Real-time field aligned stripe patterns

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Abstract:

In this paper, we present a parameterization technique that can be applied to surface meshes in real-time without time-consuming preprocessing steps. The parameterization is suitable for the display of (un-)oriented patterns and texture patches, and to sample a surface in a periodic fashion. The method is inspired by existing work that solves a global optimization problem to generate a continuous stripe pattern on the surface, from which texture coordinates can be derived. We propose a local optimization approach that is suitable for parallel execution on the GPU, which drastically reduces computation time. With this, we achieve on-the-fly texturing of 3D, medium-sized (up to 70 k vertices) surface meshes. The algorithm takes a tangent vector field as input and aligns the texture coordinates to it. Our technique achieves real-time parameterization of the surface meshes by employing a parallelizable local search algorithm that converges to a local minimum in a few iterations. The calculation in real-time allows for live parameter updates and determination of varying texture coordinates. Furthermore, the method can handle non-manifold meshes. The technique is useful in various applications, e.g., biomedical visualization and flow visualization. We highlight our method's potential by providing usage scenarios for several applications.