Abstract. Dynamic meshes are used to enable numerical PDE simulations of problems with moving geometric domains, such as the launch of a rocket or the biomechanics of a beating heart. Dynamic meshing algorithms typically combine aspects of mesh warping, mesh untangling, mesh quality improvement, and remeshing. There are several limitations of existing dynamic meshing algorithms that make them unsuitable for use in surgical applications. For example, the mesh warping algorithms upon which they are based often do not yield the desired volume meshes when applied to a noisy target surface mesh or result in a tangled mesh with inverted elements which is invalid for use in finite element simulations. In addition, the mesh quality improvement algorithms that are used for dynamic meshing typically target improvement of the average mesh quality, as opposed to the worst quality elements which most significantly impact the accuracy, stability, and efficiency of the associated numerical PDE simulations.

In this talk, I will describe the parallel dynamic meshing framework for patient-specific medical interventions, which we are designing. In particular, I will then describe two dynamic meshing algorithms which we are developing. The first algorithm I will discuss is a mechanics-based mesh warping algorithm for generation of non-manifold topology meshes of embedded objects. The second algorithm I will describe is an interior point method for improvement of the worst quality elements in a finite element mesh. I will also demonstrate the potential utility of our algorithms in improved prevention of pulmonary embolism. I will conclude by describing our plans for future research in these areas.