



OUTPUT FEEDBACK CONTROL FOR MITIGATION OF NEGATIVE DAMPING EFFECTS IN THE DRILLING PROCESS

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Abstract.

Failures during oil extraction can have impacts on exploration costs and time, especially those caused by vibrations during the drilling phase. A proper way to reduce these detrimental failures is to design an active controller that efficiently mitigates vibrations with the constraint of using the limited amount of data available in field operations. This paper aims to propose a novel control technique that uses a simple linear combination of measured signals and aims to counterbalance negative damping effects at the drill bit. The proposed controller is applied to a representative drill string model, modeled using the finite element method with non-regularized dry friction. The particular aspects regarding the application of the proposed controller for the drill string problem, i.e., reformulation of the equations of motion, determination of the output matrix and linearization are addressed. Simulations indicate that the proposed controller presents remarkable robustness regarding parameter variations while still maintaining good nominal performance.

Keywords: Drill string vibrations. Stick-slip. Negative damping. Output feedback. Active control.