Numerical solution of the density profile equation for non-newtonian fluids

G. Hastermann, **P. Lima**, M.L. Morgado and E. Weinmuller
CEMAT, Instituto Superior Técnico
Universidade Técnica de Lisboa
Av. Rovisco Pais, 1049-001 Lisboa, Portugal
plima@math.ist.utl.pt

We discuss the analytical properties and the numerical treatment of a nonlinear singular second order boundary value problem in ordinary differential equations, posed on an unbounded domain, which represents the density profile equation for the description of the formation of microscopic bubbles in a non-homogeneous non-newtonian fluid. First, we give an asymptotic analysis of the underlying equation and provide asymptotic expansions of the one-parameter families of solutions satisfying the boundary conditions at the singular points. Then, after the transformation of the problem into a new one, defined on a bounded interval, polynomial collocation is applied to solve the new problem. The results of the numerical simulation are presented and discussed.

In the present work, the analysis and computational methods proposed earlier for the case of newtonian fluids (see [1], [2]), are extended to the non-newtonian case.

References

[1] P. M. Lima,N. V. Chemetov,N. B. Konyukhova, A. I. Sukov, *Analytical-numerical investigation of bubble-type solutions of nonlinear singular problems*, J. Comput. Appl. Math., 189 (2006), pp. 260–273.

[2] G. Kitzhofer, O. Koch, P. Lima, E. Weinmuller, *Efficient numerical solution of the density profile equation in hydrodynamics*, J. Sci. Comput, 32 (2007), pp. 411–424.