

Design Optimization Method of Machine Tool Pedestal Structures

Xiaohong Ding¹, Heng Zhang¹, and Xiaohu Dong¹

¹ School of Mechanical Engineering, University of Shanghai for Science and Technology

Abstract

Machine tool pedestal structures include bed structure, stand column, and so on, which support functional parts of machine tool, thus their mechanical performance is very important to the cutting precision and cutting efficiency of machine tool. However, they are usually share a heavy ratio of material usage of the equipment. Therefore, design optimization is necessary for machine tool pedestal structures to obtain an optimal balance of mechanical performance and economic efficiency. Some key issues related to design optimization method of machine tool pedestal structures are studied in detail in this paper, which are the accurate FEM model construction, design objective related to the cutting precision and cutting efficiency and layout design optimization method of inner stiffener plates and supporting blocks. Especially, a layout design optimization method based on the growth mechanism of branch systems in nature is suggested to design the inner stiffener plate layout. A typical bed structure of a kind of cylindrical grinding machine is studied as an example, and the result show that the stiffness of the optimal structure is improved greatly, while the weight of structure is decreased by 24.48%, by compared with the traditional design structure. A 3D printed model experiment is also implemented to verify the design result.