Continuum Theory of Mixtures – Application to Debris Flow Modeling

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09.12.2010 – 14:00 h – IA 4/56

Basics of continuum mixture theory in thermodynamical context (Part I) with application to shallow gravity driven flows (Part II) will be presented.

Part I: First miscible mixtures are discussed. To illustrate the ideas underlying the thermodynamics of mixture theory a simple example (diffusive motion in a heat conducting fluid) is considered. Then, immiscible (multiphase) mixtures, for which the volume fraction plays a central role, are introduced. Results from Schneider & Hutter (2009), will be discussed.

Part II: Modeling depth-averaged equations describing a debris flow on arbitrary rigid terrain are deduced. The flowing material is a saturated mixture of solid grains and pore fluid. For the stresses of the solid constituent three models, one of Mohr-Coulomb type, are proposed, while the fluid constituent is a Newtonian/non-Newtonian fluid with small viscosity. The interaction force in the linear momentum balance equations is deduced according to Schneider & Hutter within a thermodynamical approach. To account for the shallowness of the avalanching mass coordinates attached to the topography are used.

Guests are sincerely welcome!