A Direct Texture Placement and Editing Interface

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Textures

Color Map

Normal Map

Alpha Map

Displacement Map
Overview

2 approaches to texturing
1 technical digression
7 operations
3 formulae
1 technical comparison
First Approach to Texturing
Jiri’s Texturing Tutorial

1. [Image of a 3D mesh of a head from different angles]
2. [Image of a UV map of a face]
3. [Images of a person's face from different angles]
4. [Image of a texture applied to the UV map]
Technical Digression
Flattening
Jiri’s Texturing Tutorial

1. 3D model of a head
2. UV map of the head
3. Photos of a person’s face
4. Textured image of the head
Jiri’s Texturing Tutorial

3

4

5

6

[Jiri Adamec]
Feet Texturing Tutorial

[Steven Stahlberg]
Our Approach to Texturing
Related Work

2D Image Warping, etc

[Beier and Neely 1992]
[Igarashi et al. 2005]
[Schaefer et al. 2006]
[James and Pai 1999]

3D Texture Painting

[Hanrahan and Haeberli 1990]
[Agrawala et al. 1995]
[Igarashi and Cosgrove 2001]
[Igarashi and Hughes 2002]
[Carr and Hart 2004]
[Schmidt et al. 2006]

2-Handed Manipulation

[Guiard 1987]
[Hinckley et al. 1994]
[Zeleznik et al. 1997]
[Kurtenbach et al. 1997]
[Balakrishnan and Kurtenbach 1999]
[Balakrishnan and Hinckley 2000]
[Llamas et al. 2003]
[Wu and Balakrishnan 2003]
Related Work

Parameterization

[Beier and Neely 1992]
[Maillot et al. 1993]
[Floater 1997]
[Piponi and Borshukov 2000]
[Lévy 2001]
[Sander et al. 2001]
[Sheffer and de Sturler 2001]
[Lévy et al. 2002]
[DeBry et al. 2002]

[Desbrun et al. 2002]
[Kraevoy et al. 2003]
[Yoshizawa et al. 2004]
[Yoshizawa et al. 2005]
[Lee et al. 2005]
[Sheffer et al. 2005]
[Zayer et al. 2005]
[Yamauchi et al. 2005]
7 Operations
Multi-touch
Multi-touch
Texture Placement
Texture Placement
Feature Alignment
Feature Alignment
Pushpin Constraints
Pushpin Constraints
Plastic Update
Plastic Update
Local Deformations
Local Deformations
Glue
Texture Layers
Texture Layers
Alpha Airbrush
Alpha Airbrush
Object Positioning
Object Positioning
Results
Results
3 Formulae
Parameterization Algorithm

Linearized Bending Energy

\[ \mathbf{t}_i = [u_i, v_i] \]

\[ t^T A t = E = \sum_i \frac{1}{8 \text{area}_i} \left( \sum_{j \in N(i)} (\cot \alpha_{ij} + \cot \beta_{ij})(\mathbf{t}_i - \mathbf{t}_j) \right)^2 \]
Constraints

Linear on triangles

\[
\begin{align*}
\beta_1 u_1 + \beta_2 u_2 + \beta_3 u_3 &= u_{\text{fixed}} \\
\beta_1 v_1 + \beta_2 v_2 + \beta_3 v_3 &= v_{\text{fixed}}
\end{align*}
\]
Constraints

Modify system

\[ A^{ext} = \begin{pmatrix} A & C^T \\ C & 0 \end{pmatrix} \]

\( \beta_1 u_1 + \beta_2 u_2 + \beta_3 u_3 = u_{fixed} \)

\( \beta_1 v_1 + \beta_2 v_2 + \beta_3 v_3 = v_{fixed} \)

bending energy Hessian

Need a scheme for quickly updating inverse
I Technical Comparison
Constraint Matching
Comparison

Bending

Stretching
Contributions

System for direct manipulation of textures in 3D
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Bending Energy for parameterization
Future Work

- Image editing operations
- Parameterization robustness
- User evaluations
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End