

ABSTRACT

Geometric Modeling for Non-manifold Curved Solids. (December 1995)

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In modern designs, manifold and non-manifold objects with planar and sculptured surfaces are used widely. Such shapes present many problems in integrating product and process engineering. At the root of these problems is the lack of a single unified solid based CAD system for creation and manipulation of both manifold and non-manifold objects whose shapes include both prismatic solids and sculptured surfaces. This research presents a new hybrid scheme for integrating solids and free-form surfaces. The definition of curved objects is given and a Simplicial Cell Complex representation (SCCR), which is based on simplexes and triangular B-spline patches (TBS) that is capable of supporting the definition, is proposed. Under this representation, a non-manifold solid with both planar and curved faces can also be created and modified. Moreover, the continuity between two curved faces can be maintained easily. Methods for creating solids, algorithms for regularized Boolean operations, and a set of Euler operators for local modification in SCCR are presented.

KEY WORDS

computer-aided design, solid modeling, free-form surfaces modeling, triangular B-spline patch, generalized constructive solid geometry, non-manifold representation