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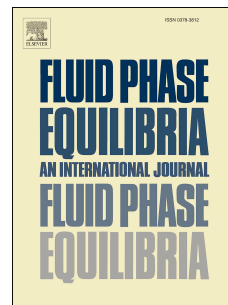
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# A fast algorithm for calculating isothermal phase behavior using machine learning

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## Abstract

Compositional models are frequently used to describe fluids in petroleum reservoir simulation, particularly for simulations of enhanced oil recovery. While compositional models are more accurate than black oil models, they incur a larger computational cost, in part, due to more complex phase-equilibrium calculations and can result in longer run times. Here, we develop an algorithm to reduce the cost of phase-equilibrium calculations for compositional models by applying two machine learning techniques: relevance vector machines and artificial neural networks. We test the algorithm on three fluid data sets and find a speedup of over 20% with an error of 0.01%, and a speedup of over 90% with a maximum error of 5%. These results suggest that the algorithm can be used to reduce the overall run time of compositional reservoir simulations with a small impact on accuracy.

*Keywords:* EoS calculation acceleration, Negative flash, Compositional simulation, Relevance vector classifier, Artificial neural network

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