Contribution ID: **765** Type: **Oral 20 Minutes**

A New High-fidelity Mesh Model for Simulation of Transport Process in a Fixed Bed Reactor

Wednesday, 16 May 2018 12:11 (15 minutes)

The traditional fixed-bed reactor design is ususally based on empirical correlations of plug flow pattern. This empirical method is usually not suitable for the low tube-to-particle diameter ratios (N=D/d< 4) where the local phenomena of channeling near the wall and the backflow in the bed are dominant. The recent "solid particle" method1 is too complicated for mesh generation, especially for large random packed beds, which seriously hinders its development. In this work, a novel mesh model is proposed and used for the simulation of fixed bed reactors by combining discrete element method with the user defined subroutine. The mesh generation process is simple and easy to be implemented, which ingeniously avoids handling the complex "contact point" problem. In this study the packed beds with spherical and cylindrical particles are investigated, the local flow in the bed can be high fidelity. The predictions of the pressure drop across the fixed bed and the heat transfer of the single particle are in good agreement with the corresponding empirical relations.

Acknowledgement
Financial support from the National Key Research and Development Program (2016YFB0301702), National Natural Science Foundation of China (21490584, 91534105, Major National Scientific Instrument Development Project (21427814) and Key Research Program of Frontier Sciences of CAS (QYZDJ-SSW-JSC030) is gratefully acknowledged.

References

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Session Classification: Parallel 7-A

Track Classification: MS 4.10: Evaluation and Optimization of Non-Conservative Transport in Porous Media