On the Numerical Simulation of Particulate Flow for Non-Newtonian Incompressible Viscous Fluids a la Bingham

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These last years have seen a renewal of interest concerning the mathematical and computational aspects of incompressible viscous flow a la Bingham. Compared to Newtonian situations the main difficulty is related to the fact that the mathematical model contains a multivalued partial differential operator which is the sub-gradient of an L1-norm of the rate-of-strain tensor. Through an equivalent formulation involving a tensor-valued multiplier it has been known for years that the above difficulty is easily overcome from a computational point of view.

The main goal of this lecture is to discuss an operator splitting based methodology combining the above multiplier characterisation with further computational ingredients (such as L2-projection methods for the treatment of the incompressibility condition div u=0, and fictitious domain techniques to take care of moving boundaries) in order to address the direct numerical simulation of Bingham particulate flow, i.e., the flow of mixtures of Bingham fluids and solid particles (assumed to be rigid here).