Contribution ID: **602** Type: **Oral Presentation**

Seepage Model of Conglomerate Based on Deep Neural Network and Finite Element-Discrete Element Coupling

Wednesday, 15 May 2024 14:30 (15 minutes)

When previous researchers reconstructed three-dimensional rock models based on two-dimensional images (cast thin sections, electron microscopy, CT slices), they usually modeled based on particle size distribution, replacing particles in the model with spheres. This method is suitable for rocks with good particle size sorting. However, the sorting of conglomerates is poor, the particle size of large particles and small particles differs by several orders of magnitude, which can easily cause large errors in calculations. At the same time, the particle morphology of conglomerates is also complex, and the impact of morphological features on permeability can no longer be ignored.

This paper proposes a method for reconstructing a seepage model based on a deep neural network and Finite Element-Discrete Element Coupling, targeting the influence of particle size distribution and particle morphology in conglomerates on permeability characteristics. The method is divided into three steps: (1) Use a deep neural network to perform semantic segmentation on two-dimensional images, dividing the image into large particle blocks, small particle blocks, and pores; (2) According to the particle size distribution and porosity of the small particle blocks, use the discrete element method for three-dimensional reconstruction, and combine CFD for seepage simulation; (3) According to the morphological features of the large particle blocks, convert them into finite element plane models, and couple them with the discrete element models to calculate the predicted permeability of the original two-dimensional image.

This paper compares the predicted permeability with physical experimental results and the classic Kozeny-Carman prediction equation, verifying the accuracy and superiority of the method in this paper. The main work and conclusions of this paper are: (1) The method in this paper can effectively consider the impact of particle shape on permeability characteristics and improve the prediction accuracy of permeability; (2) The method in this paper can make full use of the information of two-dimensional images, reducing experimental costs and calculation time; (3) The method in this paper has a certain universality and can be extended to other types of porous media.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

Country

China

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am not interested in having my paper published in the proceedings

Primary authors: YAN, Kang (Yangtze University); HAN, Denglin; WANG, Chenchen; MA, Binyu; SU, Miaomiao; ZHU, Chaobin

Presenter: YAN, Kang (Yangtze University)

Session Classification: MS06-A

Track Classification: (MS06-A) Physics of multiphase flow in diverse porous media