Inter-Surface Mapping

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Introduction

No intermediate domain
- Reduced distortion
- Natural alignment of features
How Is Our Method Different?

• Directly create inter-surface map
  – Symmetric coarse-to-fine optimization
  – Symmetric stretch metric
→ Automatic geometric feature alignment

• Robust
  – Very little user input
  – Arbitrary genus
  – Hard constraints
Algorithm Overview

1. Consistent mesh partitioning
2. Constrained Simplification
3. Trivial map between base meshes
4. Coarse-to-fine optimization
Consistent Mesh Partitioning

- Compute matching shortest paths
- Add paths not violating legality conditions
Partition

- Assign feature points on both 2 meshes.
- Find the shortest path between each pair of feature vertices. (Dijkstra search)
  - The search is constrained to not intersect with paths already in the network.
  - Solution: perform Dijkstra on both the mesh vertices and the edge midpoints.
- Select the best pair of corresponding path and split the mesh.
  - Sort by the sum of path lengths on 2 meshes.
Legality Conditions

- Paths don’t intersect
- Consistent neighbor ordering
- Cycles don’t enclose unconnected vertices
Automatic Insertion Of Feature Points

Add features if not enough to resolve genus
Coarse-to-Fine Algorithm

- Interleaved refinement
- Vertex optimization
Vertex Optimization

- Consider $v$ of $M^2$ and optimizes $v$ of $M^1$

- The optimization only modifies the map inside these corresponding neighborhoods
  - Regenerate barycentric coordinates
2D Layout
Line Searches
Stretch Metric

Automatically encourages feature correspondence

Conformal          Stretch
Results: Inter-Surface Mapping
Results: Inter-Surface Mapping

Low distortion around hard constraints
Results: Inter-Surface Mapping

Arbitrary genus (genus 2; 8 user feature points)
Robustness
Conclusion

- Directly create inter-surface map
  - Symmetric coarse-to-fine optimization
  - Symmetric stretch metric

→ Automatic geometric feature alignment

- Robust: guaranteed bijection
  - Arbitrary genus
  - Hard constraints

- General tool with many applications
Future Work

• Faster technique
  – Currently: 64K faces, 2.4GHz → 2 hours
• More than 2 models
• Surfaces with different topologies
~ The End~