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Compositional space parameterization for general multi-component multiphase systems DENIS VOSKOV, HAMDI TCHELEPI, Stanford — We present a general parameterization of the thermodynamic behavior of multiphase, multi-component systems. The phase behavior in the compositional space is represented using a low dimensional tie-simplex parameterization. This parameterization improves the robustness of the phase behavior representation as well as the efficiency of various types of compositional computations. We demonstrate this Compositional Space Parameterization (CSP) framework for large-scale compositional reservoir simulation. In the standard compositional simulation approach, an Equation of State (EoS) is used to detect the phase state and calculate the phase compositions, if needed. These EoS computations can dominate the overall simulation cost. We compare our adaptive CSP approach with standard EoS based simulation for several challenging problems of practical interest. The comparisons indicate that the CSP strategy is more robust, and computational efficient. Another type of applications is an equilibrium flash calculation of systems with a large number of phases. The complexity and strong nonlinear behaviors associated with such problems pose serious difficulties for standard techniques. Here, we describe an effective tie-simplex parameterization for such systems at a fixed pressure and temperature. The preprocessed data can be used in conventional EoS based calculations as an initial guess to accelerate convergence.

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