"An Algorithm for Triangulating Multiple 3D Polygons"

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Author: Ming Zou (mingzou@wustl.edu), Tao Ju, Nathan Carr
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I. Introduction

TMP (Triangulating Multiple Polygon) is based on the algorithm presented in paper "An Algorithm for Triangulating Multiple 3D Polygons" (SGP 2013). The algorithm reads in a set of 3D non-intersecting polygons (.curve file, see bellow) and generates a triangulation mesh (.obj file) bounded by those polygons. The shape of this triangulation can be controlled by specifying different metrics; the output surface is the optimal triangulation with a minimum metric cost. This algorithm is suitable for various surfacing application, like hole filling and lofting 3D sketches. Additionally, the algorithm can take in user defined boundary normals (.normal file, see bellow) to better control the shape of the output surface.

+ Choices of metric

There are currently 4 types of metrics
1. minimizing the total area of the mesh triangles
2. minimizing the sum of perimeter of each of the mesh triangle
3. minimizing the average of dihedral angle between each pair of adjacent mesh triangles
4. minimizing the worst of dihedral angle between each pair of adjacent mesh triangles

II. How to run

[Usage]

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TMP.exe <curveName> <useDT> <useMinSet> <areaWeight> <edgeWeight> <dihedralWeight>
<useMinMaxDihedral> <saveObj> <useNormal>
```

ARGUMENT	VALUE	DESCRIPTION	EXAMPLE
1) curveName	string	the name of the .curve file	monkey
2) useDT	{0,1}	search in Delaunay triangle space (1) or in all triangle set (0)	1
3) useMinSet	{0,1}	use minimal set to speed up the algorithm (1) or not (0)	1
4) areaWeight	rational number	use area metric	0
5) edgeWeight	rational number	use perimeter metric	0
6) dihedralWeight	rational number	use average dihedral metric	1
7) useMinMaxDihedral	{0,1}	minimizing the worst of dihedral angle between each pair of adjacent mesh triangles (1) or use other metrics (0)	0
8) saveObj	{0,1}	save surface (1) or not (0)	1
9) useNormal	{0,1}	include in normal file (1) or not (0)	0

Notes:
a. normal file should have the same name of the curve file. e.g. "monkey.curve" + "monkey.normal"
b. currently, the algorithm takes at most 6 polygons as input
c. search in all triangle set (useDT=0) could take a considerable time and memory

[Example]

1. Read in monkey saddle curve (monkey.curve) to compute a triangulation (monkey.obj), and minimize the average of dihedral. Use Delaunay triangles; use minimal set to speed up; and do not use additional normals.
e.g. TMP.exe monkey 1 1 0 0 1 0 1 0

2. Read in monkey saddle curve (monkey.curve) to compute a triangulation (monkey.obj), and minimize the average of dihedral. Use Delaunay triangles; use minimal set to speed up; and use additional normals (monkey.normal).
e.g. TMP.exe monkey 1 1 0 0 1 0 1 1

III. File Format==

1. .curve file

FILE FORMAT	DESCRIPTION
# of polygons	current the number is limited to 1~6
# of total vertices	total number of vertices of all input polygons
# of vertices in polygon_1	number of vertices in polygon_1
v[x] v[y] v[z]	the xyz coordinates of each vertex in polygon_1
	separated by blank, one vertex per line
# of vertices in polygon_2	number of vertices in polygon_2
v[x] v[y] v[z]	the xyz coordinates of each vertex in polygon_2
	separated by blank, one vertex per line
…	more polygon info
# of vertices in polygon_k	number of vertices in polygon_k
v[x] v[y] v[z]	the xyz coordinates of each vertex in polygon_k
	separated by blank, one vertex per line

2. .normal file
The same format as .curve, except that the coordinates are for the normals.
Each normal is defined on an input edge. For example, the ith normal in a polygon is actually the normal defined on edge (v_i, v_i+1) in this polygon.

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