

Dynamic Response Analysis of Linear Motion Stage with Track Roller Guides

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Abstract

This paper aims at characterizing the role of preload, friction and mass on the dynamic response of the linear motion stage used in the laser marking machine for black granite. A single-axis linear motion stage model was realized in Creo Parametric® CAE software. The mechanism design option was used to create a virtual mechanism with simulation entities for stiffness, friction, mass, damping, and motors. The experimental design was accomplished using Minitab® software to create the Taguchi orthogonal array. The simulation experiments with different values of preload, friction, and mass were conducted. The results show that increasing the linear bearing preload reduced the settling time. Increased elastic deformation increased bearing rigidity, which ultimately helped reduce vibrations and hence settling time. Furthermore, lower levels of friction reduced sticking and slipping, which led to reduced vibration levels and therefore a lower settling time.

Keywords: Linear Motion Stage, Dynamic Response, Settling Time, Linear Bearing, Track Roller Guides, Creo Parametric CAE Software, Minitab Software.