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**Daozhi Han\*** ([handaoz@mst.edu](mailto:handaoz@mst.edu)), 400 W. 12th St, Rolla, MO 65409. *Modeling and numerical methods for two-phase flows in superposed free flow and porous media.*

In this talk we derive a phase field model for two-phase flows in superposed free flow and porous media based on the virtual work principle and Onsager's variational principle. We establish the global existence of weak solution as well as weak-strong uniqueness. Finally we present a second order decoupled unconditionally stable numerical algorithms for solving the model. (Received September 19, 2021)