Direct Geometric Texture Synthesis and Transfer on 3D Meshes

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Issue: Realistic geometric texturing of high-frequency detail on 3D surfaces remains difficult and time-consuming.

Approach: Automatic extraction and transfer of 3D geometric texture from captured real-world surfaces to artificial surfaces using a combination of geometric surface fitting and 3D non-parametric sampling.

Motivation

Featureless surfaces can be readily generated from modern 3D authoring tools but generating realistic and detailed surface relief introduces a more difficult problem.

Geometric Texturing by Example

Increasingly available and accurate 3D capture tools such as laser range scanning and stereo camera rigs allow the rapid capture of 3D surface detail as part of a surface mesh representation.

A highly effective way to realistically provide relief detail for artificial surfaces is via the extraction and transfer of geometric texture from these surface captures.

Here we propose a two stage “texturing by example” approach that operates directly upon surface meshes:

1. Surface Fitting to extract the geometric surface texture as a displacement map relative to the local surface fit of a given sample mesh.
2. Non-parametric Sampling to synthesise the extracted geometric texture over the chosen target mesh.

Results

Successful transfer of architectural geometric texture from a physical cylindrical model to an artificial CAD-type surface.

The modelling of natural surfaces, derived using FFT functions to create the initial smooth target surface, can be enhanced via the transfer and synthesis of a real 3D textures that have been laser scanned from real-world natural objects.

Geometric texture extraction and transfer allows the resulting surface to maintain the global shape characteristics of the original target surface whilst implanting the localised surface detail from the specified sample.

Results

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Real geometric detail, unlike image based texturing, allows for realistic surface re-lighting and tactile haptic interaction.