Instituto de Computação

Processamento de Malhas Poligonais

Tópicos Avançados em Computação Visual e Interfaces I

Prof.: Anselmo Montenegro

www.ic.uff.br/~anselmo

Baseado nas notas do Prof. Marcos Lage

mlage@ic.uff.br

Conteúdo: Notas de Aula

Introdução e Motivação

Introdução

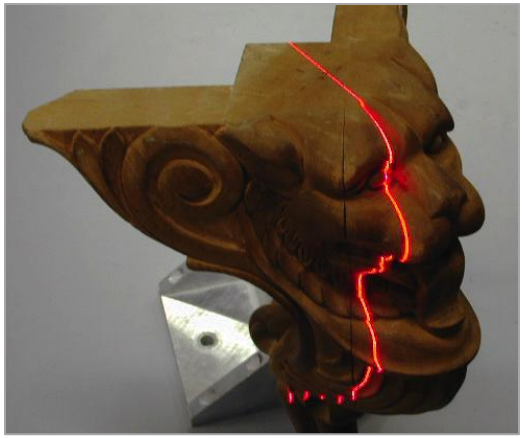
Recentes inovações na tecnologia de aquisição 3D

Tomografia
&
Ressonância

Introdução

Recentes inovações na tecnologia de aquisição 3D

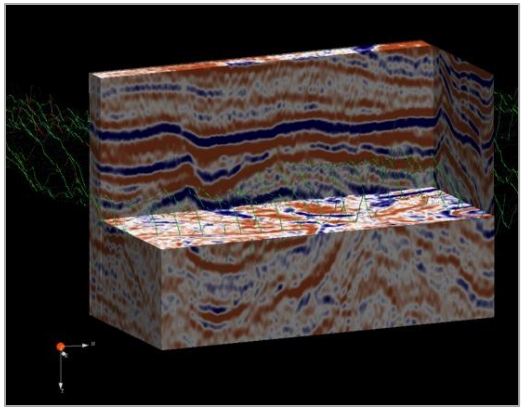
Scanner Laser 3D

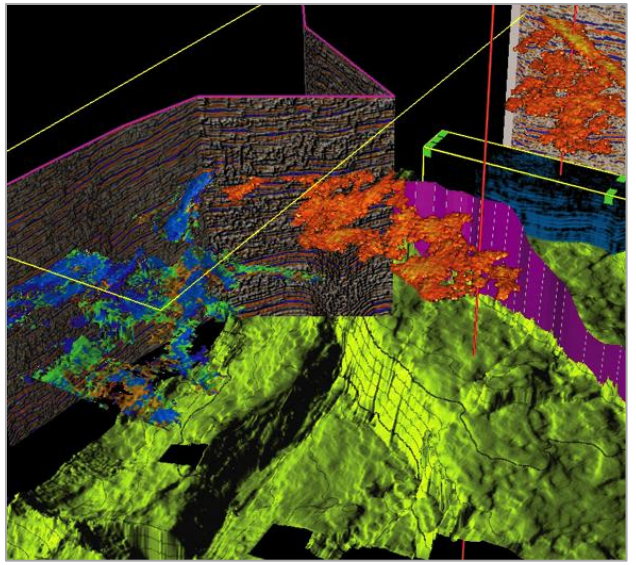


Introdução

Recentes inovações na tecnologia de aquisição 3D

Dados Sísmicos



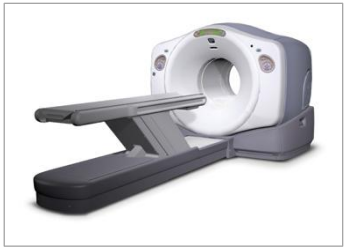


Introdução

Interesse Multidisciplinar

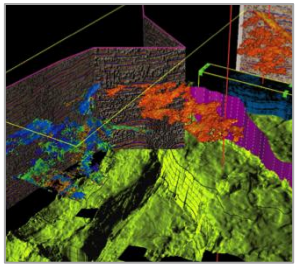
Introdução

Aquisição



Processamento Geométrico digital

Produção



Introdução

Processamento Geométrico digital

Campo da Ciência da Computação preocupado em desenvolver modelos matemáticos e algoritmos para a análise e manipulação de dados geométricos.

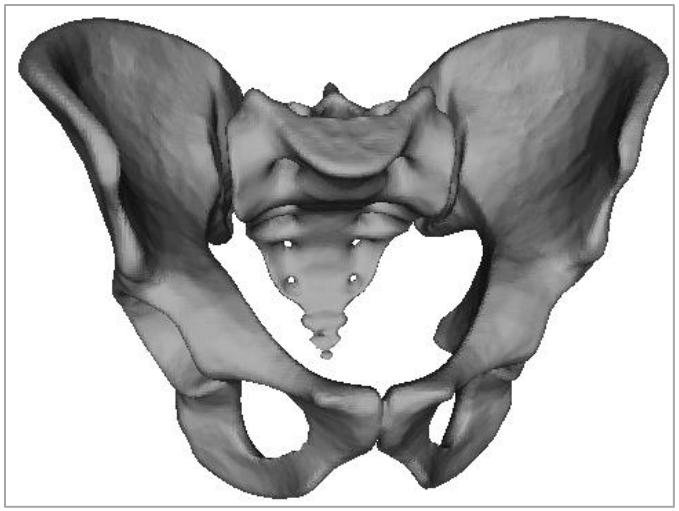
Introdução

Dado geométrico típico: malha de polígonos

Introdução

Processamento Geométrico digital

Operações Típicas

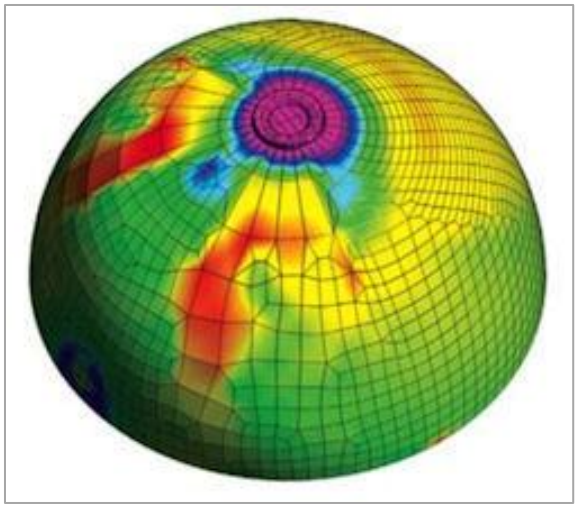


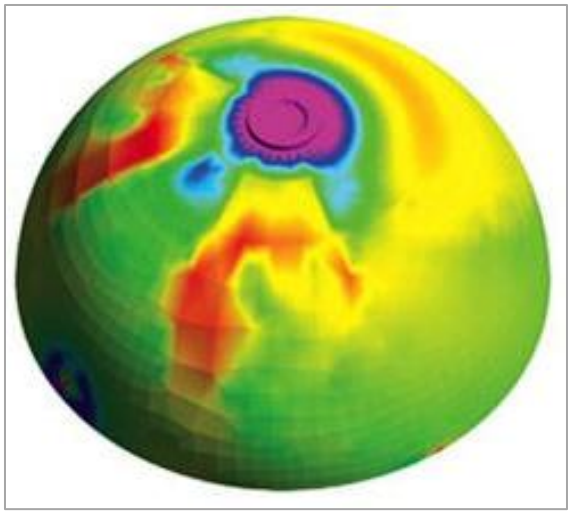
Reconstrução a partir de nuvens de pontos

Introdução

Processamento Geométrico digital

Operações Típicas

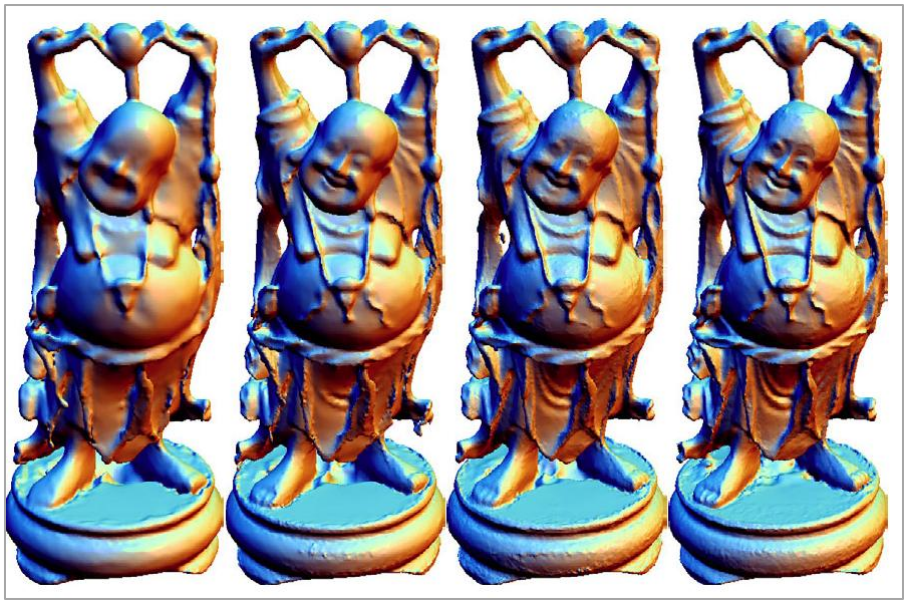




Análise geométrica

Processamento Geométrico digital

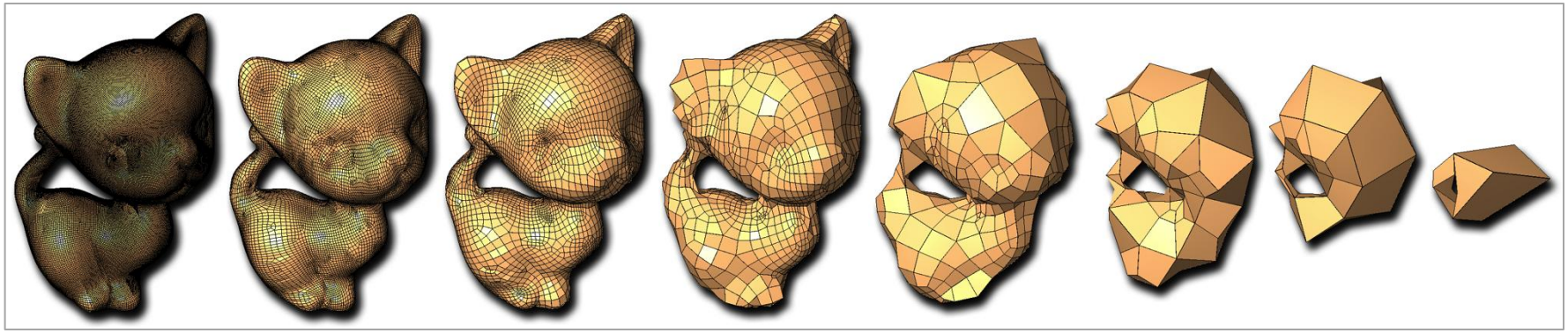
Operações Típicas



Remoção de Ruídos

Processamento Geométrico digital

Operações Típicas

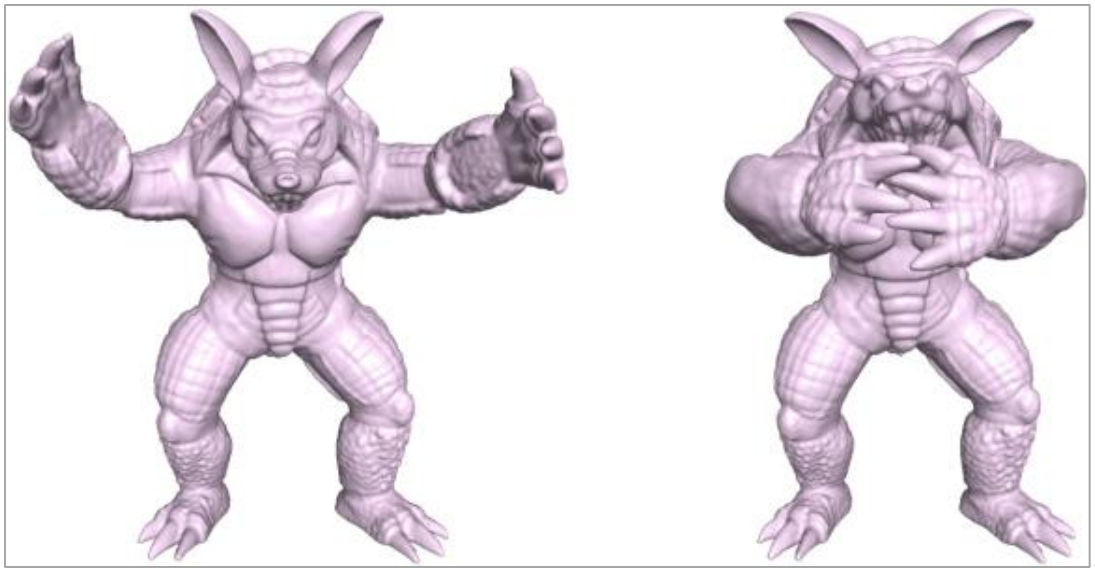


Simplificação da forma

Introdução

Processamento Geométrico digital

Operações Típicas

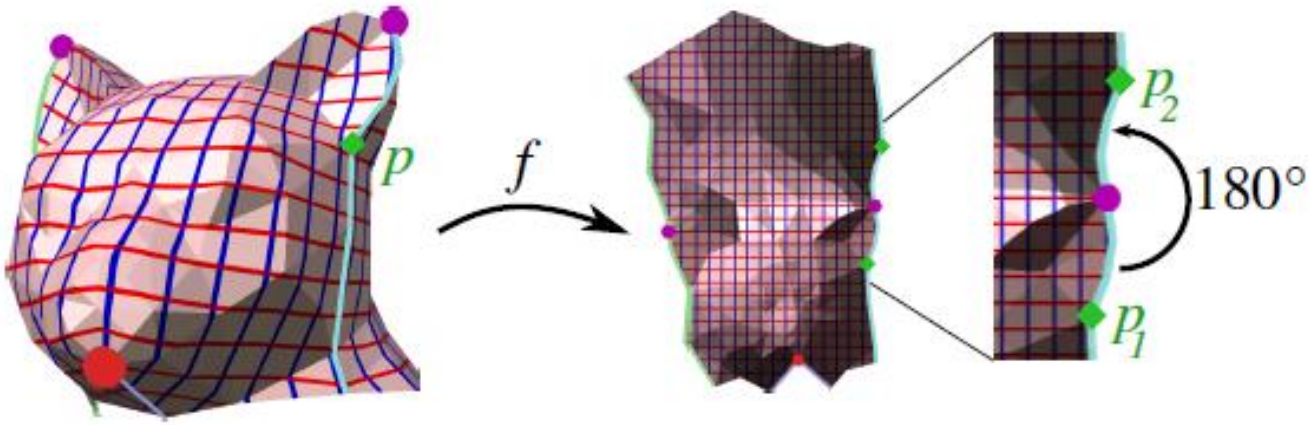


Modelagem e Design interativo

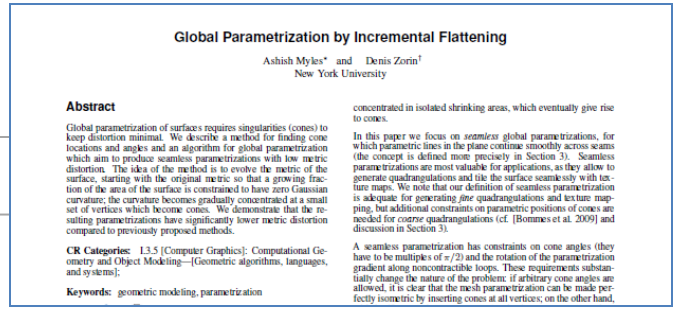
Introdução

Processamento Geométrico digital

Operações Típicas



Parametrização



Global Parametrization by Incremental Flattening

Ashish Myles* and Denis Zorin†
New York University

Abstract

Global parametrization of surfaces requires singularities (cones) to keep distortion minimal. We describe a method for finding cone locations and angles and an algorithm for global parametrization which aim to produce seamless parametrizations with low metric distortion. The idea of the method is to evolve the metric of the surface, starting with the original metric so that a growing fraction of the area of the surface is constrained to have zero Gaussian curvature; the curvature becomes gradually concentrated at a small set of vertices which become cones. We demonstrate that the resulting parametrizations have significantly lower metric distortion compared to previously proposed methods.

CR Categories: I.3.5 [Computer Graphics]: Computational Geometry and Object Modeling—[Geometric algorithms, languages, and systems];

Keywords: geometric modeling, parametrization

concentrated in isolated shrinking areas, which eventually give rise to cones.

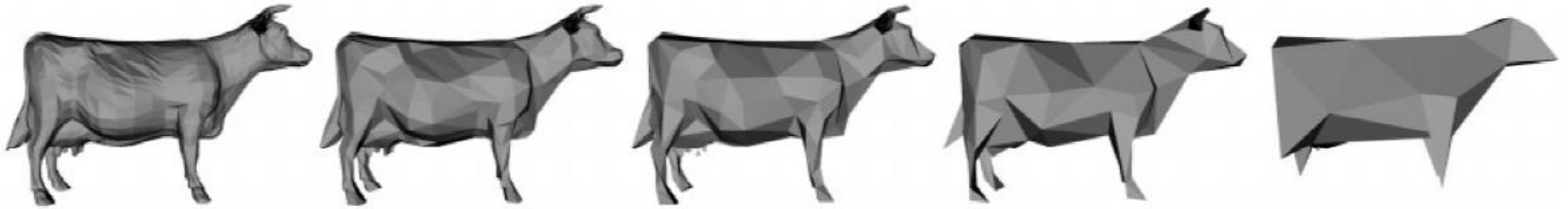
In this paper we focus on *seamless* global parametrizations, for which parametric lines in the plane continue smoothly across seams (the concept is defined more precisely in Section 3). Seamless parametrizations are most valuable for applications, as they allow to generate quadrangulations and tile the surface seamlessly with texture maps. We note that our definition of seamless parametrization is adequate for generating *fine* quadrangulations and texture mapping, but additional constraints on parametric positions of cones are needed for *coarse* quadrangulations (cf. [Bommes et al. 2009] and discussion in Section 3).

A seamless parametrization has constraints on cone angles (they have to be multiples of $\pi/2$) and the rotation of the parametrization gradient along noncontractible loops. These requirements substantially change the nature of the problem: if arbitrary cone angles are allowed, it is clear that the mesh parametrization can be made perfectly isometric by inserting cones at all vertices; on the other hand,

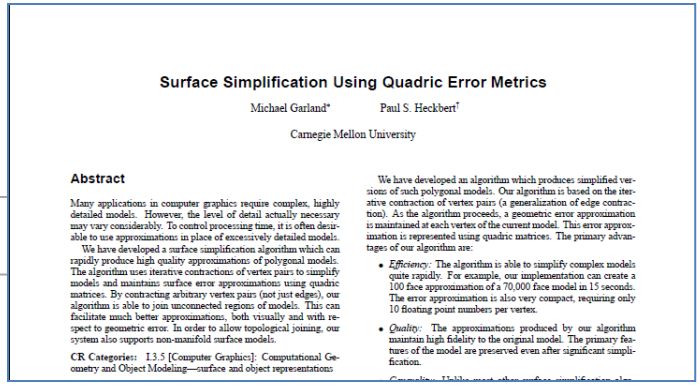
Introdução

Processamento Geométrico digital

Operações Típicas



Parametrização



Surface Simplification Using Quadric Error Metrics

Michael Garland* Paul S. Heckbert†

Carnegie Mellon University

Abstract

Many applications in computer graphics require complex, highly detailed models. However, the level of detail actually necessary may vary considerably. To control processing time, it is often desirable to use approximations in place of excessively detailed models.

We have developed a surface simplification algorithm which can rapidly produce high quality approximations of polygonal models. The algorithm uses iterative contractions of vertex pairs to simplify models and maintains surface error approximations using quadric matrices. By contracting arbitrary vertex pairs (not just edges), our algorithm is able to join unconnected regions of models. This can facilitate much better approximations, both visually and with respect to geometric error. In order to allow topological joining, our system also supports non-manifold surface models.

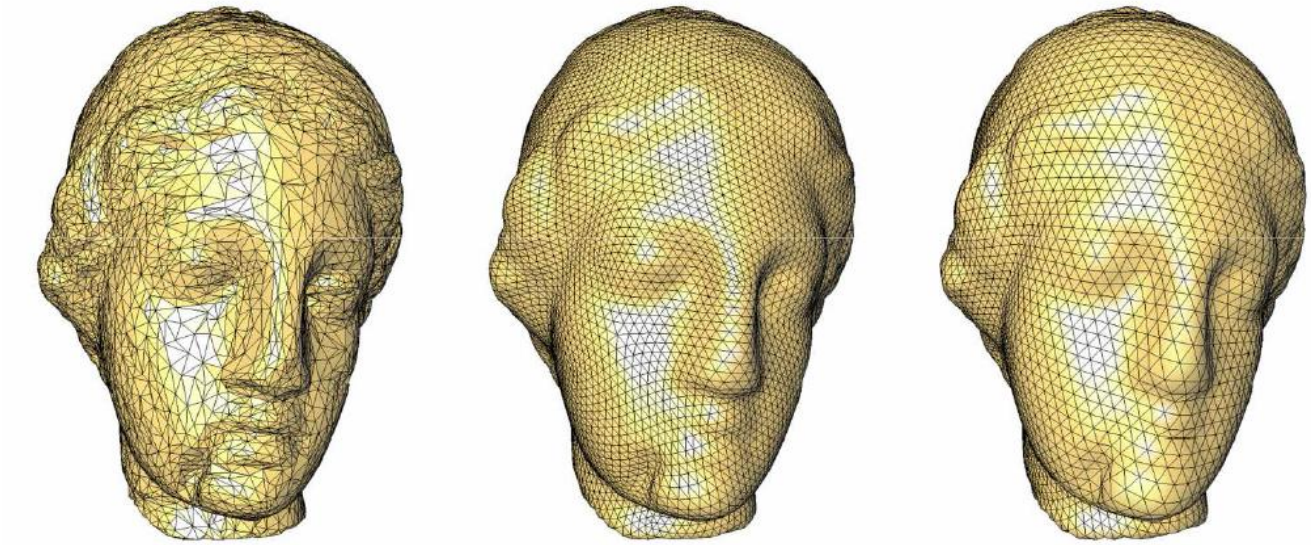
CR Categories: I.3.5 [Computer Graphics]: Computational Geometry and Object Modeling—surface and object representations

We have developed an algorithm which produces simplified versions of such polygonal models. Our algorithm is based on the iterative contraction of vertex pairs (a generalization of edge contraction). As the algorithm proceeds, a geometric error approximation is maintained at each vertex of the current model. This error approximation is represented using quadric matrices. The primary advantages of our algorithm are:

- *Efficiency:* The algorithm is able to simplify complex models quite rapidly. For example, our implementation can create a 100 face approximation of a 70,000 face model in 15 seconds. The error approximation is also very compact, requiring only 10 floating point numbers per vertex.
- *Quality:* The approximations produced by our algorithm maintain high fidelity to the original model. The primary features of the model are preserved even after significant simplification.

Processamento Geométrico digital

Operações Típicas



Remalhamento

Introdução

Processamento Geométrico digital

Operações Típicas

Edição

Introdução

Processamento Geométrico digital

Pipeline Básico