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IMPLİCATİONS OF THE LACK OF SCALE SEPARATİON İN GRANULAR FLOWS DRİVEN BY GRAVİTY

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Starting from the observation that granular flows driven by gravity can be considered a macroscopic representation of molecular gases, kinetic theories have been applied to granular flows since 1978 (Ogawa).
A great difference exists between molecular and granular gases: the collisions among particles are no more perfectly elastic in granular flows, as they were in the molecular case. Jenkins & Savage (1983), in order to represent the loss of energy due to inelasticity, introduced the coefficient of restitution e, that correlates the particle velocity before and after the impact.
However another important difference must be highlighted; in molecular fluids there is a strong scale separation: the microscale, represented by the mean free paths, is very much smaller than the macroscale, that is the scale according to which gradients change (Goldhirsch 2003, 2007). In granular flows, we still have a scale separation, but not so strong: the dimension of a single particle becomes comparable to that of the control volume. This leads probably to a correlation between the single particle velocity and the concentration, hence the definition of the averaged values becomes crucial.
In this respect, we may distinguish between two types of average: the ensamble average, used in the standard kinetic theories, in which we consider constant the number of particles per unit *n* (that represents the concentration) and the average defined by Drew, in which the average of the variable ψ is defined as follows:

$$\bar{\psi} = \frac{< n\psi >}{< n >}$$

Clearly in this case *n* is not considered constant. Thus, if we analyse the case in which the property ψ is the velocity **c**, a change of the average type could mean a change in the system of equations used till now: indeed according to the second average $<n\mathbf{c}> \neq n<\mathbf{c}>$, and the derivatives of such average could lead to additional diffusive terms.