Contribution ID: **203**

Type: **Oral Presentation**

Prediction of Flow and Reactive Transport using Physics-Informed Neural Networks

Friday, 4 June 2021 10:40 (15 minutes)

Flow and reactive transport in fractured and porous media are fundamental to understanding coupled multiphysics processes critical to various geoscience and environmental applications such as geologic carbon storage, subsurface energy recovery, and environmental biogeochemical processes. Although fluid dynamics simulations provide fundamental solutions to flow and reactive transport processes, these computational simulations are often computationally intensive and would not be scalable to high dimensional applications. Deep learning can offer computationally efficient solutions to such problems while reliable neural network models require a large number of training samples. Physics-informed neural network approaches can provide machine learning solutions to physical systems respecting the laws of physics given by general nonlinear differential equations with a small number of training data, but training such networks require domain-specific expertise for better convergence. In this work, we apply hybrid physics informed neural networks and data augmentation to predict fluid flow in a constrained geometry. We test our models to evaluate various flow and reactive transport problems in 2D domains using the advection-diffusion(or dispersion)-reaction and Navier Stokes/Darcy equations. Additionally, we test flow and transport problems in the presence of an obstructing cylinder to analyze fluid velocity and concentration distribution from advection-diffusion-reaction. Comparison of results between the physics-informed deep learning approaches and computational simulations will be presented to highlight the accuracy of physics-informed neural networks and advance computational efficiency.
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Time Block Preference

Time Block C (18:00-21:00 CET)

References

No presentation on May 31st (Memorial Day in US)

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Student Poster Award

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