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PET2OGS: Algorithms to link the static model of Petrel with the dynamic model of OpenGeoSys

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Abstract

A set of three algorithms named PET2OGS is developed to integrate the static model (Petrel) with the dynamic model (OpenGeoSys). PET2OGS consists of three sub-algorithms that convert finite difference methods (FDMs) grids to finite element methods (FEMs) grids. The algorithms and the workflow of the integration procedures are described in detail. After the proposed algorithms are tested on a variety of grids both in homogeneous and heterogeneous media, the integrated platform of the static and dynamic models is applied to model CO₂ storage in a saline aquifer. A successful demonstration of the proposed algorithms proved a robust integration of the platform. With some minor modifications of the algorithms in the part of input and output, the proposed algorithms can be extended to integrate different combinations of FDM-based static models and FEM-based dynamic models beyond the example combination in the paper.

Keywords:

FDM, FEM, Petrel, OpenGeoSys, static modeling, dynamic modeling, CO₂ storage

1. Introduction

Modeling of coupled processes in subsurface media has been a multidisciplinary work that combines the static nature of geology in geological time scales and the dynamic nature of human activities in relatively short time scales. Due to the difference in the time scales of geology and human activities, the former is termed as a static model while the latter is referred to as a dynamic model. In the static model of geology, we often attempt to

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