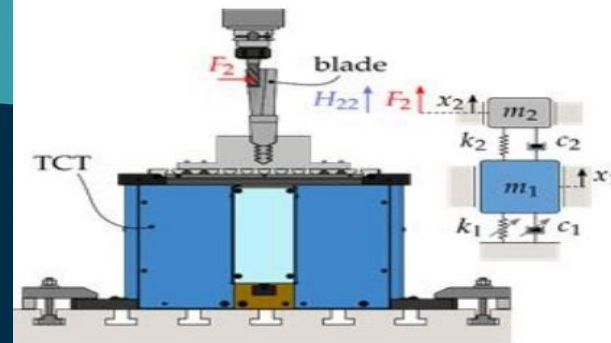
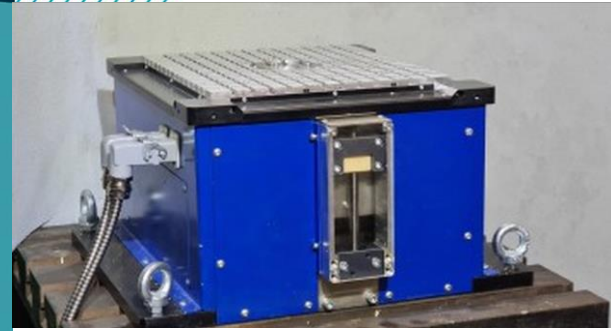


TUNEABLE CLAMPING TABLE

CHATTER SUPPRESSION METHOD FOR THE MANUFACTURING OF THIN-WALLED PRODUCTS



Milling operations on thin-walled fan, compressor and turbine blades are complicated by static deflections and the occurrence of regenerative, high-amplitude vibration (chatter). The low stiffness and damping properties of the thin-walled blades promote the onset of chatter which may damage both the product and the machine tool. In the event of a tool breakage, in most cases the tool gets stuck in the workpiece, which then can lead to the total loss of a rather costly semi-finished product.

SOLUTION

BME's tuneable clamping table provides a blade clamping solution to mitigate chatter vibrations with a universal clamping system and minimal interference with the cutting process. It is implemented in a semi-active form. The controlled mode is a dominant translational mode with a fixed moving mass guided by flexures with stiffness. The table features a rotary spring with unequal stiffness characteristics in its two main directions, driven by a motor-encoder assembly. This permits the external modification of the stiffness of the device via the angular position of the spring. Viscous damping is provided by the eddy current damping modules under the table, whose damping level can be adjusted by modifying the immersion of the conductive plates inside the magnetic field created by permanent magnets.

TRL 5 Breadboard validation in relevant environment

SEEKING

one or more industry partners for licensing or transfer of rights.

BENEFITS

- Universal clamping solution for a wide set of blade geometries
- Minimal interference with the cutting process
- Larger stable region can be achieved during manufacturing process with the right tuning
- Lower amplitude vibrations in milling

APPLICATION

- Manufacturing and repairing of fan, compressor, and turbine blades
- Manufacturing of thin-walled parts

PUBLICATIONS

J. Munoa, M. Sanz-Calle, Z. Dombovari, A. Iglesias, J. Pena-Barrio, G. Stepan, "Tuneable Clamping Table for Chatter Avoidance in Thin-walled Part Milling", CIRP Annals vol. 69, no. 1, pp. 313-316, Elsevier, 2020. M. Sanz-Calle, Z. Dombovari, J. Munoa, A. Iglesias, L. Norberto López de Lacalle, "Self-Tuning Algorithm for Tuneable Clamping Table for Chatter Suppression in Blade Recontouring", Applied Sciences vol. 11, no. 6, article 2569, MDPI, 2021.

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INTELLECTUAL PROPERTY

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