Università degli Studi di Pavia

Dipartimento di Meccanica Strutturale

in collaboration with

Centro di Simulazione Numerica Avanzata – CeSNA

Istituto Universitario di Studi Superiori

SEMINAR

Image-Based Geometric Modeling and Mesh Generation for Complicated Domains

With finite element method (FEM) and scanning technology seeing increased use in active research areas such as biomechanics, there is an emerging need for image-based high-fidelity geometric modeling and quality mesh generation of the spatially realistic domains. It is well known that FEM is currently well-developed and efficient, but mesh generation for complex geometries (e.g., the human body) still takes ~80% of the total analysis time and is the major obstacle to reduce the total computation time. It is mainly because none of the traditional approaches is sufficient enough to effectively construct finite element meshes for arbitrarily complicated domains, and generally a great deal of manual interaction is involved in mesh generation.

In this talk, I will highlight our research in this area along with details of meshing pipelines, especially octree-based algorithms to extract adaptive and quality 2D (triangular or quadrilateral) and 3D (tetrahedral or hexahedral) meshes of volumetric domains, conforming to boundaries defined as level sets of a scalar function on the domain. Automatic mesh generation and robust quality improvement for heterogeneous domains with non-manifold boundaries, sharp feature preservation in all-hexahedral meshing for CAD assemblies, and guaranteed-quality all-quadrilateral mesh generation will be discussed. In addition, high-order element construction is another research focus in our Computational Biomodeling Laboratory, which has been integrated with computation through isogeometric analysis. This talk will describe our latest research on wavelets-based NURBS simplification and fairing, converting any unstructured quadrilateral/hexahedral mesh to T-splines, as well as cubic Hermite model construction. Finally, I will show several applications of our meshing schemes.

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MS1 Conference Room,
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