PLATEAU-RAYLEIGH INSTABILITY IN SUPERPARAMAGNETIC FERROFLUIDS: A SIMPLIFIED 1D THEORY

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Abstract. In this work, we study the Plateau-Rayleigh instability of a superparamagnetic ferrofluid under the presence of a magneic field. The Plateau-Rayleigh instability [1], which is driven by surface tension, occurs when a thin column of fluid with a predominant axial flow is broken into several drops of fluid. Based on the thin geometry of the flow, we propose a set of 1D governing equations in term of the axial velocity of the flow and of the free surface position. An axial magnetic field is considered and is taken into account in the formulation in the effective pressure in the flow [2]. We perform a linear stability analysis to identify the range of unstable wavenumbers and solve the full nonlinear governing equations with the method of lines [3]. We observe that the simplified theory matches very well the linear theory presented in [4] and that presence of the magnetic field slows down the growth of the instabilities, leading to configurations for which the breakup can be prevented.

Keywords:

Mathematics Subject Classifications (2010): 76D45, 76E17, 65M20.

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