

## Study on Dynamic Stiffness Matching and Optimization Design Method of a Machine Tool

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**Abstract :** The stiffness of each component has different influences on the stiffness of the machine tool. Taking the five-axis gantry machining center as an example, we made the modal analysis of the machine tool, followed by raising and lowering the stiffness of the pillar, slide plate, beam, ram and saddle so as to study the stiffness matching among these components on the standard of whether the stiffness of the modified machine tool changes more than 50% relative to the stiffness of the original machine tool. The structural optimization of the machine tool can be realized by changing the stiffness of the components whose stiffness is mismatched. For example, the stiffness of the beam is mismatching. The natural frequencies of the first six orders of the beam increased by 7.70%, 0.38%, 6.82%, 7.96%, 18.72% and 23.13%, with the weight increased by 28Kg, leading to the natural frequencies of several orders which had a great influence on the dynamic performance of the whole machine increased by 1.44%, 0.43%, 0.065%, which verified the correctness of the optimization method based on stiffness matching proposed in this paper.

**Keywords :** machine tool, optimization, modal analysis, stiffness matching

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