Material Science

Crystal Grain Visualization

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Overview

- Introduction
- Motivation
- Goals
- State of the Art
- Query Raycasting
  - Concept
  - Data Analysis
  - Results
- Future Work
  - Query Raycasting
  - Tensor Visualization
- Questions
Introduction
Motivation

- Predictive, microstructure-sensitive ductile failure model
- Established visualization methods are insufficient
Goals

- Information Extraction
- New Exploratory Visualizations
- Data Format Improvement
State of the Art

Color Coding
(Courtesy of S. Zaefferer)

Cutting Planes
Query Raycasting - Concept
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Query Raycasting - Concept
Query Raycasting – Data Analysis

- Volume
- Center of Mass
- Mass
- Principle Moments of Inertia
- Betti Numbers
- Grain Boundary
- Previous Grain ID
- Misorientation Clusters
- Normal
- Curvature
- Stress/Strain Tensor Principle Components
Query Raycasting – Data Analysis

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- Stress/Strain Tensor Principle Components
- Filtering
Query Raycasting – Data Analysis

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Query Raycasting - Results

Timestep 1
Query Raycasting - Results

Timestep 1

Timestep 100
Future Work - Query Raycasting

- Specify Values to Visualize
- Specify Timestep Range
- More Powerful Filter Criteria
Future Work - Query Raycasting

- Specify Values to Visualize
- Specify Timestep Range
- More Powerful Filter Criteria

```sql
SELECT orientation, max_tensor
FROM timestep_0001 TO timestep_0100
WHERE grainid > 42
    AND volume > 6
    AND volume < 42
```
Future Work – Query Raycasting
Future Work – Query Raycasting
Future Work - Tensor Visualization

Super Quadrics
(Courtesy of G. Kindlmann)
Future Work - Tensor Visualization

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Stream Tubes
(Courtesy of Y. T. Weldeselassie)
Future Work - Tensor Visualization

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Merging-Ellipses
(Courtesy of W. Chen)
Future Work – Tensor Visualization

Topological Analysis
(Courtesy of T. Weinkauf)
Future Work – Tensor Visualization

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Contour Boxplot
Questions?

Thank you
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