# Bridging from Pore to Continuum: A Hybrid Mortar Domain Decomposition Framework for Subsurface Flow and Transport

## Research Team

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## Objectives of Research

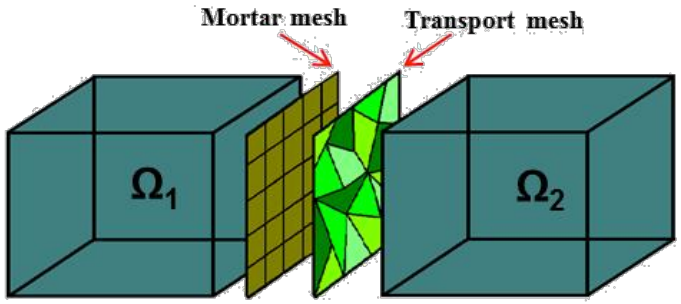
Develop a hybrid mortar domain decomposition framework for parallel modeling (linear and nonlinear) flow and transport across scales and in large pore-scale domains.

## Conclusions

- Efficient mortar methods were developed for coupling flow and transport
- Methods were shown to be much more efficient than solving the domain as a whole

## Impact on Geological Carbon Storage

New algorithms can be used to predict advective/diffusive/reactive transport across scales.



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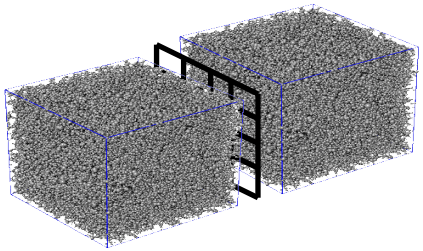
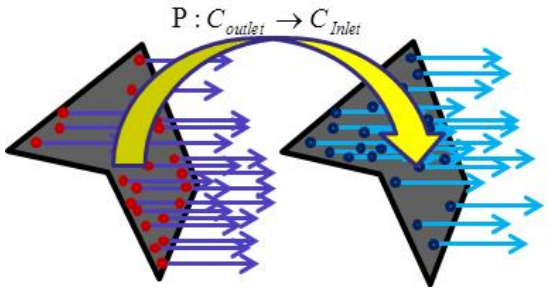
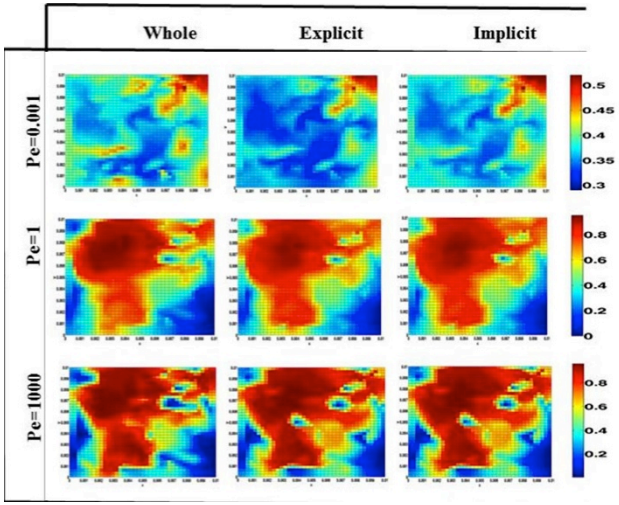
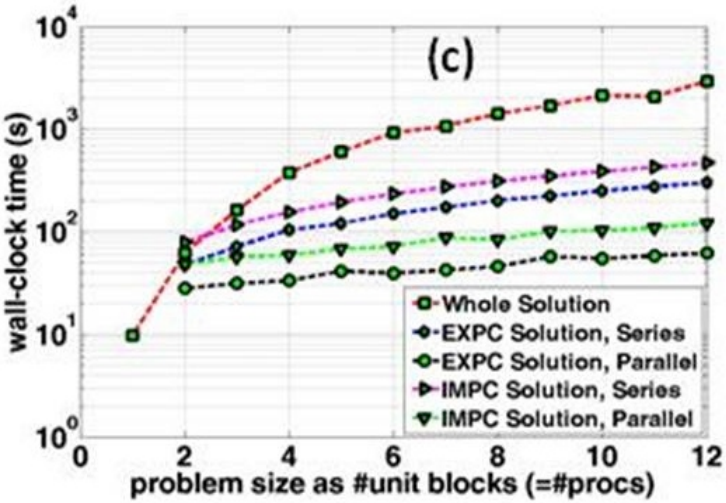





- Developed a “global mortar formulation” for flow and transport
- EXPC and IMPC scheme for coupling transport; EXPC faster and easier
- Concentration and pressure fields at interface match full solution well
- Domain decomposition much FASTER than solving full solution, even in series



# Pore-scale multiphysics model of chemical and mechanical processes at crack tips

## Research Team

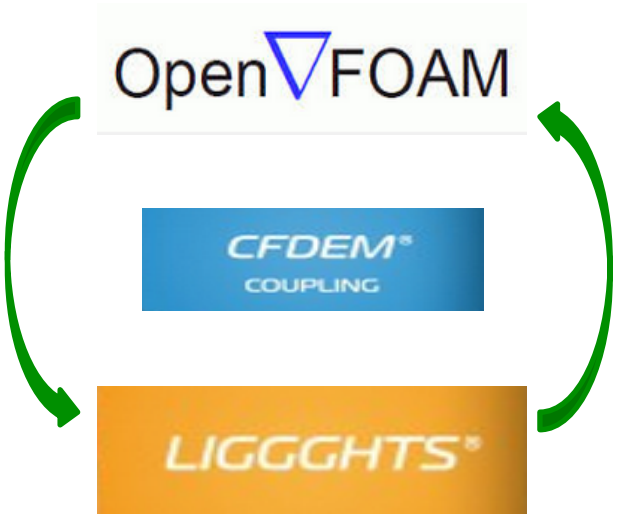
Zhuang Sun and Matthew Balhoff

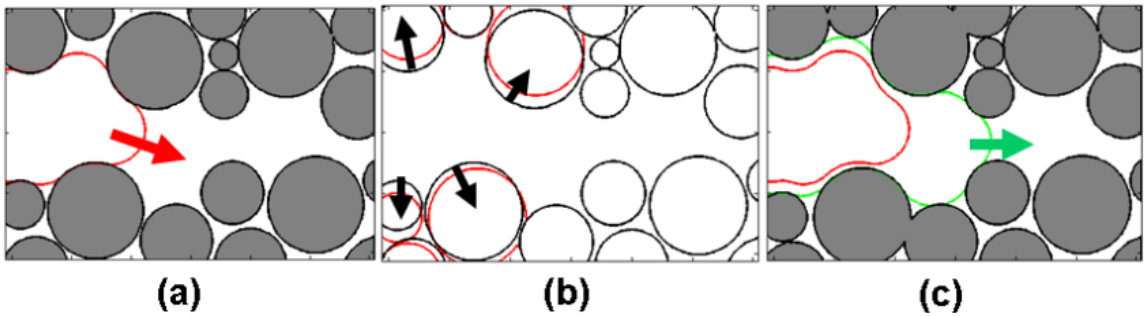
## Objectives of Research

Study the pore-scale mechanism of CO2 leakage via fracture tip during CO2 subsurface sequestration.

## Method

Couple OpenFOAM (CFD simulator) and LIGGGHTS (DEM based particle simulator) through CFDEM (Open source CFD-DEM engine).




2D coupling process on pore scale
(Prodanovic et al., 2012)