



## MECHANICS SEMINAR

# Mathematical analysis of foam flow in porous media

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### **Abstract.**

Foam is used in enhanced oil recovery to improve the sweep efficiency by controlling the gas mobility. A common way to describe the foam displacement is by using population balance models, which consider the foam texture as part of the gas phase. Numerical simulation of such equations presents serious difficulties connected to the high non-linearity in the fractional flow. The linear kinetic model is studied mathematically for large initial reservoir water saturation and all possibilities of injection saturation. It was observed that the model contains some structural instabilities, *i.e.*, a small variation in some parameters leads to qualitatively different solutions. One of these solutions presented localized decay in relative gas mobility, indicating that this behavior is due to the equations' mathematical properties. Using the fractional-flow methods, an application of the method of characteristics, we solve the corresponding Riemann problem for this model. The methodology combines theoretical analysis with numerical experiments to provide scientific evidence for the existence (and stability) of solutions. Some mathematical properties of the model will be presented supported by direct numerical simulations.

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