

FLOWS DRIVEN BY A QUASI-INCOMPRESSIBLE CAHN-HILLIARD-NAVIER-STOKES TYPE MODEL

Martin Řehoř

*Mathematical Institute of Charles University, Sokolovská 83,
186 75 Praha 8 – Karlín, Czech Republic*

e-mail: rehor@karlin.mff.cuni.cz

Abstract

A diffuse interface model for a mixture of two incompressible constituents with non-matching densities is introduced within a thermodynamic framework. It is a variant of a model derived in Lowengrub and Truskinovsky (R. Soc. Lond. Proc. Ser. A Math. Phys. Eng. Sci. 454 (1998), no. 1978, 2617–2654). The total mixture density in this model is uniquely determined by the concentrations of single constituents. The system of governing equations describes a quasi-incompressible flow in the sense that the barycentric velocity field is non-solenoidal due to the possibility of total density changes. These changes occur due to the mixing of the constituents of different densities in a small interfacial region, although the fluids are macroscopically immiscible. The model requires a discussion on appropriate numerical schemes for solving the equations for realistic values of physical parameters. Some possibilities are tested on various benchmark examples.