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MESH GENERATION FOR COUPLED PROBLEMS

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ABSTRACT

Abstract: There are numerous multiphysics applications in science and engineering which require the numerical solution of partial differential equations (PDEs) on meshes. Examples include micro-electro-mechanical systems, ground water modeling, and cardiovascular applications. The simulation of such phenomena can be quite challenging due to the large range of spatial and temporal scales present due to the different types of physics involved.

Various types of meshes are employed in the simulation of multiphysics applications. The choice of which type of meshes to employ is often based on the physics and geometric domains involved. For example, two popular methods for the simulation of fluid-structure interaction problems are arbitrary Lagrangian-Eulerian (ALE) methods and embedded boundary methods ALE methods use deforming Lagrangian meshes to follow the fluid and fixed Eulerian meshes for the solids. On the other hand, embedded boundary methods are used to simulate solids immersed in a fluid. Other types of meshes, such as unstructured body-fitted meshes may also be used. The choice of method has implications for the fluid-solid interface and the mesh generation process itself.

Various challenges occur when exchanging information between the physics components based on the type of meshes being employed and the type of coupling scheme used to solve the PDEs. Often the meshes are tailored to best represent the physics on each domain in a multidomain simulation. Different physics components can be defined on distinct physical domains and coupled across interfaces between the domains; sometimes the interfaces also evolve over time and must be tracked/captured. Another challenge is that the meshes might not match along the interfaces and hence require a remapping of the information from one mesh to another.

The goal of the minisymposium is to discuss recent progress and challenges in mesh generation for coupled problems. Talks by researchers who focus on the development of numerical methods for generation of meshes used in coupled problems and practitioners who perform computational simulations on multiphysics applications using such meshes are both welcome.