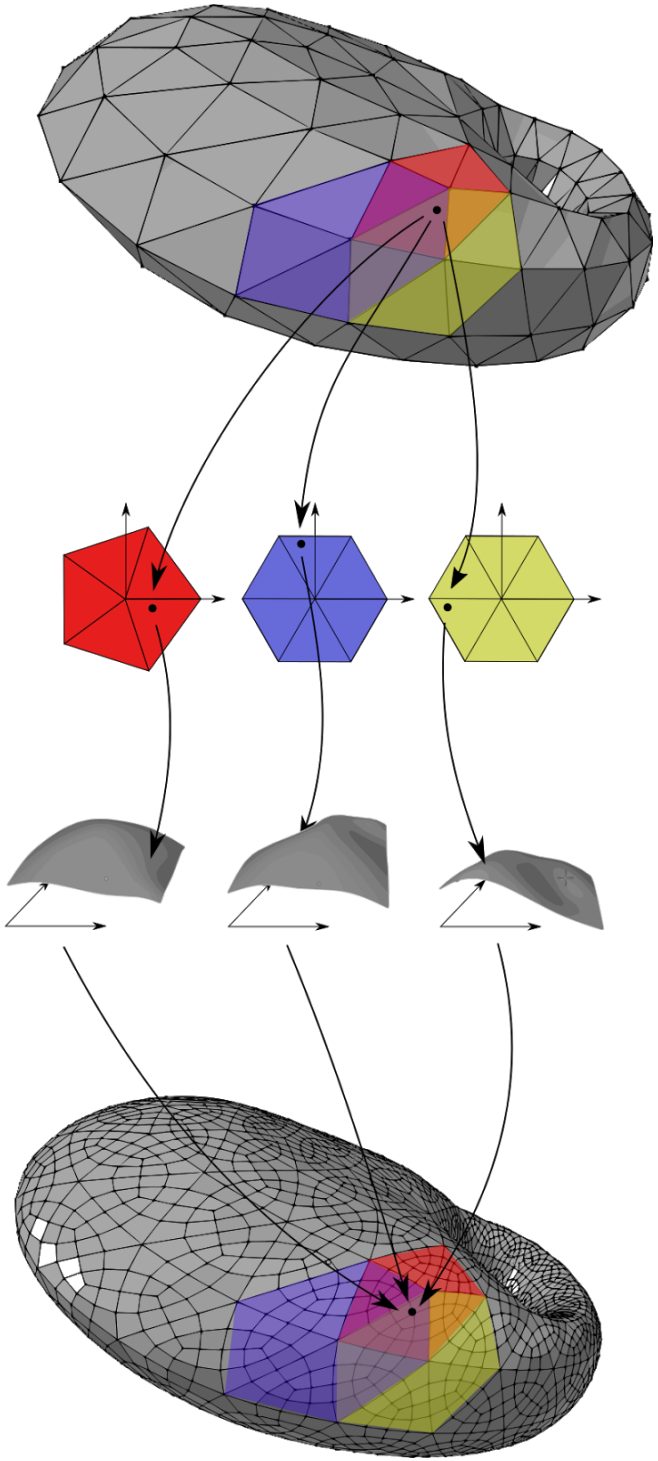

CIS565 Final Project Proposal: Parametric Pseudo-Manifolds

Models for games and animation are typically presented as triangulated meshes. In most cases, these meshes are intended to approximate smooth surfaces, but the closeness of this approximation is limited due to computational and artistic constraints. In 2008, constructs called “Parametric Pseudo-manifolds” (PPMs) were described by Siqueira et al.[1] , which provide a mapping between a triangular mesh and a smooth surface ‘close’ to it. The surface can be shown to be arbitrarily smooth, and the mapping is amenable to sampling this surface on-the-fly. However, this concept has not been applied in any practical piece of software.

We propose to implement this method in CUDA. The goal will be a demo program that loads an arbitrary triangular mesh, and tessellates it using vertex positions sampled from the corresponding PPM. Particularly, we aim to utilize the fact that the mapping is per-vertex/per-face to fully parallelize the computation, and to show that the method can be used for real-time applications.

Applications for efficient PPMs are any computation on triangular meshes where high face count is desired for smoothness or accuracy, but sufficiently high counts are prohibitive, e.g. soft-body simulation. By performing the simulation on a simpler mesh, and then sampling the PPM at higher resolution, one could possibly run a good-quality simulation in real-time. We may implement a version of this as a stretch goal.

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[1] Siquiera, Xu, Gallier, “Construction of C$^\infty$ Surfaces from Triangular Meshes Using Parametric Pseudo-Manifolds”, SEAS Technical Report 877, April 2008, http://repository.upenn.edu/cis_reports/877/