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Abstract

In this research, disturbances in a product of inertia measurement system (POI-MS) are investigated theoretically and experimentally. These disturbances mainly originate from some various mechanical or electrical sources including fluctuations of transmission system (belt-pulley mechanism oscillation), electro-motor non-continuous power generation (electro-motor speed fluctuation) and also misalignment of the rotor system (unbalancing). Knowing sensitivity of the measurement system performance to the mentioned factors will help the designer to eliminate disturbances and increase accuracy of the system. In this study, at first, disturbances in the measured transmitted force of POI-MS is investigated by performing some experiments. In order to reduce time and cost, more disturbance analyses are performed via simulations. In this regard, a dynamic model of POI-MS is developed in MSc. Adams software. This model includes nonlinear stiffness of the air bearings and flexibilities of the belt-pulley system. Then, effect of possible disturbance sources including belt flexibilities, speed fluctuations of electro-motor and unbalances in rotating parts on the performance of the POI-MS is investigated. Finally, some solutions are presented to eliminate disturbances in POI-MS and improve its accuracy.

Keywords: Disturbance Analysis, Product of Inertia Measurement, Spin Balance Machine, MSc. Adams