Paper Number 49004
Title Gradual Deformation of Continuous Geostatistical Models for History Matching
Authors Roggero, F., Institut Francais du Petrole; Hu, L.Y., Institut Francais du Petrole
Source SPE Annual Technical Conference and Exhibition, 27-30 September, New Orleans, Louisiana

Copyright Copyright 1998, Society of Petroleum Engineers Inc.

Abstract

This paper presents a new methodology for constraining 3-D stochastic reservoir models to well and historical production data. Based on the inversion framework, this methodology is mainly composed of a new algorithm for gradually deforming continuous geostatistical models and of an efficient optimization algorithm. The gradual deformation algorithm generates a process of realizations which evolve smoothly while preserving the overall statistical characteristics of the stochastic model. Deformation control by a limited number of parameters improves the efficiency of the process. In comparison with other approaches, the number of iterations is significantly reduced.

The deformation procedure can be coupled with an optimization algorithm to obtain automatic history matching capability. The inversion of several model parameters and the gradual selection of a new constrained realization can be performed simultaneously. The analytical gradient method as well as approximated gradients are used to improve the convergence rate of the procedure.

The successful application to a 3-D synthetic case, derived from an actual field case, is described in the paper. The shape of the top structure of the reservoir and the activity coefficient of an aquifer are simultaneously constrained to the historical data recorded for 5 wells. The structural uncertainties are described by a geostatistical model. The definition of the top structure is improved by gradual deformation to ensure the geostatistical consistency of the model during the match of production data. An interference well test case is also presented to illustrate the decrease in uncertainties obtained by integrating a geological description and pressure data.