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Subject: Re: Point/Polygon Routine

Posted by [jlaw](#) on Wed, 03 Jan 1996 08:00:00 GMT

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In article 760@ncar.ucar.edu, cavanaugh@uars1.acd.ucar.edu (Charles Cavanaugh) writes:

>

> Does anyone have a routine that determines if a given 2-D point is inside a  
> given 2-D polygon?

I did have, but I left it behind when I changed jobs.

Are you any good at finite elements??( This is where I looked this up)

Consider a triangle of points I,J,K with coordinates  
( Xi,Yi ) , ( Xj,Yj ) , ( Xk,Yk).

the Area of the triangle is then

$$0.5 * \det \begin{pmatrix} 1 & X_i & Y_i \\ 1 & X_j & Y_j \\ 1 & X_k & Y_k \end{pmatrix}$$

Now take the point P at ( Xp, Yp ).

( Strictly, if P is inside the triangle) we can define "Area coordinates"  
as follows:

$$L_i = \text{area}(pjk) / \text{area}(ijk)$$

$$L_j = \text{area}(pki) / \text{area}(ijk)$$

$$L_k = \text{area}(pij) / \text{area}(ijk)$$

If P is indeed inside the triangle, all the area coordinates are positive.  
But if P is outside the triangle, one or more is negative.

For a polygon, split it into a set of triangles. If the point is inside one  
of the triangles, it must be inside the polygon.

I think this all depends on the points being placed in the correct sense  
around the triangle ( ie clockwise or anticlockwise.)You had better experiment  
a little, but that is the basic principle.

It is not actually many lines of code.

all the best

f.

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