

Application of Modal Analysis for Commissioning of a Ball Screw System

Authors : T. D. Tran, H. Schlegel, R. Neugebauer

Abstract : Ball screws are an important component in machine tools. In mechatronic systems and machine tools, a ball screw has to work usually at a high speed. Otherwise the axial compliance of the ball screw, in combination with the inertia of the slide, the motor, the coupling and the screw, will cause an oscillation resonance, which limits the systems bandwidth and consequently influences performance of the motion controller. In this paper, the modal analysis method by measuring and analysing the vibrating parameters of the ball screw system to determine the dynamic characteristic of existing structures is used. On the one hand, the results of this study were obtained by the theoretical analysis and the modal testing of a ball screw system test station with the help of an impact hammer, respectively using excitation by motor. The experimental study showed oscillating forms of the ball screw for each frequency and obtained eigenfrequencies of the ball screw system. On the other hand, in this research a simulation with the help of the numerical modal analysis in order to analyse the oscillation and to find the eigenfrequencies of the ball screw system is used. Furthermore, the model order reduction by modal reduction and also according to Guyan is carried out. On the basis of these results a secure and also rapid commissioning of the control loops with regard to operating in their optimal function is targeted.

Keywords : modal analysis, ball screw, controller system, machine tools

Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development

Conference Location : Chicago, United States

Conference Dates : December 12-13, 2020