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Streamline splitting the thermo- and hydrodynamics in compositional gas-liquid flow through porous media and application to hydrogen - water behaviour in radioactive waste deposits

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We examine a two-phase gas-liquid system consisted of N chemical species, which is described by N mass balance equations for each specie, two momentum balance equations (Darcy's law) for each phase, and N+2 thermodynamic algebraic equations controlling the phase state and the specie dissolution in both phases. Using the property of a contrasting mobility between gas and liquid, we have shown that the model can be transformed into two subsystems in such a way that the new thermodynamic module becomes totally independent of the hydrodynamic one. In turn, the hydrodynamic sub-system is reduced to two equations only (for pressure and saturation) which possess some asymptotic analytical solutions. The new thermodynamic model which describes the behaviour of an open system is tested on a particular case. We show how these results can be applied to a hydrogen-water system in a radioactive waste deposit.