Rheology of Granular Mixtures Differing in Size and/or Density
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— Rheology of mono-dispersed granular materials is well understood and it is well
known that these materials follow a friction law where the shear stress to pressure
ratio is determined by the Inertial number I. However, rheology of the general and
more common case of granular mixtures of different size and/or different density
particles has not received attention of researchers. We study the rheology of binary
mixtures flowing over an inclined plane under the influence of gravity by means of
DEM simulations. We show that the friction law for single component granular
material with appropriate modification in the inertial number expression captures
the rheology of the mixtures as well and can predict the viscosity of both, same-size
different-density particle mixtures and different-size same-density particle mixtures.
For the case of mixture of particles differing in size and density both, we obtain
a well-mixed or a segregated state depending upon the over-all composition of the
mixture. The modified friction law is able to predict the viscosity for this case
as well for both well-mixed and segregated state. Thus we show that friction law
with a generalized definition of Inertial number can predict the rheology of granular
mixtures differing in size and/or density.

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