme points Pt and interior holes defined by H. Then delaunay triangulation is used to generate triangulations by using the grid points. And lastly we delete triangles within the holes or outside the boundary of the region.

## Value

V	an N by two matrix that lists vertices with the i <sup>th</sup> row storing in Cartesian coordinates for the i <sup>th</sup> vertex. N is the number of vertices.
Tr	a K by three matrix that each row represents one triangle. All the elements are the integers that stand for the indices of vertices in V.

## Examples

```
# square domain
bb = rbind(c(0,0), c(1,0), c(1,1), c(0,1))
VT = TriMesh(Pt = bb, n = 2)

# irregular domain
data("horseshoe")
VT = TriMesh(Pt = horseshoe, n = 9)

data("shape")
VT = TriMesh(Pt = shape, n = 15)

data("weird")
VT = TriMesh(Pt = weird, n = 25)

data("USbb")
VT = TriMesh(Pt = USbb, n = 15)

# region with holes
data("BMP")
VT = TriMesh(Pt = BMP$bound, n = 25, H = list(as.matrix(BMP$H1),as.matrix(BMP$H2)))

data("mymontreal")
VT = TriMesh(Pt = mymontreal$bound, n = 25, H = list(mymontreal$H1,mymontreal$H2))
```

TriPlot

*Triangulation Plot***Description**

This function plots a 2D triangulation.

**Usage**

```
TriPlot(V, Tr, col = 1, lwd = 1)
```

**Arguments**

V	an N by two matrix that lists vertices with the i-th row storing in Cartesian coordinates for the i-th vertex. N is the number of vertices.
Tr	a K by three matrix that each row represents one triangle. All the elements are the integers that stand for the indices of vertices in V.
col	A specification for the plotting color, defaulting to 1.
lwd	The line width, a positive number, defaulting to 1. The interpretation is device-specific, and some devices do not implement line widths less than one.

**Value**

A triangulation plot of a 2D region.

**Examples**

```
# rectangular domain
bb=rbind(c(0,0),c(1,0),c(1,1),c(0,1))
VT=TriMesh(bb,2)
TriPlot(VT$V,VT$Tr)

# irregular domains
data("horseshoe")
VT=TriMesh(horseshoe,n=8)
TriPlot(VT$V,VT$Tr)

data('shape')
VT=TriMesh(shape,15)
TriPlot(VT$V,VT$Tr)

data('weird')
VT=TriMesh(weird,25)
TriPlot(VT$V,VT$Tr)

# region with holes
data("BMP")
VT=TriMesh(BMP$bound,25,list(as.matrix(BMP$H1),as.matrix(BMP$H2)))
TriPlot(VT$V,VT$Tr)
```

```
data("mymontreal")
VT=TriMesh(mymontreal$bound,25,list(mymontreal$H1,mymontreal$H2))
TriPlot(VT$V,VT$Tr)
```

USbb

*United States of America Domain Boundary Data***Description**

A list of coordinates of the boundary vertices of the United States of America

**Usage**

```
data('USbb')
```

**Format**

USbb is a dataframe with vertices information of the modified external boundaries of the mainland of the United States of America.

**x.coord** The latitudes of the external boundary.

**y.coord** The longitudes of the external boundary.

**References**

Data courtesy by First-Data-Lab, 2022.

weird

*weird***Description**

A dataframe of coordinates of an external boundary of a spiral region.

**Usage**

```
data('weird')
```

**Format**

weird is a dataframe with vertices of the boundary of a spiral region.

**v1** The latitudes of the external boundary.

**v2** The longitudes of the external boundary.

**References**

This example is courtesy by Phong Luu during class.

# Index

## \* **datasets**

- BMP, [1](#)
- shape, [2](#)
- USbb, [5](#)
- weird, [5](#)

BMP, [1](#)

shape, [2](#)

TriMesh, [2](#)

TriPlot, [4](#)

USbb, [5](#)

weird, [5](#)