

Surface Completion of an Irregular Boundary Curve Using a Concentric Mapping

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Abstract:

It is frequently necessary to complete the design of a surface from a specification of its boundary. Many techniques have been developed to solve this problem if the boundary is topologically a triangle or rectangle, and the curves are specified as NURBS. More complex boundaries generally require manual efforts to decompose the perimeter into topologically rectangular or triangular regions and entail auxilliary boundary specifications. The case of a single irregular boundary curve is not addressed by previous surface completion methods.

This paper introduces a technique for completing the surface when the boundary is specified by a simple, closed, planar, NURBS curve. The mapping produces a NURBS surface whose outer boundary is the input curve, and whose parameterization generalizes the polar parameterization of the disc. Therefore, the parameter values corresponding a point on the surface lend intuition to its location and proximity to the boundary. The paper explores further mathematical properties of the mapping in the context of geometric design.

The technique has theoretical significance as a means for parameterizing an arbitrary polygon. It may also provide an occasional alternative to the use of trimming curves. For example, it is often necessary to cap an open region of a surface with a planar section. The method of this paper can be used to fill this hole with a single tensor product piece.

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