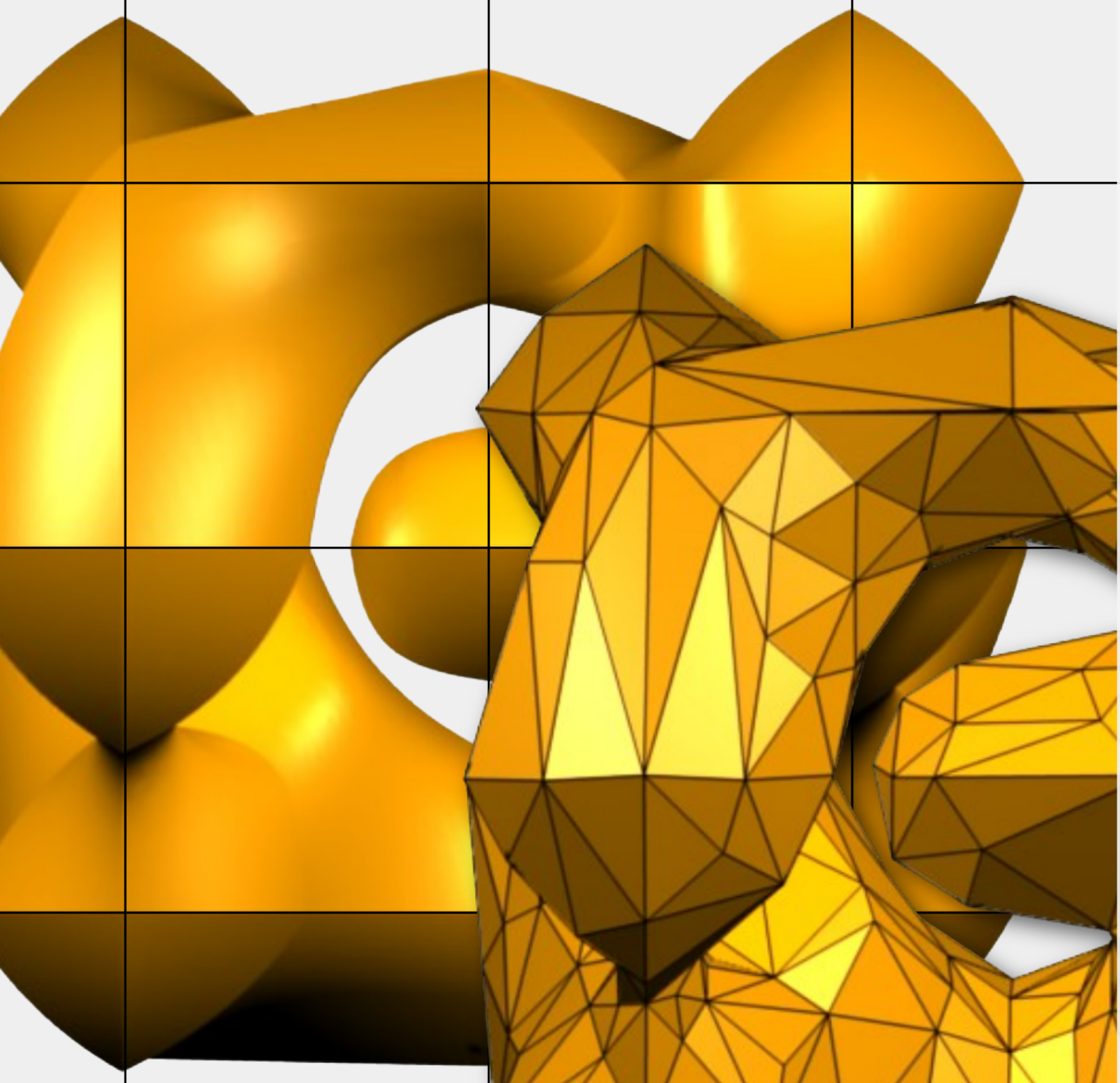

Topology Verification for Isosurface Extraction

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The importance of properly implemented isosurface extraction for verifiable visualization led to a previously published paper on the general Method of Manufactured Solutions (MMS), inclusive of a supportive software infrastructure. This work builds upon that foundation, while significantly extending it. Specifically, we extend previous work on verification of geometrical properties to ensuring correctness of considerably more subtle topological characteristics that are crucial for the extracted surfaces. We first show a new theoretical synthesis of results from stratified Morse theory and digital topology for algorithms created to verify topological invariants and then we demonstrate how the MMS approach can be extended to embrace topology, consistent with the design intent for MMS. The transition to topological verification motivated these considerable theoretical advances and algorithmic development, consistent with general MMS principles. The methodology reported reveals unexpected behavior and even coding mistakes in publicly available popular isosurface codes, as presented in a case study for visualization tools that documents the extensibility of MMS to topological criteria.

Paper