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Real Time Model Identification Using Multi-Fidelity Models in Managed Pressure Drilling

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Abstract

Highly accurate model predictions contribute to the performance and stability of model predictive control. However, high fidelity models are difficult to implement in real time control due to the large and often nonconvex optimization problem that must be completed within the feedback cycle time. To address this issue, a switched control scheme that uses high fidelity model predictions in real time control is presented. It uses real time simulated data to identify a linear empirical control model. The real time model identification procedure does not interrupt the process, and is suitable for nonlinear processes where offline model identification is difficult. Controller stability is discussed, and the control scheme is demonstrated in a managed pressure drilling simulation. The switched controller provides improved performance over both a high fidelity model based controller and a nonadaptive empirical model.

Keywords: drilling automation, nonlinear model predictive control,

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