Dynamic Local Remeshing for Elastoplastic Simulation

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Overview

• Dynamic, local remeshing





Plasticity using material space remeshing



Finite Element Simulation



Material Space

World Space

Finite Element Simulation



Material Space

World Space

Finite Element Simulation



Material Space

World Space

Plasticity



Material Space

World Space

Plasticity



Material Space

World Space

Plasticity



Material Space

World Space



Material Space

World Space



Material Space

World Space





Material Space

World Space





Material Space

World Space

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Material Space

World Space





Material Space

World Space



Material Space

World Space

Artificial Plasticity



World Space Remeshing

Artificial Plasticity





Material Space Remeshing World Space Remeshing

Artificial Plasticity





Material Space Remeshing

World Space Remeshing



World Space

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Material Space



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World Space

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World Space 11

Material Space

Material Space

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World Space 12

Material Space

World Space 13

Material Space

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Resampling

Material Space

Elastic Material





Material Space

High Plasticity





Material Space

Medium Plasticity





Material Space

Low Plasticity





Material Space

Mixed Plasticity





Material Space









Adaptive refinement











Why Dynamic Remeshing?

completely reshape domain



Why Dynamic Remeshing?

completely reshape domain









control element quality

Why Dynamic Remeshing?

completely reshape domain









control element quality







adaptive refinement and coarsening

• Remesh as little as possible

- Remesh as little as possible
 - Target only bad tets



- Remesh as little as possible
 - Target only bad tets
 - Improve mesh in every time step

















Dynamic Local Remeshing Local operations:

Require improvement after each operation

Dynamic Local Remeshing Local operations:

- Require improvement after each operation
- Schedule most local operations first

Mesh Quality

Mesh Quality



Mesh Quality











Vertex smoothing modifies surface



Vertex smoothing modifies surface

Control surface modification using quadric error




Contributions

Dynamic, local remeshing is possible and necessary

 Maintaining a minimum strain energy mesh greatly reduces artificial plasticity



Conclusions (I)

Dynamic Local Remeshing

- Maintains high quality throughout
- Enables adaptivity
- More accurate than remeshing from scratch







Conclusions (II)

Strain energy minimizing material space mesh

• Lower resampling error, lower artificial plasticity



Materials from purely elastic to very plastic

Conclusions (II)

Strain energy minimizing material space mesh

• Lower resampling error, lower artificial plasticity



• Materials from purely elastic to very plastic

http://graphics.berkeley.edu/papers/Wicke-DLR-2010-07/

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