

## Modelling flotation columns through a conservation law with multiply discontinuous flux

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### Abstract

Flotation is a unit operation that is extensively used in the recovery of valuable minerals and coals in mineral processing and related applications. The theory of froth flotation is complex, involving three phases (solids, water, and froth or gas) with many subprocesses. However, essential insight to the hydrodynamics of a flotation column can be obtained by studying just two phases: gas and fluid [?, ?]. In [?], the authors proposed a reformulation of the approach based on the drift-flux theory, as a one-dimensional non-linear conservation law with a multiply discontinuous flux: the unknown is the gas volume fraction as a function of height and time, and the flux function depends discontinuously on spatial position due to feed inlets for gas, feed slurry and wash water. The resulting model adds a new real-world application to the field of conservation laws with discontinuous flux. Steady-state solutions were studied in detail, including their construction by applying appropriate entropy conditions across each flux discontinuity. This analysis leads to operating charts and tables collecting all possible steady states along with some necessary conditions for their feasibility in each case. Numerical experiments showed that the transient model recovers the steady states, depending on the feed rates of the different inlets.

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