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An integrated CNC system for chatter suppression in turning

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ABSTRACT

Self-excited chatter vibrations are one of factors affecting the reduction of cutting efficiency, especially while machining highly compliant machine parts. Their occurrence can be limited by the proper technological parameters selection. These parameters can be determined by analysing the cutting process stability, which requires knowledge of the machine-tool-workpiece system dynamic properties. Normally, these properties are determined experimentally, which is troublesome in industrial practice. This article presents a method in which dynamic properties are calculated by single-board computer integrated with a Computer Numerical Control (CNC) system, with no need to carry out additional experimental tests. It is possible with the receptance coupling approach which allows for obtaining the workpiece geometry by analyzing the machining program and then determining the machine tool – workpiece system dynamic properties. These properties are the input to the presented algorithm that facilitates the selection of cutting parameters enabling stable turning of highly compliant machine parts. The presented system is dedicated to turning but can also be adapted to determine the stability of milling with flexible tools.

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Izvirni znanstveni članek

Integriran CNC sistem za zatiranje resonančnih vibracij pri struženju

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POVZETEK

Samovzbujajoče se resonančne vibracije so eden od dejavnikov, ki vplivajo na zmanjšanje učinkovitosti rezanja, zlasti pri obdelavi visoko natančnih izdelkov. Njihov pojav lahko omejimo s pravilno izbiro tehnoloških parametrov. Te parametre je mogoče določiti z analizo stabilnosti rezalnega procesa, kar zahteva poznavanje dinamičnih lastnosti sistema stroj-orodje-obdelovanec. Običajno se te lastnosti določijo eksperimentalno, kar je v industrijski praksi težavno. Ta članek predstavlja metodo, pri kateri se dinamične lastnosti izračunajo z računalnikom, ki je integriran s sistemom za računalniško numerično krmiljenje (CNC), brez potrebe po izvedbi dodatnih preizkusov. Določitev dinamičnih lastnosti sistema stroj-obdelovanec se izvede s posebnim pristopom, ki omogoča pridobitev geometrije obdelovanca z analizo obdelovalnega programa. Te lastnosti so vhod v predstavljeni algoritem, ki olajša izbiro rezalnih parametrov, ki omogočajo stabilno struženje visoko natančnih izdelkov. Predstavljeni sistem je namenjen struženju, lahko pa ga prilagodimo tudi za ugotavljanje stabilnosti rezkanja s prilagodljivimi orodji.

PODATKI O ČLANKU

Ključne besede:
Računalniško numerično krmiljenje (CNC);
Resonančne vibracije pri obdelavi;
Vibracije;
Analiza stabilnosti;
Vreteno obdelovalnega stroja;
Rezalni parametri;
Struženje

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