Generating Random Points from Arbitrary Distribution In Polygonal Areas

O. Kesemen[1] and **Ü. Ünsal**[1]

[1]Department of Statistics and Computer Science, Faculty of Science

Karadeniz Technical University, 61080 Trabzon, Turkey

okesemen@gmail.com, ulkunsal@gmail.com

Abstract

Random numbers generation in polygonal area is used in many applications area simulation. These application areas can be distribution of living life in a pond, level of pollution in a city, density of tree species in a forest, traffic flow in a region, density of flight in air space, diversity of wildlife in a region, crime rate in a city etc. [1].

Traditionally, acceptance-rejection method is used that in a polygonal area which it has known probability density function (f(x,y)) to generate random numbers [2]. For this, at first rectangular area boundaries which are surrounding polygon is found. By the help of these boundaries X and Y random values are created which they selected from uniform distribution. If created point is out of polygonal area, point is rejected. If selected point within polygonal area for adapting selected point to probability density function, a random value which is between zero and highest probability density value within polygonal area selected from uniform distribution (z direction). If this value is bigger than value of f(X,Y) is rejected, if not it is accepted. Thus, a random point is selected in polygonal area. This procedure can be repeated any numbers of random numbers are generated. Used method not only generate unnecessary random number but also it causes increased computational time for investigating whether the point in polygonal area.

The basis of proposed method is based on that calculated by dividing triangle pieces of the all area with corner points of polygonal area by combining together. By selecting a certain random point in polygonal area, triangulation size can be reduced and calculation sensitization can be increased. A plane which is in the probability density function value of corner points of each triangle, regarded as probability density function of the triangle. Under the probability density functions that they have all triangles volume be equal 1 is agreed as the probability basic axiom. Hence volume of triangular prism of each triangle formed is gave probability that the selection of the triangle. The probability density function defines in a unit triangle which is subtending the probability density function for each triangle. A random number generated within this defined triangle is moved by the principle of affine invariance into selected triangle area. In this manner any number of random numbers can be generated.

The method proposed in this study not only prevents unnecessary random number generation but also reduces computation time indeed. Specially, when want to generate a large number of random numbers it can be used as an effective method.

Keywords: *Random Number, Poligonal Area, Triangulate*

References

[1] Kesemen, O. and Dogru, F.Z., Cumulative Distribution Functions of Two Variables in Polygonal Areas, 7. International Statistical Congress,28 Apr-01 May 2011 Belek-ANTALYA.

[2] Martinez, W.L. and Martinez, A.R., Computational Statistics Handbook with MATLAB, Chapman & Hall Crc, 2002.