Analysis of the Stiffness of Linear Guideways and the Cross Section Design

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ABSTRACT

This study was concentrated on the stiffness analysis of linear guideways. Finite element models for various guideways were built. Under prescribed loading conditions, the numerical results of deformation based on simulations were compared to those calculated using empirical formulae. The stiffness at the interfaces modeled by 2-D springs were then accordingly adjusted to meet the calculated empirical data, so that the numerical results of simulations can be as close as possible to the real conditions. As for the part of cross section design of guideways, the widths of them were taken as the design variables. Using the same loading conditions, the results of analyses based on different widths were compared, and suggestions for the design of such guideways were provided. Under the conditions of constant lengths of the sliders, it shows that the deformations for the cases of steel balls of different diameters are almost the same. Such results seem reasonable, because a large ball has larger stiffness compared to one that is smaller in size. This point reveals that the diameters of steel balls at the interfaces are not the major concern in design. The study also shows that the width of a guideway does not matter too much. Therefore, it is suggested that design should be directed to the investigation concerning the influence of contact angles at the interfaces of guideways and sliders.

Keywords : Linear guideways; Stiffness; Finite element analysis

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