**Discretization Techniques for Simulation Domains**

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**Abstract:**

This talk will present recent techniques for representing continuous domains in computational settings. First, I will present a meshing technique for biomedical data in the form of segmented 3D images from sources such as CT or MRI. Anatomical structures have been described by various material labels, and the goal is to construct a tetrahedral mesh which conforms to the complex, non-manifold surfaces that bound the volumetric regions between labels. This algorithm starts with a background body-centered cubic (BCC) lattice, and then through subdivision and localized warping, produces tetrahedral meshes with bounded dihedral angles. The implementation of this algorithm, Cleaver, is open source (available for download at [http://www.sci.utah.edu/software/cleaver.html](http://www.sci.utah.edu/software/cleaver.html)) and has the capability to produce high quality conforming meshes with millions of elements in seconds.

Finally, I will conclude with some discussion of recent work for representation of flow fields to preserve topological properties. Analysis and visualization of complex vector fields remain major challenges because of a gap between the concepts of smooth vector field theory and their computational realization. The discrete nature of our representation enables us to directly compute and classify analogues of critical points, closed orbits, and other common topological structures.

Both of these projects are joint work with researchers at the University of Utah. The first is with Jonathan R. Bronson, Adam Bargteil, and Ross T. Whitaker while the second is with Shreeraj Jadhav, Harsh Bhatia, Valerio Pascucci, and Peer-Timo Bremer.

**About the Speaker:**

Joshua A. Levine is an assistant professor in the Visual Computing division of the School of Computing at Clemson University. He received his PhD from The Ohio State University after completing his BS and MS in Computer Science from Case Western Reserve University. His research interests include geometric modeling, scientific visualization, mesh generation, topological analysis, vector fields, volume and medical imaging, surface reconstruction, computer graphics, and computational geometry.

All are welcome!  
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