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A mixture theory for size and density segregation in granular free-surface flows ANTHONY THORNTON, DEEPAK TUNUGUNTLA, University of Twente — In the past years much work has been undertaken on developing mixture theory continuum models to describe kinetic-sieving driven size-segregation [1-3]. We propose an extension to these models that allows their application to bidisperse flows over inclined channels, with particles varying in density and size [4]. Our model incorporates both a recently proposed explicit formula, for how the total pressure is distributed among different species of particles, of Marks et al. [2], which is one of the key elements of mixture theory-based kinetic sieving models and a shear rate-dependent drag. The resulting model is used to predict the range of particle sizes and densities for which the mixture segregates. The prediction of no segregation in the model is benchmarked by using discrete particle simulations, and good agreement is found when a single fitting parameter is used which determines whether the pressure scales with the diameter, surface area or volume of the particle.

[1] Gray and Thornton. Proc. Royal Soc. A, 461:1447-1473, 2005.
[2] Marks, Rognon, and Einav. JFM, 690:499-511, 2012.
[3] Fan and Hill.NJP, 13(9):095009, 2011.
[4] Tunuguntla, Bokhove and Thornton. JFM, 749:99-112, 2014.

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