Consideration of Non-Constant Viscosity in the Analysis of the Navier-Stokes Equations

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In this paper, we study the question of asymptotic degrees of freedom in a viscous flow. Particularly, we create a bound on the dimension N of the determining node set xi of a fluid with time-dependent viscosity nu(t). If the fluid velocity is calculated at these N points, the fluid velocity can be determined asymptotically over the entire domain Omega. To support the proof of this bound on N, we are required to develop some new norm inequalities. We also illustrate how the Navier-Stokes equations, the most accepted model for the flow of a viscous fluid, arrive from physical conservation laws and properties of norms and normed spaces. For the construction of the problem, we consider a domain of Omega in R^d, d = 2 or d = 3 , a polyhedral domain which has been exactly tessellated with a quasi-uniform, shape-regular set of simplices. The main novelty of this paper is the creation of a bound on N that considers a non-constant viscosity (nu is replaced by the real-valued function nu(t)).