A General Purpose Patatoid Generator Theory and Applications

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***Abstract*— As there is a constant need in the scientific community, we present in this paper a non-particular figure generator, based on a SF-AMPG method. The shapes which are built with this algorithm are convinient for most applications.**

I. Introduction

People writing articles, often explaining general (non-particular) situations, always face a lack of figures with non-particular shapes, i.e. which are **not** either a perfect square, triangle, circle or ellipse...We focus here on the issue of drawing a perfect non-particular smooth figure (not a polygon), trying to provide with results that would not look like an ellipse.

We propose a method to solve this problem : after reviewing some theoretical points (section II), we propose an implementation (section III), and finally present some results (section IV). This will be followed by a discussion (section V).

II. Theory

We decided to use a spline-based approach ; for a complete review of splines theory, one can read [1]. The algorithm, called SF-AMPG (which stands for Shape Free - Anchoring Model Patatoid Generator), works as follows :

1) We first define a rectangular bounding box for the figure, and chose one random point on each side, called **anchoring point**,
2) then, we compute the four lengths between these four anchoring points and place a fifth anchoring point on the longest segement,
3) Finally, we build a spline curve crossing these five anchoring points.

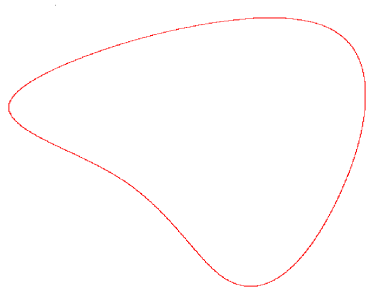

Fig. 1. Example of shape given by the SF-AMPG

III. Implementation

We implemented this algorithm with Scilab[1], a free scientific software package. We report script code for open distribution.

```
// user defines bounding box
largeur=input('Patatoid width ?');
hauteur=input('Patatoid height ?');

// random choice of 4 anchoring points
Rand = rand(1,5);
Rand(5) = 0.5+0.2*(Rand(5)-0.5);
x = [Rand(1)*largeur, largeur, Rand(2)*largeur, 0];
y = [0, Rand(3)*hauteur, hauteur, Rand(4)*hauteur];

// computation of the fifth anchoring point
for i=1:4
  dist(i)=sqrt( (x(modulo(i,4)+1)-x(i))^2 +
                (y(modulo(i,4)+1)-y(i))^2 );
end
[m,index]=max(dist);

// creation of base vectors
xmore = x(index)*Rand(5)+x(modulo(index,4)+1)*(1-Rand(5));
ymore = y(index)*Rand(5)+y(modulo(index,4)+1)*(1-Rand(5));
xnew = [x(1:index), xmore, x(index+1:length(x)), x(1)];
ynew = [y(1:index), ymore, y(index+1:length(y)), y(1)];
t = 1:length(xnew);
der(1)=0;
der(2)=der(1);

// periodic cubic spline interpolation
xx=linspace(1,length(xnew),10000);
xi = interp(xx, t, xnew, splin(t, xnew ,"periodic"));
yi = interp(xx, t, ynew, splin(t, ynew ,"periodic"));
```

IV. Results

All figures computed by our Patatoid Generator are very convinient for all purposes. We show in fig. 1 an exemple.

V. Discussion

We presented here a Patatoid Generator based on a SF-AMPG algorithm, able to provide with smart non-regular shapes, usefull when dealing with a general case (instead of a particular figure). This idea could be extended to many other similar generators : there is also an important need for unspecified triangles.

The author would like to thank all people that motivated these works, and especially S. Chareyron for her initial impulse.

References

[1] Bartels, Beatty, and Barsky "An Introduction to Splines for Use in Computer Graphics and Geometric Modelling" published by Morgan Kaufman, Los Altos, CA, 1987.

[1] The Scilab Consortium; www.scilab.org