MECHANICAL ENGINEERING

BYTEST S.R.L. - Design of industrial systems for standard testing of structures and materials

Funded By	BYTEST S.R.L. [P.iva/CF:05102770012]
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Context of the research activity	Machine design applied to the development of industrial systems for destructive and non-destructive testing of materials and structures. These machines are specifically designed and manufactured to meet particular testing requirements, for example in radiography, X-ray, optical inspection, impact, or tensile testing. The research activity will focus on the design, analytical modeling, and numerical simulation of machines used for standard qualification and testing. The study will consider multi-physical interactions between structures and fluids. In addition, control algorithms aimed at improving the dynamic stability of the systems will be investigated. Experimental testing and validation will be carried out in an industrial environment under real operating conditions.
Objectives	This research is financed by the company Bytest, which is fully owned by the multinational TUV-SUD, global leader in the sector of qualification and standardization of materials, products, special processes in any field of production. The PhD research focuses on the design and development of industrial machines and systems intended for material testing applications. These systems are engineered by the company to meet specific functional and performance requirements defined by international standards in the qualification of industrial processes. The research project aims to investigate the dynamic behavior of such mechanical systems, which are often subject to uncertainties, disturbances, and variable operating conditions. The objective is to develop robust control strategies capable of ensuring stability and high performance under these challenging conditions. The methodological approach will include modeling, simulation, and experimental validation of complex mechanical systems. Particular attention will be given to the development and validation of numerical models and

	control algorithms designed to address issues of instability and vibration. The use of frequency-domain analysis tools, in combination with optimal and predictive control techniques, will enable the exploration of efficient and innovative control solutions. The ultimate goal is to ensure that the developed methodologies are transferable to real industrial applications.

Skills and competencies for the development of the activity	Mechanical design methods: static/dynamic modeling of m-k-c systems, analytical modeling of multi-d.o.f. systems, mechanics of vibrations. Mechanical behavior of materials. Fundamentals of numerical modeling.