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Development of constrained layer damping toolholder to improve chatter stability in end milling

Yang Liu [a,b], Zhanqiang Liu [a,b,*], Qinghua Song [a,b], Bing Wang [a,b]

[a] *School of Mechanical Engineering, Shandong University, Jinan 250061, China,*

[b]*Key Laboratory of High Efficiency and Clean Mechanical Manufacture (Shandong University), Ministry of Education, P. R. China*)

[*]Corresponding author, Tel.: 86-531-88393206, Fax: 86-531-88392045,

melius@sdu.edu.cn

Abstract

The chatter occurs during milling operation when the axial depth of cut is too large and/or the spindle speed approaches one of natural frequencies of the machining system. The critical axial depth of cut and stable spindle speed ranges for chatter occurrence are influenced by dynamic stiffness and natural frequency of the milling toolholder. In this work, a novel constrained layer damping toolholder was developed to increase chatter stability of end milling operation. Firstly, optimum design geometrical parameters were analytically solved with respect to optimum damping and constraining layer materials. Then the developed damping toolholder was manufactured. Lastly, modal tests and cutting experiments were carried out to verify the effectiveness of chatter suppression with the developed damping toolholder. The frequency response, cutting forces and machined surface quality were measured and compared. It is found that the dynamic stiffness and critical axial depth of cut for the