Title: Delaunay Meshes for Space-Time Applications: Open Problems

Abstract: Space-time methods have significant potential to produce high-fidelity solutions to unsteady problems in the fields of structural mechanics, fluid mechanics, and electromagnetics. However, there are many challenges associated with implementing these methods. In particular, evolving real-world problems which possess 3D spatial geometry necessitate the construction of 4D space-time geometries. Moreover, one must successfully generate 4D CAD, 4D meshes, 4D refinement/coarsening strategies, etc. In addition, naive attempts to extend existing 3D methods may encounter unique issues due to the non-Euclidean structure of 4D space-time. In this talk, we discuss the idea of using Delaunay meshing techniques to generate unstructured meshes for space-time problems. We motivate the utilization of these meshes by appealing to the optimality properties of Delaunay meshes in lower dimensions, and demonstrate that some of these optimality properties extend into higher dimensions. In addition, we explain how recent advances in Delaunay meshing enable the treatment of the 4D anisotropic space-time setting. Finally, we discuss several open research problems which illustrate the inherent promises and difficulties of the proposed technology.