

Numerical Methods for Elasticity and Incompressible Newtonian Flows

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The original physical equations for mechanics of continua are first-order partial differential systems. Traditionally, these original first-order systems are converted through differentiation and elimination into second-order partial differential systems with less variables. Computation is then based on these reduced second-order systems or their variants. Although substantial progress in numerical methods and in computations has been achieved, these problems may still be difficult and expensive to solve.

There are many advantages to directly simulate the original physical systems - the first-order systems. This can be done through either least-squares or mixed finite element methods. These two methods have different numerical properties. In this talk, we will introduce both the methods for elasticity and incompressible Newtonian fluid flows and discuss their numerical properties. Numerical results for a benchmark test problem of planar elasticity will be presented.