

Filling holes of Generalized Offset Surfaces by Biquadratic Splines

M. Pasadas

SUMMARY

Standard Offset surfaces are defined as locus of the points which are at constant distance along the unit normal direction from the generator surfaces. Offset are widely used in various practical applications, such as tolerance analysis, geometric optics and robot path-planning. In some of the engineering applications, we need to extend the concept of standard offset to the generalized offset where distance offset is not necessarily constant and offset direction is not necessarily along the normal direction.

Normally, a generalized offset is functionally more complex than its progenitor because of the square root appears in the expression of the unit normal vector. For this, an approximation method of its construction is necessary.

In many situations it is necessary to fill or reconstruct certain function defined in a domain in which there is a lack of information inside one or several sub-domains (holes). In some practical cases we may have some specific geometrical constraints, of industrial or design type, for example, the case of a specified volume inside each one of these holes.

The problem of filling holes or completing a 3D surface arises in all sorts of computational graphics areas, like CAGD, CAD/CAM, Earth Sciences, computer vision in robotics, image reconstruction from satellite and radar information, etc.

In this work we present an approximation method of filling holes of the generalized offset of a surface when there is a lack of information in a sub-domain of the function that defines it. We prove the existence and uniqueness of solution, we show how to compute it and we establish a convergence result of this approximation method. Finally, we give some graphical and numerical examples.

Keywords: Generalized offset surfaces, filling holes, spline approximation, variational methods, biquadratic splines

AMS Classification: 41A15, 65D10, 65D17, 65K10

¹Department of Applied Mathematics
University of Granada, Spain
email: mpasadas@ugr.es