Contribution ID: **335** Type: **Poster (+) Presentation**

Modelling Multi-scale 3-D Digital Rocks by a New Image Segmentation Method

Wednesday, 2 June 2021 10:00 (1 hour)

Conventional digital rocks constructed by micro-CT with single resolution cannot identify entire pore space and mineral components of tight sandstones due to the multi-scale pores and high clay contents. The porosities of digital rocks are far less than those measured in lab, which results in the difference between measured petrophysical properties and calculated properties based on digital rocks. In this study, we proposed a method to construct multi-scale digital rocks by fusing 3-D images scanned via micro-CT at different resolutions. First, cylindrical tight sandstone samples with a diameter of 25.4mm were scanned at a resolution of 13.99μm to construct low-resolution 3-D grayscale images. Then, sub-plugs with a diameter of 5mm were drilled from the cylindrical simples and scanned by micro-CT at a resolution of 2.99μm to build high-resolution 3-D grayscale images. Furthermore, the two grayscale images were precisely registered using SIFT image registration method. In case of high-resolution images, watershed segmentation algorithm was applied to segment the cores into pores and minerals. The relationship curves between grayscale value and composition of the low-resolution grayscale images were established based on the registered region. A multi-scale digital rock was built from the low-resolution grayscale image after segmentation. The fine intragranular pores that cannot be resolved by the high-resolution images are acquired by board ion beam scanning electron microscope (BIB-SEM). The bulk porosities of multi-scale digital rocks agree well the helium porosity measured in lab. The effective elastic moduli of each voxel are determined by its mineral composition and fine structure. Given the effective bulk and shear moduli of each voxel, the elastic modulus of the rock can be calculated using the finite element method (FEM) based on the low-resolution digital rocks. The predicted elastic moduli match the measured results well. The numerical results show that the modeling method provides an accurate digital rock that can represent true tight sandstones in porosity and mineral components.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

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