Robust Backlash Estimation for Industrial Drive-Train Systems—Theory and Validation - DTU Orbit (19/10/2019)

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Backlash compensation is used in modern machinetool controls to ensure high-accuracy positioning. When wear of a machine causes deadzone width to increase, high-accuracy control may be maintained if the deadzone is accurately estimated. Deadzone estimation is also an important parameter to indicate the level of wear in a machine transmission, and tracking its development is essential for condition-based maintenance. This paper addresses the backlash estimation problem using sliding-mode and adaptive estimation principles and shows that prognosis of the development of wear is possible in both theory and practice. This paper provides the proof of asymptotic convergence of the suggested estimator, and it shows how position offset between motor and load is efficiently utilized in the design of a very efficient estimator.

The algorithm is experimentally tested on a drive-train system with the state-of-the-art Siemens equipment. The experiments validate the theory and show that expected performance and robustness to parameter uncertainties are both achieved.

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