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# Time-explicit methods for joint economical and geological risk mitigation in production optimization - DTU Orbit (08/11/2017)

**Time-explicit methods for joint economical and geological risk mitigation in production optimization**

Real-life applications of production optimization face challenges of risks related to unpredictable fluctuations in oil prices and sparse geological data. Consequently, operating companies are reluctant to adopt model-based production optimization into their operations. Conventional production optimization methods focus on mitigation of geological risks related to the long-term net present value (NPV). A major drawback of such methods is that the time-dependent and exceedingly growing uncertainty of oil prices implies that long-term predictions become highly unreliable. Conventional methods therefore leave the oil production subject to substantial economical risk. To address this challenge, this paper introduces a novel set of time-explicit (TE) methods, which combine ideas of multi-objective optimization and ensemble-based risk mitigation into a computationally tractable joint effort of mitigating economical and geological risks. As opposed to conventional strategies that focus on a single long-term objective, TE methods seek to reduce risks and promote returns over the entire reservoir life by optimization of a given ensemble-based geological risk measure over time. By explicit involvement of time, economical risks are implicitly addressed by balancing short-term and long-term objectives throughout the reservoir life. Open-loop simulations of a two-phase synthetic reservoir demonstrate that TE methods may significantly improve short-term risk measures such as expected return, standard deviation and conditional value-at-risk compared to nominal, robust and mean-variance optimization. The gains in short-term objectives are obtained with none or only slight deterioration of long-term objectives.

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