# Improving wet plastic recycling through innovative lagrangian particle-fluid simulations
# IMPRECSIM

Experienced researcher: Darius Markauskas
(Email: markauskas@leat.ruhr-uni-bochum.de)
http://orcid.org/0000-0001-7062-4415

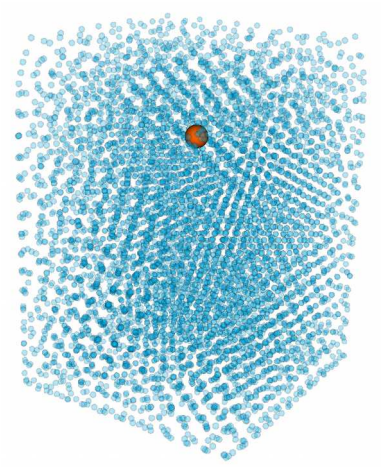
Starting date: 01/06/2015
Duration in months: 18
Call identifier: H2020-MSCA-IF-2014
Topic: MSCA-IF-2014-EF
Marie Skłodowska-Curie Individual Fellowships (IF-EF)

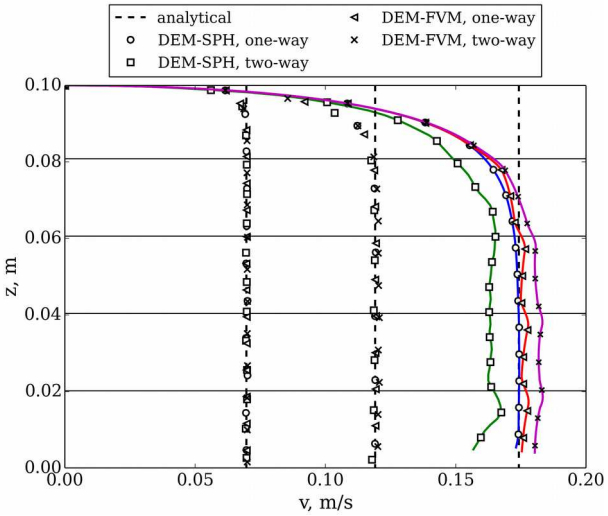
## Description of the project

Wet particle separation is used widely in mineral processing as well as plastic recycling to separate mixtures of particulate materials into further usable fractions due to density differences. Despite its wide usage wet particle separation processes are often attributed to operational problems especially if density differences of the feed material are low. Numerical modelling has not yet been applied to wet separation processes due to the lack of applicable numerical schemes. On this background numerical modelling can strongly contribute towards improving the design and process parameters of wet particle separation technologies especially in the field of plastic recycling. The research consists of two parts. The first objective is the development of a novel, fully Lagrangian particle-fluid modelling framework applicable to systems of particles of complex shape in a wet environment. For modelling the particles, the Discrete Element Method (DEM) is employed. For the fluid part, the Lagrangian Smooth Particle Hydrodynamics (SPH) is used which enables handling free surfaces and large movements of the fluid, inherently. While unresolved fluid flow around particles is already used in mesh based methods, coupling the DEM and SPH in one computational framework is a challenging task addressed in this project. In the second part of the project, the developed framework is applied to the modelling of a wet separation process involving a sink-float drum separator for plastic recycling.

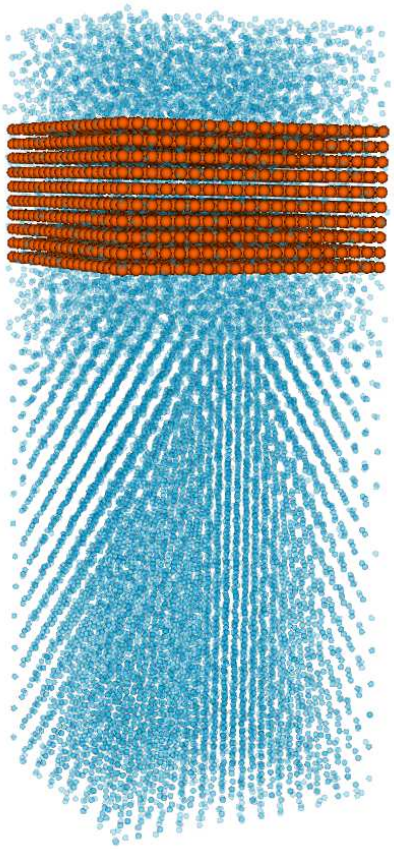
## Development of fully Lagrangian particle-fluid modelling framework

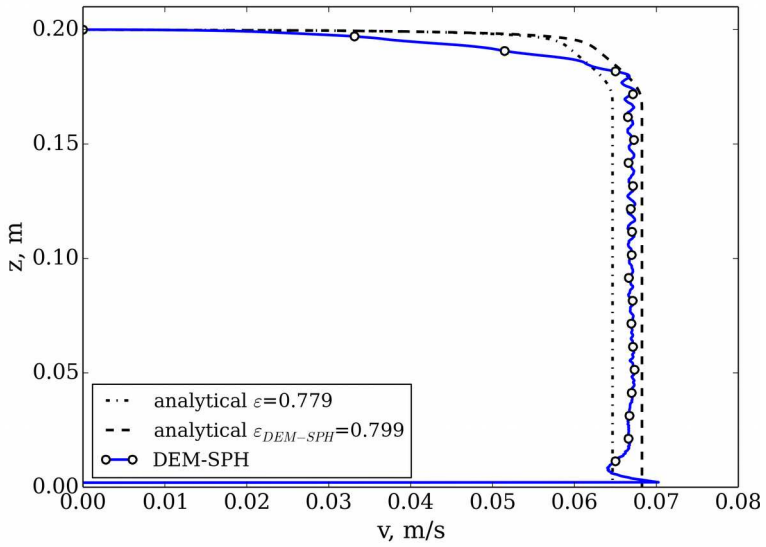
Single particle sedimentation test



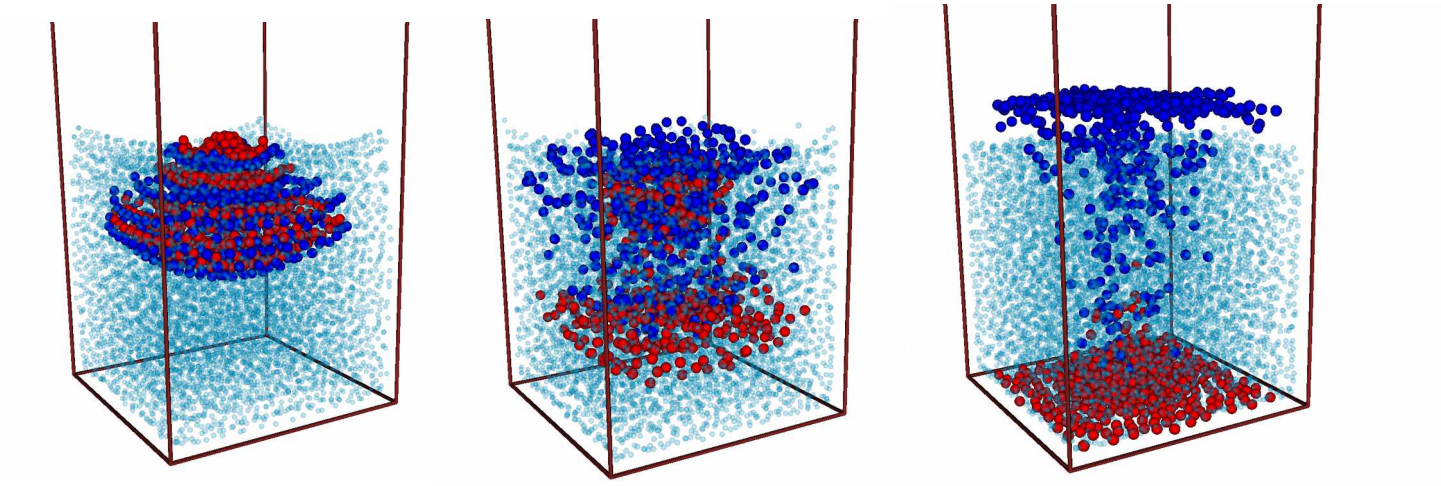


Settlement of the porous block

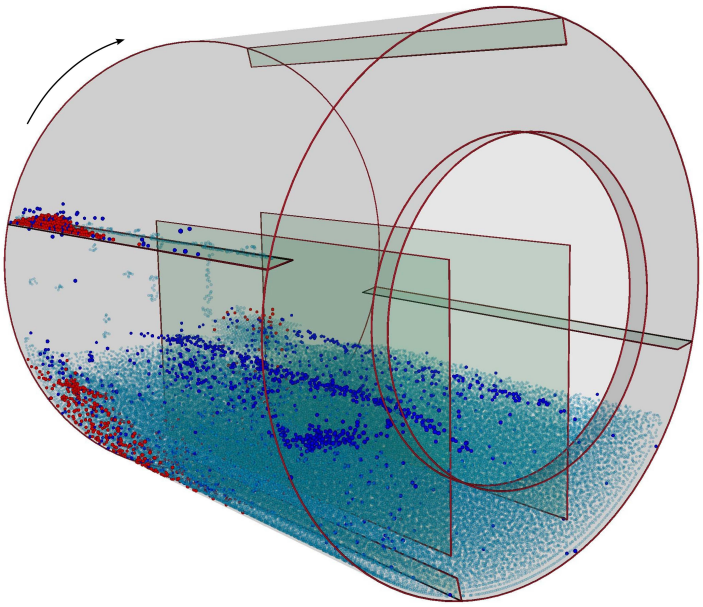





**Application of framework to the problem of particle sorting**



**Wet drum separation**



**Dissemination of the results**

1) Published paper in a journal:
D. Markauskas, H. Kruggel-Emden, R. Sivanesapillai, H. Steeb. Comparative study on mesh-based and mesh-less coupled CFD-DEM methods to model particle-laden flow. Powder Technology. 305 (2017) 78-88.

A version of the final peer-reviewed manuscript accepted for publication is available on arXiv.org: arxiv:1603.06808

2) Presentation of the results in the conference:
Talk: Numerical analysis of wet separation of particles by density differences. Presenter: D. Markauskas, Co-author: H. Kruggel-Emden. 14th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2016, 19-25 September 2016, Rhodes, Greece.

3) Accepted manuscript for publication in the conference proceedings:
D. Markauskas, H. Kruggel-Emden. Numerical analysis of wet separation of particles by density differences. Proceedings of 14th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM 2016, 19-25 September 2016, Rhodes, Greece, 4 p.

A version of the final peer-reviewed manuscript accepted for publication is available on arXiv.org: arxiv:1609.08421