Geometry Processing

CS 6968 Spring 2009

Overall information:

Web page:

http://www.vistrails.org/index.php/GeometryProcessing/Spring2009

Each student must have an account on the Wiki in order to add his/her comments about each class.

(please send an email to Claudio asking your account if you don have one yet)

Additional Classes:

Additional classes will be given so as to make the students familiar with some softwares and packages that could be used in the homeworks and projects

Grades:

Your grade will be a combination of class participation (20%), assignments (20%), and your project (60%)
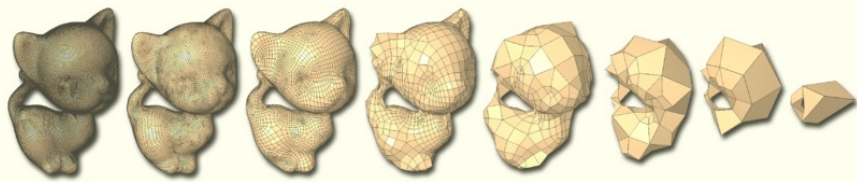
(No Exams!)
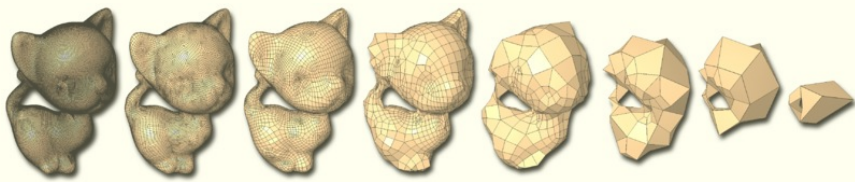
Geometry Procesing:

Acquisition devices as 3D laser scanners, time-of-flight depth cameras, and medical imaging have brought with them the need for new geometry processing tools.

As in the case of signal processing, fundamental algorithms and mathematics have to be developed to process geometry. However, this task is *considerably* more challenging in the context of geometry processing:

- The underlying space is not necessarily Euclidean
  - Conventional vector calculus can not be readily employed
  - Representation is not Cartesian

- Regular sampling is not the rule
  - Fourier analysis can not be employed directly
  - More intricate data manipulation
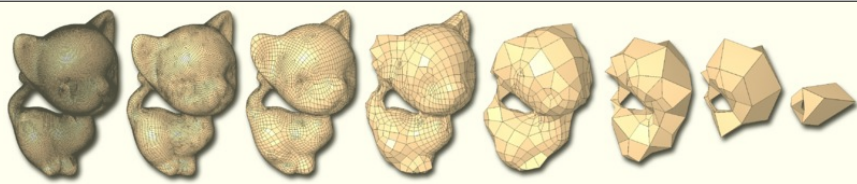
How can typical operations such as denoising, compression, transmission, enhancement detection, and editing be accomplished in the context of geometry processing?

What are the appropriated computational and mathematical tools?

How can the effectiveness of the representation/operation be measured?

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These are some of the questions we are going to answer during the course !
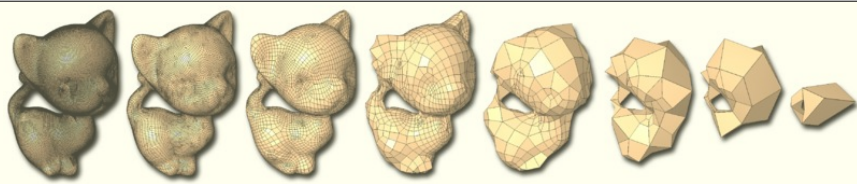
Typical Problems: Representation
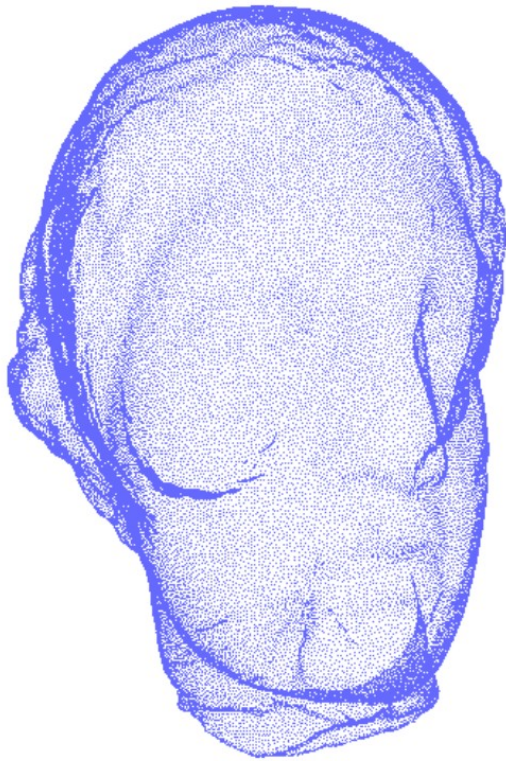
Points
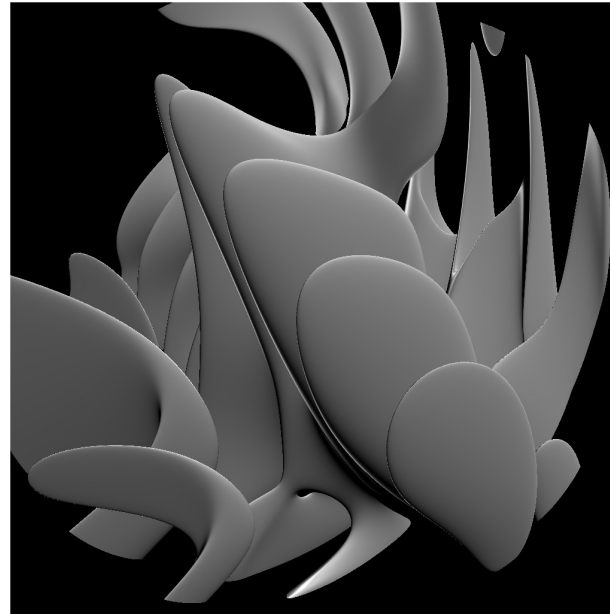
Surface
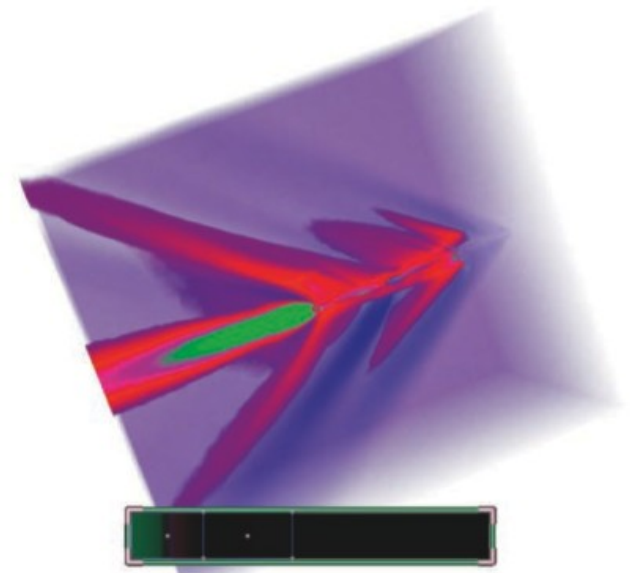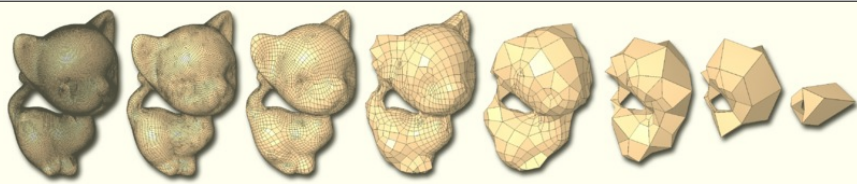
Volume
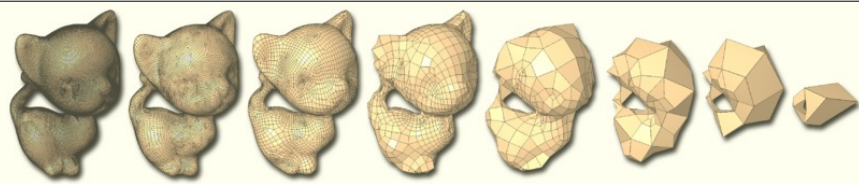
Typical Problems: Surface Extraction

[C. Dietrich, et al., 2008]
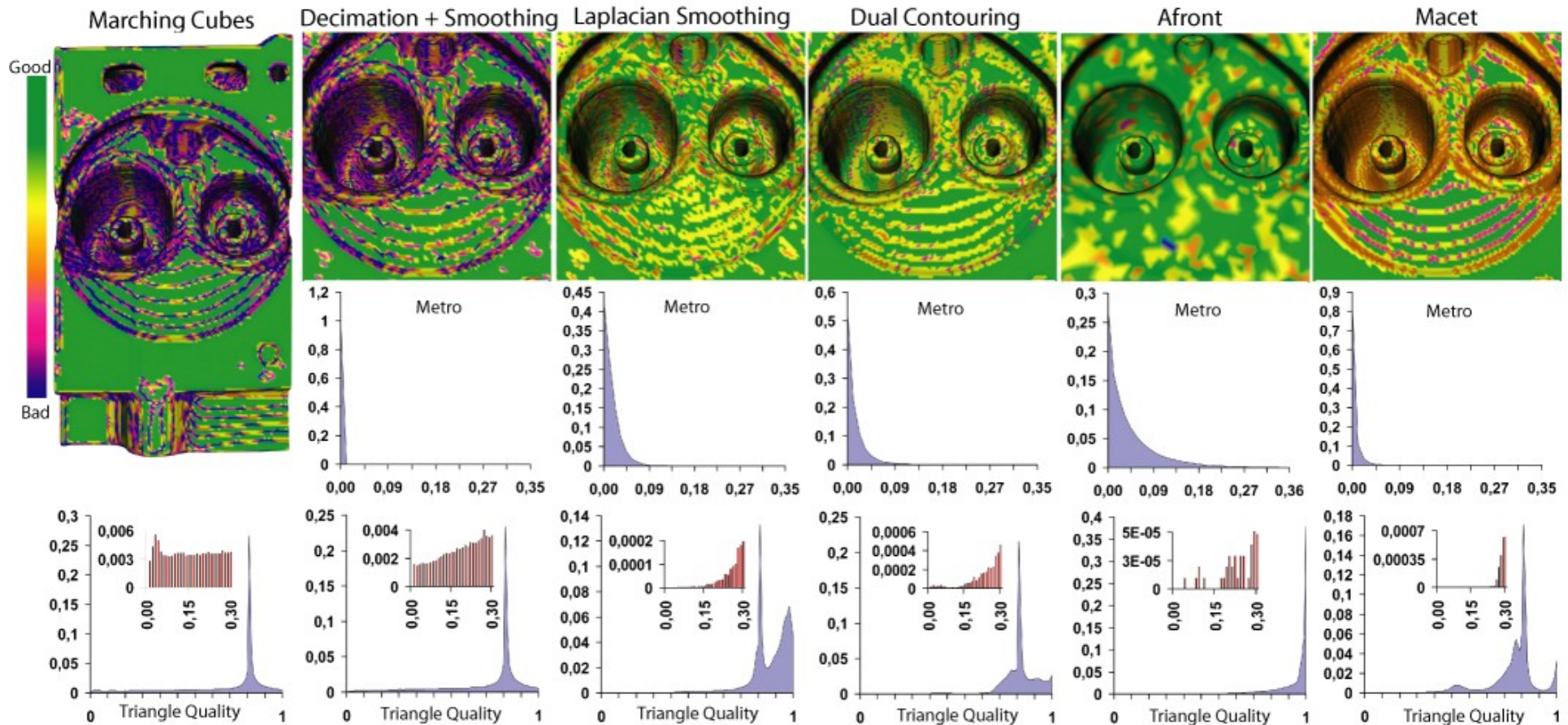
Typical Problems: Denoising/Smoothing
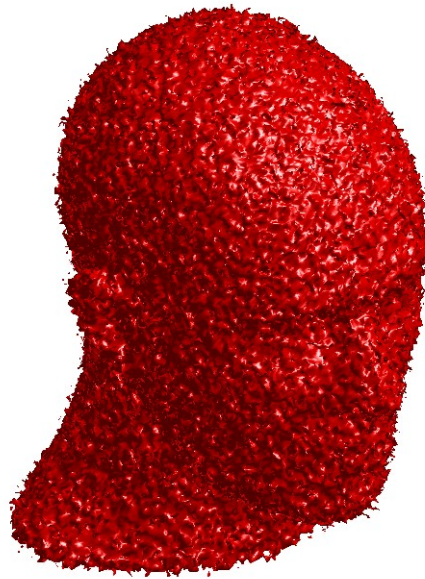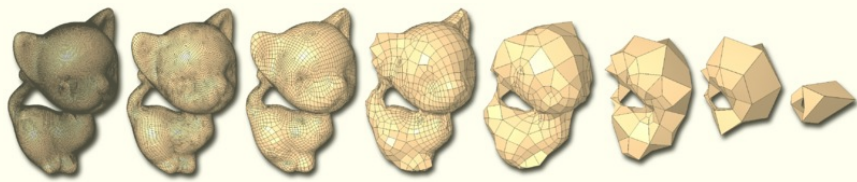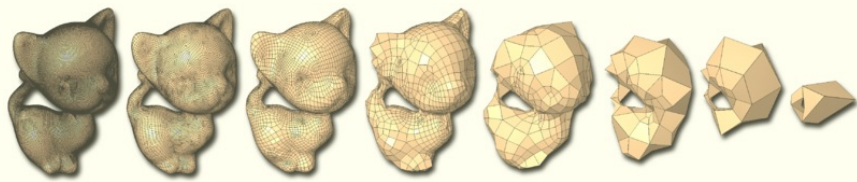
Typical Problems: Simplification/Reduction
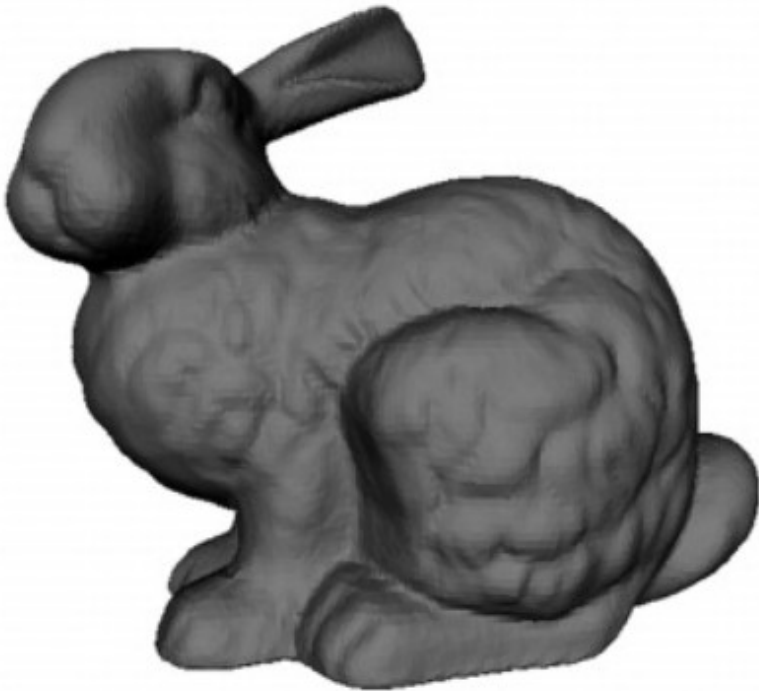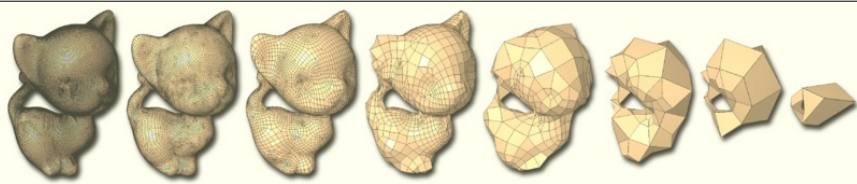
[M. Garland and P.S. Heckbert, 1997]

Typical Problems: Remeshing
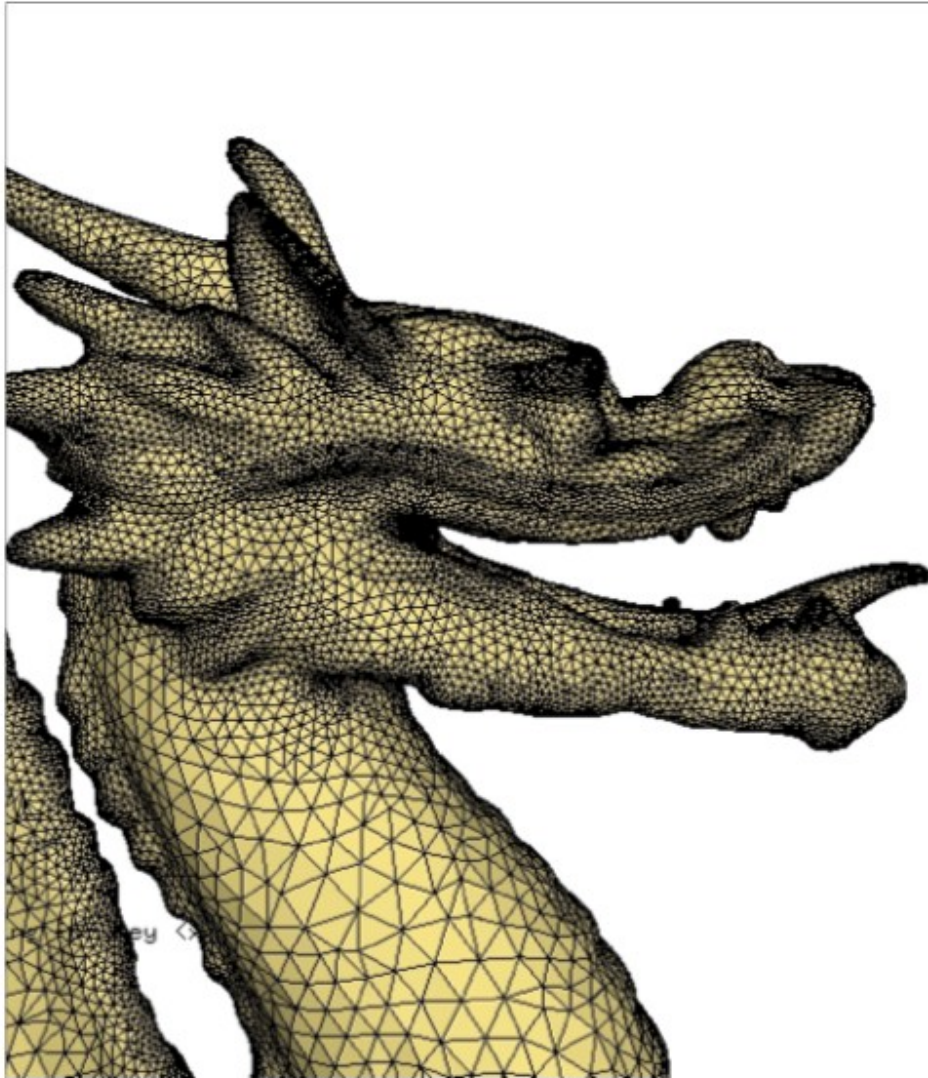
Typical Problems: **Parametrization**
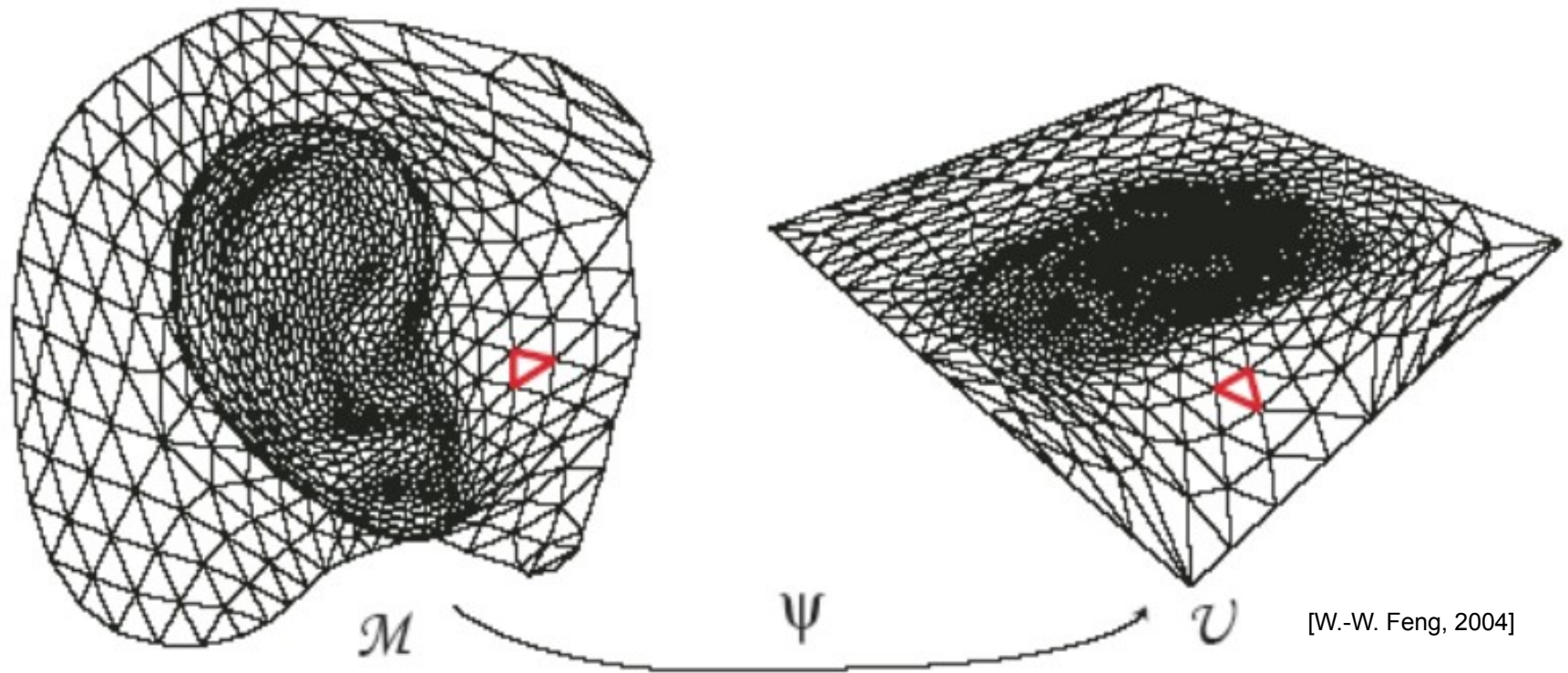
$\mathcal{M}$ ψ $\mathcal{U}$ [W.-W. Feng, 2004]

Typical Problems: Triangulation X Quadrangulation
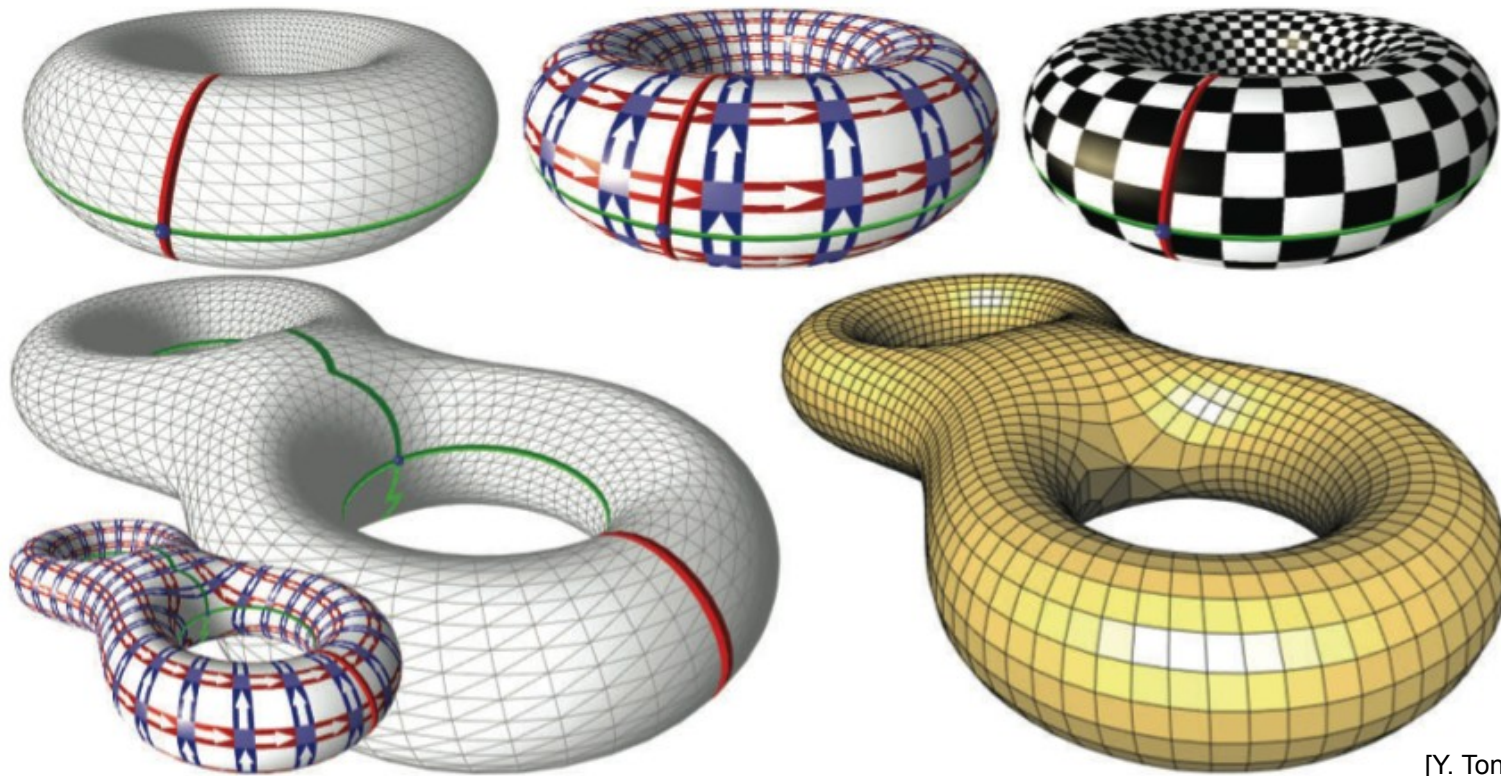
[Y. Tong, et al., 2006]
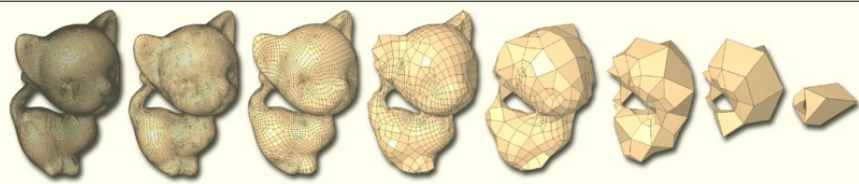
Typical Problems: Spectral Processing
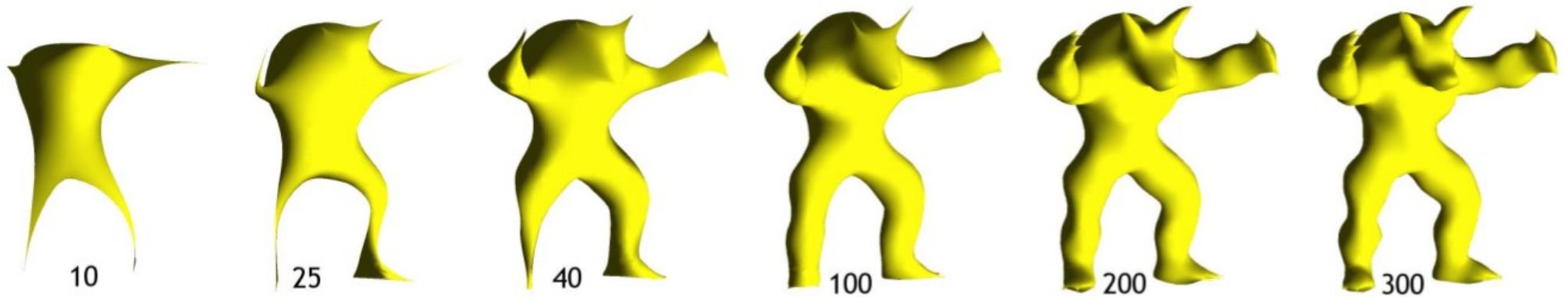
[B. Levy, 2006]

Typical Problems: Mesh Compression
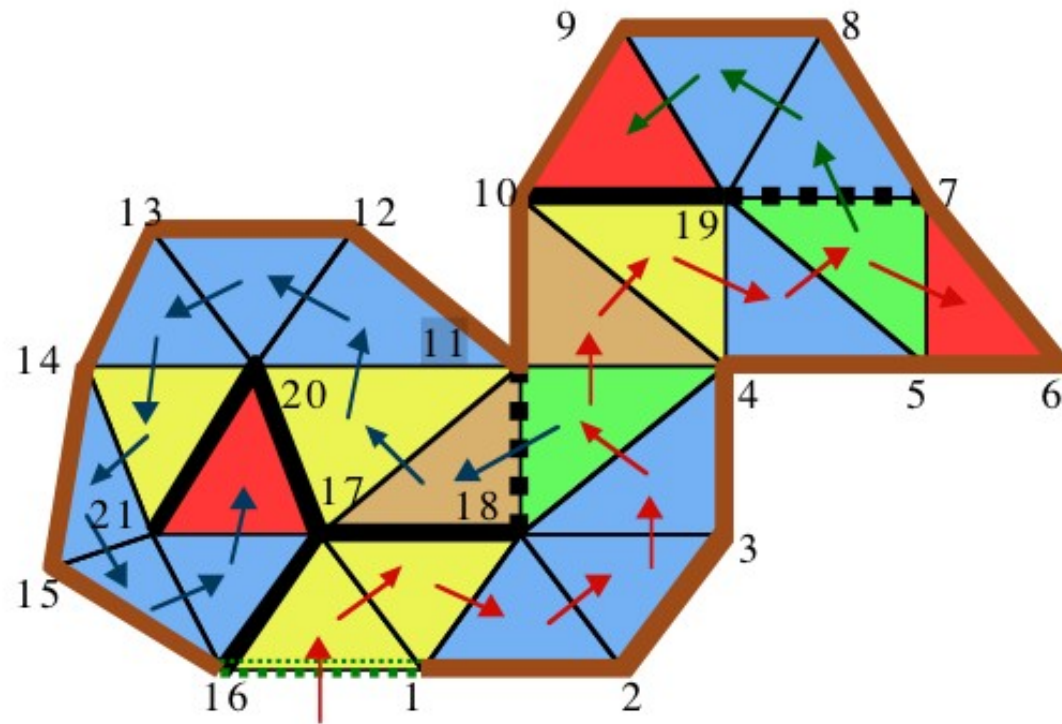
[J. **Rossignac, 1998**]

Typical Problems: Mesh Editing
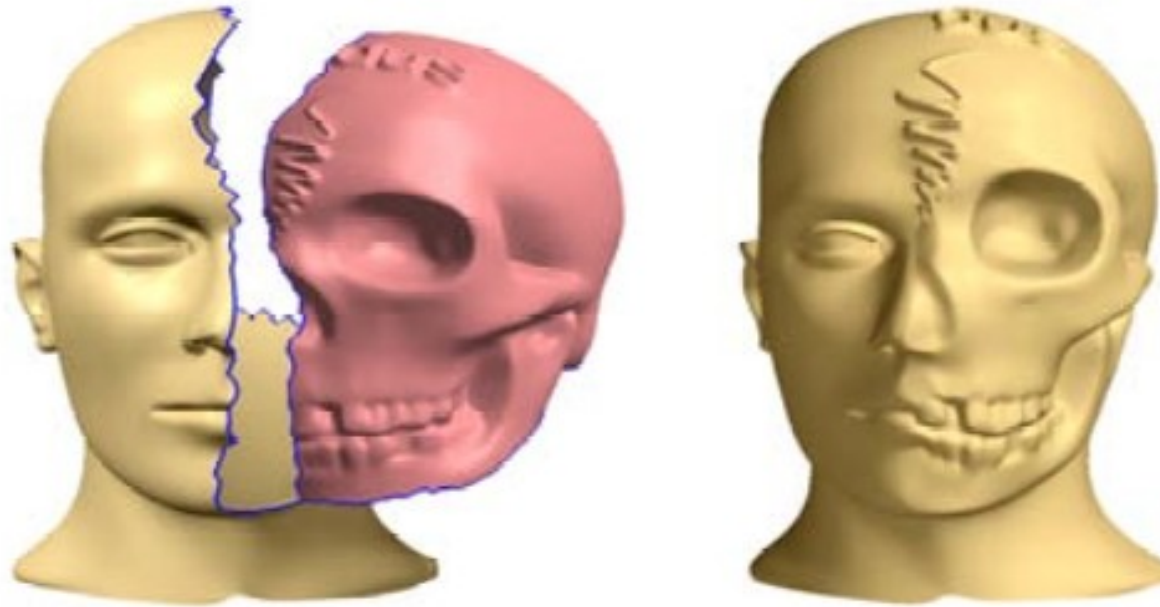
[Y. Yu, et al., 2004]
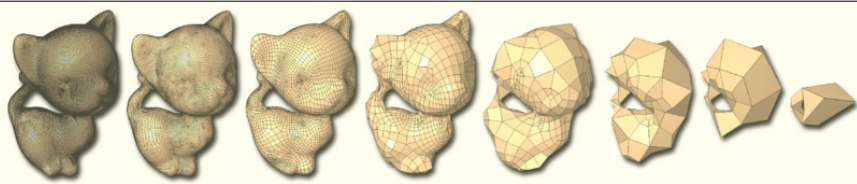
Typical Problems: Mesh Repair
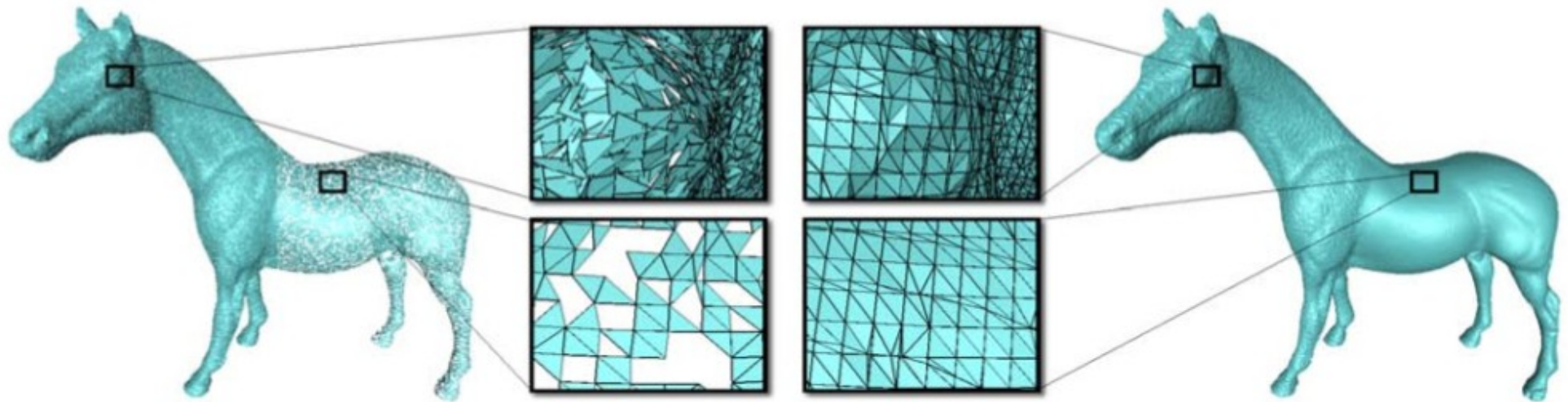
[T. Ju, 2004]

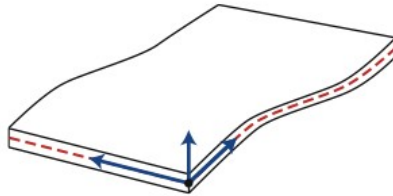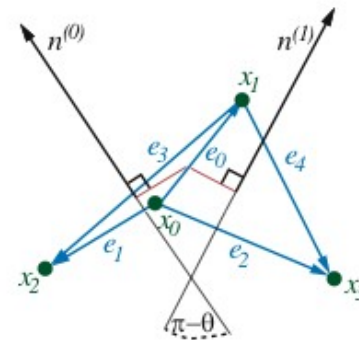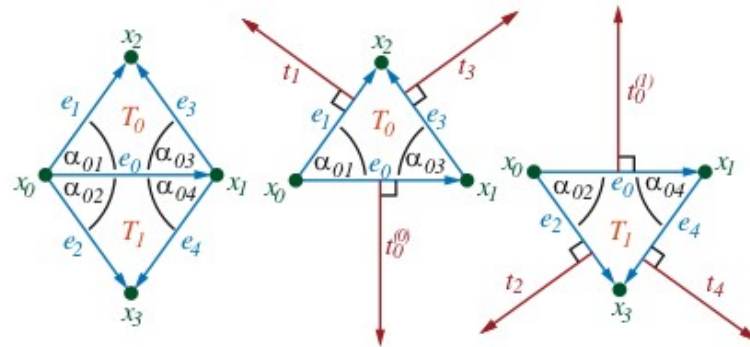## Typical Problems: Point Set Surfaces

[M. Alexa, et al., 2001]

Typical Problems: Discrete Exterior Calculus

[E. Grinspun, 2004]

[Max Wardetzky, et al., 2008]