Directions for Running TriangleIntersection2.exe

1 Introduction

The program illustrates four intersection routines for triangles in 2D:

1. Test for intersection of stationary triangles.
2. Find the intersection set of stationary triangles.
3. Test for intersection of moving triangles during a specified time interval and report the first time of contact.
4. Find the intersection of moving triangles during a specified time interval and report the first time of contact and the intersection set at that time.

When you run the program, a window is displayed and shows two triangles, one drawn in red (triangle 0) and one drawn in blue (triangle 1). Figure 1 shows the initial window.

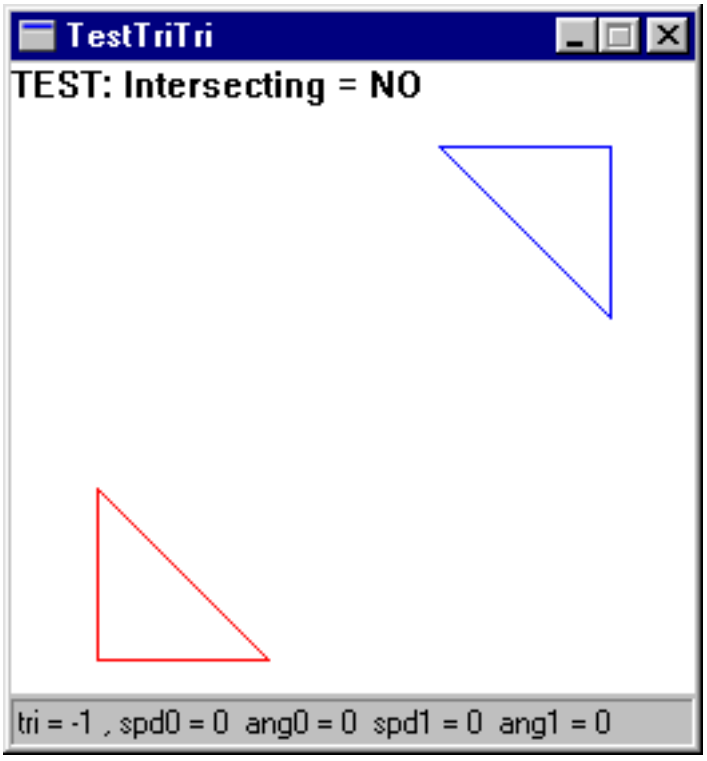

Figure 1. The initial window for TestTriTri.exe.

The status bar shows the active triangle (initially -1 since no triangle is active). The status bar also shows the velocity of each triangle as a speed and an angle index for an angle measured from the positive x–axis.

Given an angle index of $N \in \{0, \ldots, 31\}$, the actual angle is $\theta = 2\pi N/32$. The initial angles are both zero, so the direction of velocity is $(1, 0)$. The speeds are both zero, so the velocities themselves are $(0, 0)$. A triangle is activated by clicking on it with the left mouse button. The upper portion of the window shows the type of intersection test: `TEST`, `FIND`, `TEST VEL`, or `FIND VEL`. These correspond to the four tests mentioned above, in that order. To toggle among the types, press the `'t'` key. After the type is a statement about whether or not the triangles are intersecting.

2 Moving the Triangles

You can move a triangle by clicking on an interior point with the left mouse button and dragging to a new location. In the `TEST` case, Figure 2 shows the two stationary triangles that have been dragged so that they intersect.

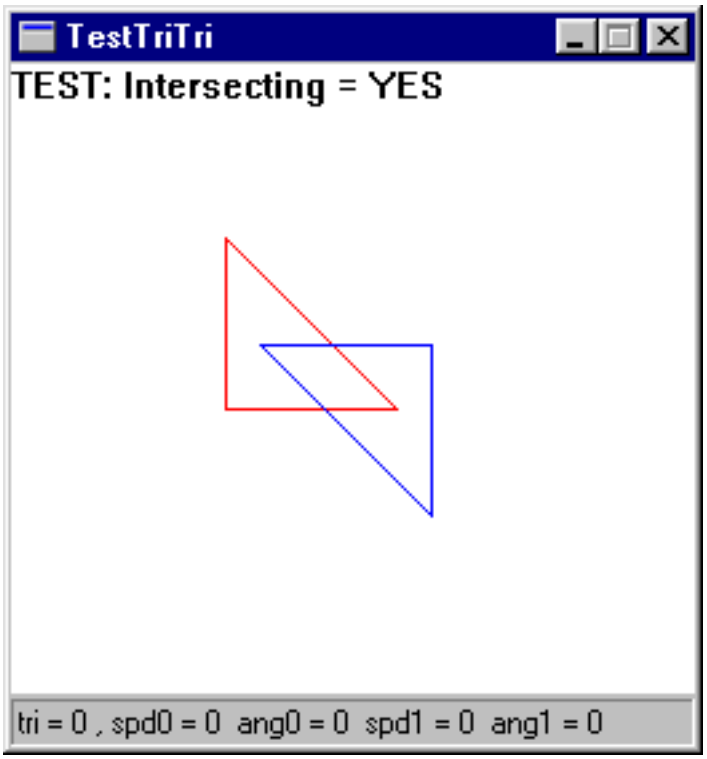

Figure 2. Two intersecting triangles in the `TEST` query.

3 Changing the Triangle Vertices

You can also change a triangle vertex by clicking with the left mouse button near a vertex and dragging it. Figure 3 shows the two stationary triangles that have been modified and moved. The `FIND` case is used. In this case, the intersection section set is calculated and displayed in purple.

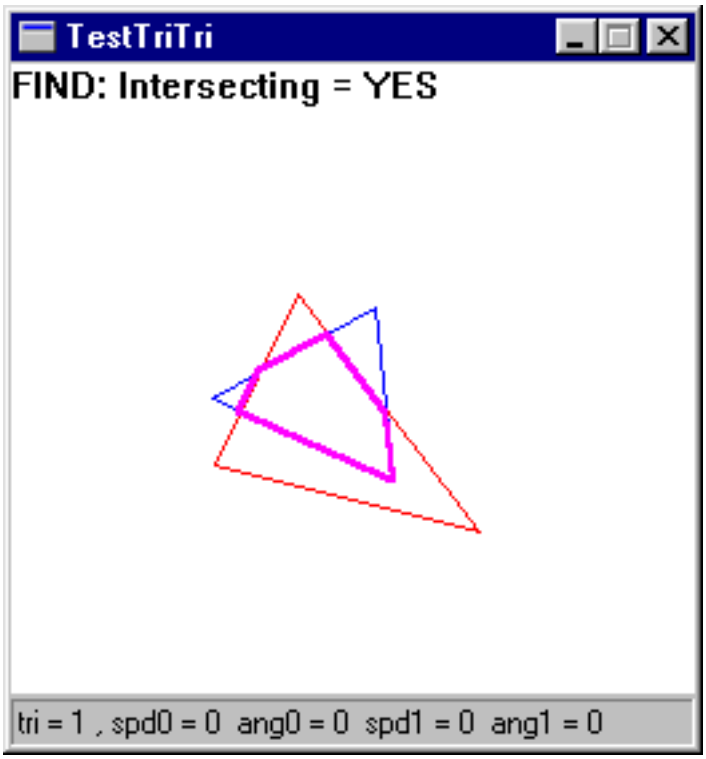

Figure 3. Two modified and intersecting triangles in the `FIND` query.

4 Changing the Triangle Velocities

Activate the triangle whose velocity you want to change. The speed can be modified by pressing the '<' and '>' keys. The minimum speed is zero and the maximum speed is 64. The angle index can be modified by pressing the '+' and '-' keys. In the `TEST` and `FIND` cases, only the status bar changes. However, in the `TEST VEL` and `FIND VEL` cases, triangles are drawn in dark red and dark blue that correspond to the original triangles moved by their velocities over an interval of 1 unit of time. The paths of the vertices over that time interval are also drawn. Figure 4 shows a typical image for two modified and moved triangles in the `TEST VEL` case.

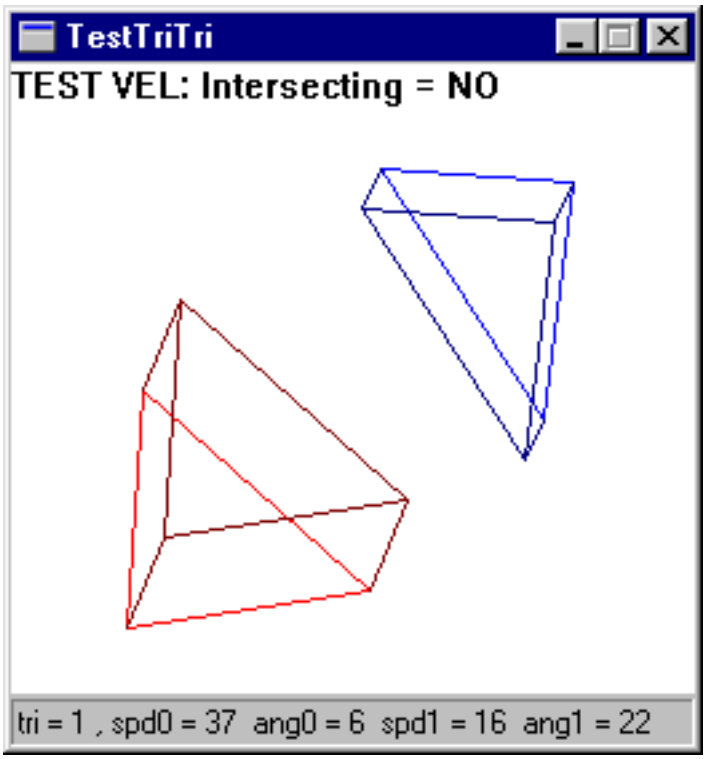

Figure 4. Two modified and moved triangles in the `TEST VEL` query, both triangles having nonzero velocities.

5 Test or Find Intersections for Moving Triangles

In the cases `TEST VEL` and `FIND VEL`, if the triangles do intersect at first time $T \in [0, 1]$, the program draws the triangles moved only over the interval $[0, T]$ so that they are just touching. As you drag one original triangle towards the other, you will notice that the moved triangles vary in distance from the originals, this being the case since T is changing as you drag the triangles. If $T = 0$, the triangles are initially intersecting. In the case `FIND VEL`, the intersection set at first time of contact is drawn in purple, either a single point or a line segment. If $T = 0$ in this case, the polygon of intersection is drawn. Figure 5 shows a case where $T > 0$.

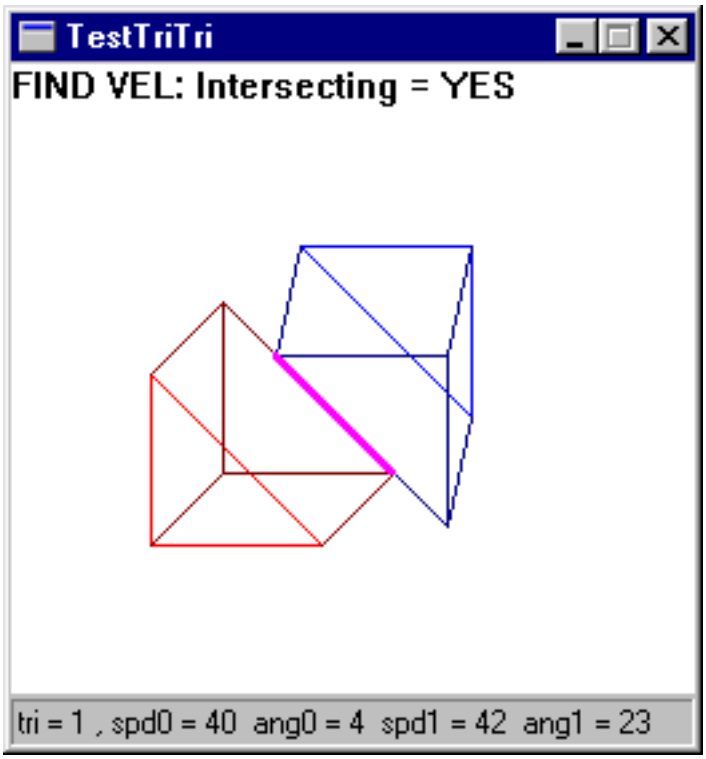

Figure 5. Two modified and moved triangles in the `FIND VEL` query, both triangles having nonzero velocities.

Figure 6 shows the case $T = 0$.

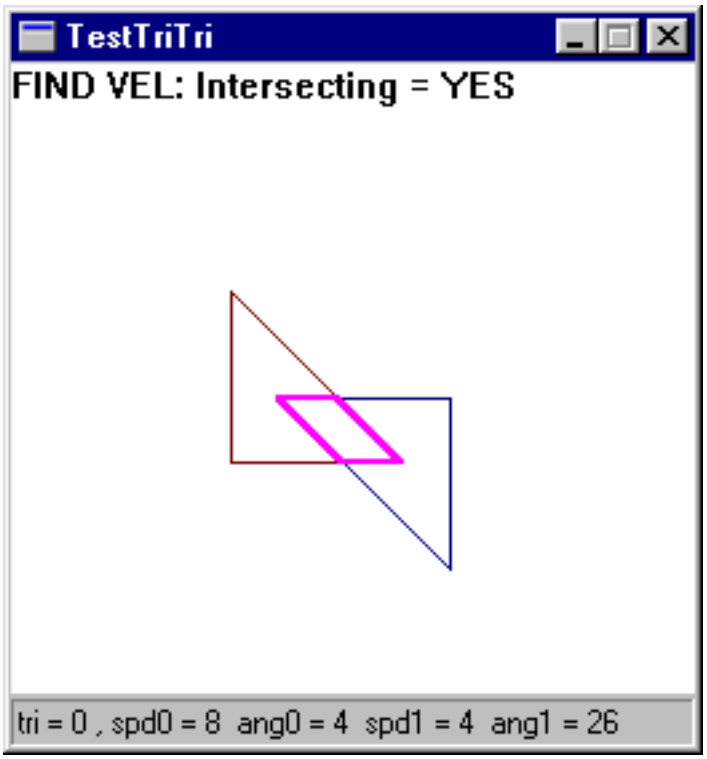

Figure 6. Two modified and moved triangles in the `FIND VEL` query, both triangles having nonzero velocities, but are intersecting at time 0.

Note that the moved triangles are drawn on top of the original ones, despite the fact that both have nonzero velocities. This is the case since $T = 0$ causes the triangles to be moved by a zero distance.

6 Exiting the Program

Press the `'q'` or `ESC` keys or select the x–button at the upper right of the window.