Aerospace Engineering Master's Defense

A Level Set Approach for Denoising and Adaptively Smoothing Complex Geometry Stereolithography Files

School for Engineering of Matter, Transport and Energy

Karthik Kannan

Advisor: Dr. Marcus Herrmann

abstract

Stereolithography files (STL) are widely used in diverse fields as a means of describing complex geometries through surface triangulations. The resulting stereolithography output is a result of either experimental measurements, or computer-aided design. Often times stereolithography outputs from experimental means are prone to a lot of noise, surface irregularities and holes in an otherwise closed surface.

A general method for denoising and adaptively smoothing these dirty stereolithography files is proposed. Unlike existing means, this approach aims to smoothen the dirty surface representation by utilizing the well established levelset method. The level of smoothing and denoising can be set depending on a per-requirement basis by means of input parameters. Once the surface representation is smoothened as desired, it can be extracted as a standard levelset scalar field.

The approach presented in this thesis is also coupled to a fully unstructured cartesian mesh generation library with built-in localized adaptive mesh refinement (AMR) capabilities, thereby ensuring lower computational cost while also providing sufficient resolution. Future work will focus on implementing tetrahedral cuts to the base hexahedral mesh structure in order to extract a fully unstructured hexahedra-dominant mesh, which can be used in fluid flow simulations.

November 17, 2014; 8:15 AM; GWC 535