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**Diane L. Denny\*** ([diane.denny@tamucc.edu](mailto:diane.denny@tamucc.edu)), Department of Mathematics and Statistics, Texas A&M University-Corpus Christi, Corpus Christi, TX 78412. *On a unique solution to equations modeling incompressible fluid flow.* Preliminary report.

We study the initial-value problem for a system of nonlinear equations that models the flow of an incompressible fluid. The system includes a parabolic equation for the velocity and an algebraic equation (the equation of state) for the pressure as a function of the density. We prove the existence of a unique solution for the velocity and density under periodic boundary conditions, with a small initial velocity gradient. The key to the proof lies in obtaining an  $L^2$  estimate for the density. (Received September 20, 2007)