

## FORTH: FORCE-CONTROLLED TOOL HOLDER FOR VIBRATION-LESS, ACCURATE AND CHIP JAMMING-FREE INTERNAL TURNING

### OBJECTIVES

The FORTH project aims at developing a mechatronic tool holder to provide a solution to the three problems that currently limit machining quality and/or productivity in turning operations :

- Active damping vibration suppression,
- Tool deformation,
- Chip jamming.

### APPLICATIONS

Internal turning includes boring, bottle boring and trepanning operations performed in lathes to accurately create or enlarge a hole in a part. Internal turning is used in the manufacturing of a huge range of different parts in sectors such as aerospace, oil and gas, energy generation, automotive, naval, paper, and construction machinery.

### FRAMEWORK

Within the framework of the FORTH project, CEDRAT TECHNOLOGIES is involved in several key tasks :

- Determination of the specifications of the actuators and sensors by test results analyses performed on a  $\varnothing 32\text{mm}$  and  $\varnothing 50\text{mm}$  boring bars in terms of :
  - » Dynamic force,
  - » Accelerations,
  - » Current and voltage,
  - » Bandwidth.
- Modeling of the system dynamics (boring bar and proof-mass actuator) and optimization of the closed loop response,
- Development and trade-off of several solutions for active damping,
- Design of two types of piezo actuators for active damping in boring bars  $\varnothing 32\text{mm}$ ,

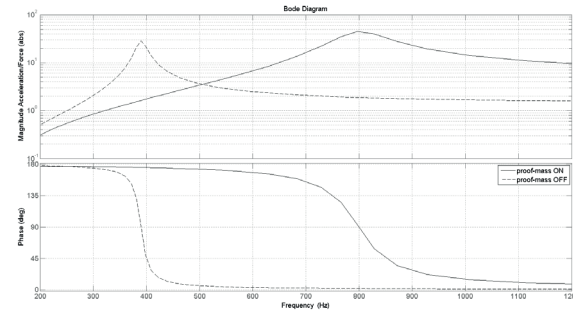


Fig. 1: Modeling of the impact of a proof-mass system on the boring bar response – Bode diagram of the acceleration at the tip of the boring bar versus the cutting force with a proof-mass active damper on or off

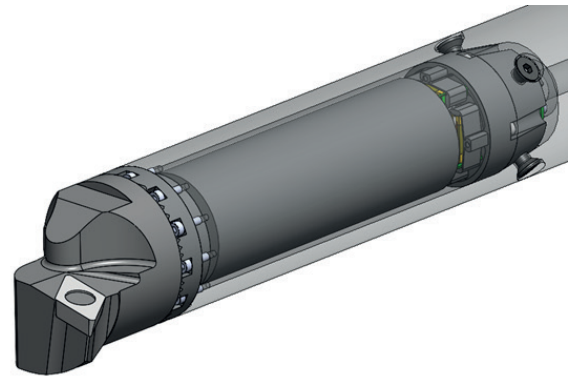


Fig. 2: Boring bar  $\varnothing 32\text{mm}$  equipped with a PM35XS proof mass piezo actuator

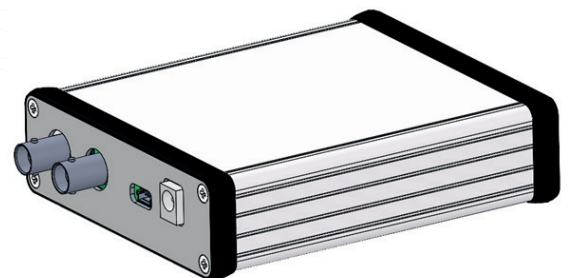


Fig. 3: Electronic box for signal conditioning

- Design of a dedicated PCB (Printed Circuit Board) for acceleration measurements at the level of the actuator,
- Design of dedicated PCBs for signal conditioning,
- Manufacturing of a dedicated electronic rack with integrated controller and driver,
- Mounting and factory verification of the piezo actuators,
- Tests of the active boring bar (equipped with the piezo actuators) in real conditions (machining operations) and performances analyses.

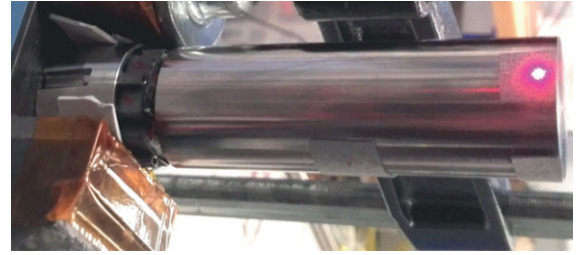


Fig. 4: Piezo actuators factory verification using laser instrument

### PARTNERS INVOLVED :

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