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Title:

Stability and control of penetration rate and pressure in rotary drilling system

Abstract:

The main idea of this work is to study the annular pressure profile throughout the well bore continuously while drilling. A new nonlinear dynamical system is developed and a controller is designed to stabilize the penetration rate and pressure, consequently achieve asymptotic tracking by applying feedback control of the main pumps. Hence, the work studies the control design for the well known Managed Pressure Drilling system (MPD). MPD provides a closed loop drilling process in which pore pressure, formation fracture pressure, and bottomhole pressure are balanced and managed at surface. Although, responses must provide a solution for critical downhole pressures to preserve drilling efficiency and safety. Our MPD scheme is elaborated in reference to a nontrivial backstepping control procedure, and the effectiveness of the proposed control laws is shown by simulations.