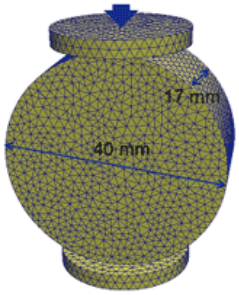
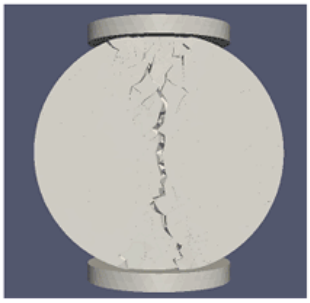
Numerical Simulation of Particle Stress and Fracture using FEMDEM: Application to Process Catalysts

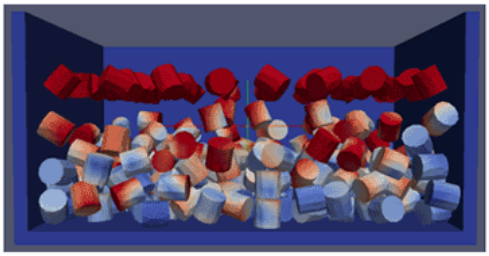
Johnson Matthey CASE/EPSRC PhD Studentship Award- Duration 36 months

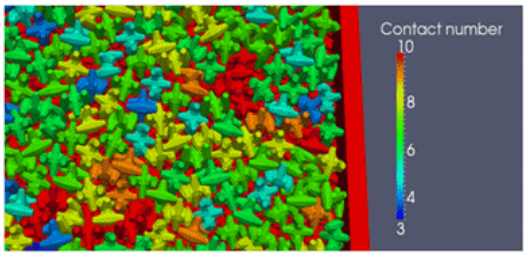




Supervision:
Dr JP Latham, Dr Jiansheng Xiang
Industry Contacts:
Principal Investigator - Dr Michele Marigo
Co-investigators - Dr Mikael Carlsson, Prof Hugh Stitt
Applications are invited for a PhD studentship to join AMCG (Applied Modelling and Computational Group) in the Department of Earth Science & Engineering.

Imperial College London (ICL), Earth Science and Engineering Department, has developed a 3D code based on the combined Finite-Discrete Element Method (FEMDEM), see VGeST.net. These codes allow not only particle flows to be simulated for moving particles (the DEM part) but they also allow detailed stress calculations to be undertaken on any complex particle shapes and complex structures (such as packed beds) by meshing the interior of the solid (the FEM part). This code therefore offers the prospect in the long term of simulating stresses and fracture during loading of cylindrical and other sophisticated shapes - such as might be developed and optimized for catalyst pellets in Johnson Matthey's production processes.





This studentship links JM's future needs with Imperial's excellence award winning AMCG research group. Implementing fracture in the 3D multi-body FEMDEM code that is capable of capturing packing processes with great accuracy is still very much a "work in progress" and this project will develop and validate certain aspects of the code that are relevant to JM's interests. For example, the research will reveal how force and stress chains form within packed beds or packed tubes and how different pellet shapes and strengths contribute to improved catalyst performance. The student will also have a unique opportunity to work at JM's laboratories on pellet preparation as well as strength and fracture studies to validate existing 2D models and support the development and validation of the 3D fracture models. The aim would be to compare laboratory measurements at JM with the equivalent FEMDEM models to examine particle stresses and fractures e.g. in a system with a small number of particles in a tubular container. The PhD may emphasise code developments or results interpretation or be a balance between the two.

The Candidate: Successful candidates will join, and be supported by, a dynamic research group with world-class expertise in modelling. The candidate will have the opportunity to develop their career and profile by presenting at international conferences in numerical and applied fields and publishing in high impact journals. Candidates should have a good mathematical background and a good degree/diploma in an appropriate field such as earth science, physics, mathematics, mechanical, civil or materials engineering. Experience of research relevant to the mechanics of fracture will be an advantage. Good written and spoken communication skills are essential. For further information please see our website: www.ese.ic.ac.uk. The project is funded by EPSRC and JMTC who require candidates to be UK/EU. Minimum Stipend for 2013 - 2016 is £16,000 per annum. **Application forms and instructions to send CVs, references etc can be obtained from our website using the 'Apply' button below or from Ms Samantha Delamaine (E-mail: sam.delamaine@imperial.ac.uk, Tel: +44 (0) 207 594 7339). Further information about the project can be obtained from John-Paul Latham (j.p.latham@imperial.ac.uk). Interviews are planned for May-June and applications are accepted until the post is filled. An early start date is preferred.**

Committed to equality and valuing diversity. We are also an Athena Bronze SWAN Award winner, a Stonewall Diversity Champion and a Two Ticks Employ.