Simulation of particle transport in viscoelastic fluid flow using CFDEMcoupling and workflow integration into the MarketPlace platform

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ABSTRACT

Many materials commonly used in industry show viscoelastic behaviour in liquid state. Polymers or biological fluids are common examples in this regard. Simulation of these materials introduces additional complexities compared to the commonly considered Newtonian fluids. The coupled simulation of particles in such fluids is particularly challenging since the usually rather high viscosity of viscoelastic materials increases the stiffness of the system and hence complicates time integration of the coupled particle fluid system.

In the framework of computational fluid dynamics, viscoelastic materials are often modelled by the separation of the stress tensor into a Newtonian component and an additional contribution of the elastic stress tensor requiring the solution of an additional differential equation for the latter. This approach was also adopted for the description of viscoelastic materials in CFDEMcoupling [1] where a new solver was developed to simulate viscoelastic fluids. Depending on the material under investigation a suitable material model needs to be chosen from the range of models available in literature. The capabilities of different material models are investigated for model configurations and workflows for the determination of fluid parameters are outlined along with the integration of this workflow into the framework of the EU Materials Modeling Markeplace platform [2] is which is currently being developed. Furthermore, the development of models for particle drag within this framework is discussed and coupled simulations of particles dispersed in a viscoelastic fluid are demonstrated.

REFERENCES

[1] Goniva, C., Kloss, C., Deen, N.G., Kuipers, J.A.M. and Pirker, S. (2012): “Influence of Rolling Friction Modelling on Single Spout Fluidized Bed Simulations”, Particuology, DOI 10.1016/j.partic.2012.05.002

[2] Materials Modelling Marketplace for Increased Industrial Innovation, www.the-marketplace-project.eu