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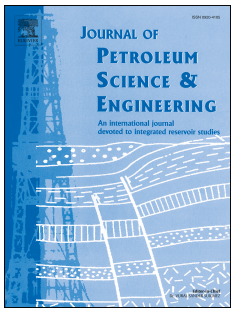

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Emulation of Reservoir Production Forecast Considering Variation in Petrophysical Properties

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Abstract

Implementation of proxy models, such as emulators might reduce the computational time required in a variety of reservoir simulation studies. By definition, an emulator uses reservoir properties as input parameters in a statistical model constructed from simulator outputs. However, incorporation of petrophysical properties distributions in all model grid-blocks implies too many input parameters for direct emulation. Currently, most employments of emulation only consider single-value parameterization of reservoir properties.

In this work, we propose a methodology to consider spatially-distributed properties, such as porosity and permeability, in reservoir emulation technique. First, we present the process of finding a procedure to deal with geostatistical realizations in the emulator and then implement it in a risk quantification application. Construction of an emulator in a probabilistic approach involved: selection of a base model, definition of uncertain inputs, selection of outputs to be emulated, sampling inputs to generate scenarios, simulation of scenarios, and building the emulator. As an application, we used emulators to generate risk curves at the final production time of a synthetic reservoir model.

By implementing the proposed procedure, we showed that emulators can provide reliable results during risk analysis in oilfield development. Furthermore, with emulators it is possible to generate risk curves that reproduce simulations results at a lower computational cost.

It can be expected that parameterization of petrophysical properties will boost the applicability of the reservoir emulation technique. For instance, emulators can significantly reduce both the time and computational resources demanded in various reservoir studies for high heterogeneity and complex reservoir models such as found in the Brazilian pre-salt area.

Keywords: Risk, Petrophysical uncertainty, Proxy model, Reservoir, Simulation.

1. Introduction

During the initial stage of oilfield development, as described by Schiozer et al. (2015), a reservoir characterization under uncertainties is required to build possible scenarios. Reservoir