

ABSTRACT

Topological Sufficiency of Nonmanifold Boundary Representations
with the R-set Domain. (December 1995)

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In the brief twenty year history of solid modeling research, one question has been raised three times in different versions all by prominent solid modeling researchers [12, p. 36; 19, p. 32; 22, p. 268]. The question basically is what constitutes the sufficient topological information required to represent r-set solids. This question has far reaching theoretical and application implications for solid modeling CAD/CAM/CAE systems in general. This research provides an answer to this question.

R-set solids are the generalization of manifold solids. Pieces of the theoretical foundations for manifold boundary representations can be found scattered throughout the literature, but have not been formulated and organized into an accessible and coherent whole. The first part of this dissertation does just that. The second part of this dissertation starts with an examination of the basic assumptions of boundary representations within the r-set domain. After concluding that r-set solids and r-set boundary surfaces do correspond to each other one-to-one, we develop the topological sufficiency conditions for r-set solids. We first investigate r-set solids without singular edges. With these results in hand, we then address r-set solids in general. The investigation reaches its conclusion with the Theorem

of Sufficient Topological Information for R-set Solids. The final part of this dissertation summarizes our contributions, compares our terminology and results with other published nonmanifold works and points out future research directions.

Key Words: solid modeling, boundary representations, nonmanifold boundary representations, r-set solids, topological sufficiency