FLOTATION WITH SEDIMENTATION II: NUMERICAL SOLUTION AND CHARACTERIZATION OF STATIONARY SOLUTIONS

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Abstract. Flotation is a unit operation extensively used in the recovery of minerals in mineral processing and related applications. It takes advantage of the differences in hydrophobicity, the physical property of being attracted to water, to separate valuable minerals from gangue.

In a first step, essential insight to the hydrodynamics of a flotation column can be obtained by studying just two phases: gas and fluid. In [3], the authors introduced a one-dimensional two-phase model with a multiply discontinuous flux, derived from fundamental principles as the drift-flux theory, describing the interaction between gas bubbles and fluid. Of special interest is the study of the stationary solutions, and the definition of operating charts characterizing the necessary conditions for their feasibility in each case. The conservation law obtained is discretized using a method-of-lines approach with Godunov's numerical scheme [2] for the discretization of the numerical fluxes. The numerical experiments show that the proposed model is valid for transient simulations as well as prediction of steady states.

Although the results presented in [3] help with the better understanding of the flotation process taking place in a flotation column, it is fundamental to include the solid particles present in the suspension and their interaction with gas bubbles into the system. In a second step, we include settling particles within the suspension into the system. This class of particles do not interact with the gas bubbles, hence attachment and detachment processes are neglected. Exploiting the fact the system of balance laws obtained is triangular, we can implement a numerical method specifically defined for this class of systems [1]. The study of stationary solutions is more complex in this scenario, as gas bubbles influence the behaviour of solids, but operating charts are also provided and steady-sate solutions are categorized in detail.

Finally, in a third step, we consider settling particles that do interact with gas bubbles, including attachment and detachment processes, and obtaining a system of three PDEs with discontinuous flux and sources terms.

Keywords: Kinematic flow models, flotation, steady state, conservation law, discontinuous flux.

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