Konrad-Zuse-Zentrum
für Informationstechnik Berlin

Takustraße 7
D-14195 Berlin-Dahlem
Germany

MICHAEL ZILSKE, HANS LAMECKER[1], STEFAN ZACHOW

Adaptive Remeshing of Non-Manifold Surfaces

[1]Supported by the DFG Research Center MATHEON "Mathematics for key technologies"

accepted for publication in Proc. EUROGRAPHICS 2008 / G. Drettakis and R. Scopigno, Volume 27 (2008), Number 3

ZIB-Report 07-01 (Januar 2007)

Adaptive Remeshing of Non-Manifold Surfaces

Michael Zilske, Hans Lamecker, Stefan Zachow

January 15, 2008

Abstract: We present a unified approach for consistent remeshing of arbitrary non-manifold triangle meshes with additional user-defined feature lines, which together form a feature skeleton. Our method is based on local operations only and produces meshes of high regularity and triangle quality while preserving the geometry as well as topology of the feature skeleton and the input mesh.

ACM Computing Classification System (1998): I.3.3 [Computer Graphics]: Line and Curve Generation, I.4.6 [Computer Graphics]: Feature Detection, I.4.7 [Computer Graphics]: Feature Measurement

1 Introduction

The majority of remeshing schemes for triangular surfaces are designed for manifold-with-boundary surface models [AUGA05]. Some methods which rely on a global parameterization of the surface even require it to be isomorphic to a disk. However, there are applications where this restriction is too prohibitive. Important examples are bio-medical applications, that often require geometric models which volumetrically describe different tissue compartments, and computer-aided engineering, where interfaces between more than two adjacent machine parts are often modeled. In these cases boundary surfaces separating different materials are not represented as separate objects, but as a single mesh comprised of several surface patches. They contain *seams*, i.e. paths of non-manifold edges, where more than two different regions meet. The problem of remeshing such non-manifold surfaces, however, has - to the best of our knowledge - not been addressed.

Besides the preservation of seams another important aspect of surface remeshing is the preservation of feature lines. A feature line can be an automatically detected or interactively defined edge-path on the input surface which is expected to have a corresponding edge-path in the output mesh. Such feature lines are often required for post-processing, e.g. for surface decomposition and nurbs surface generation.

In this paper, we introduce a remeshing scheme for non-manifold surface models, which at the same time preserves feature lines embedded into the input mesh. Our method can be regarded as a generalization of [SG03, SAG03] to non-manifold surfaces with feature lines. It is based on local operations only. Our main contribution is the unified treatment of feature lines and non-manifold vertices by means of feature skeletons, which were introduced by Vorsatz, Rössl and Seidel [VRS03] specifically to preserve feature lines. It turns out that the