



Pole for Doctoral Studies  
Center for Doctoral Studies Sciences, Technologies, and Medical Sciences

## ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE



**Ms. JABRI Fatima-Ezzahrae**

**Will present their research work with the aim of earning a  
Doctorate**

**Doctoral program: Engineering Sciences and Techniques  
Discipline: Engineering Sciences and Techniques  
Specialty: Mechanical Engineering**

**On 03/01/2026 at 11H00 at the Conference Hall, the National  
School of Applied Sciences of Tangier, UAE  
Under the Theme**

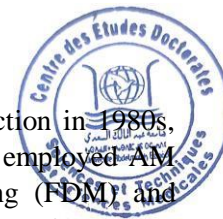
**Process Parameter Optimization in SLS and Non-Destructive  
Defect Detection in FDM: An Integrated Approach to Polymer 3D  
Printing Quality Assurance**

**Front of the jury composed of :**

First Name & Last Name	Establishment	Designation
Pr. BOUMANE Abderrazak	ENSA of Tangier, UAE	President
Pr. SARSRI Driss	ENSA of Tangier, UAE	Reviewer
Pr. BOUAJAJ Adel	ENSA of Tangier, UAE	Reviewer
Pr. AIT TALEB Abdelmajid	ENSAM of Meknes, UMI	Reviewer
Pr. LASRI Larbi	ENSAM of Meknes, UMI	Examiner
Pr. BEN SAID AMRANI Nabil	ENSA of Tangier, UAE	Examiner
Dr. DEMARBAIX Anthonin	HEPH-Condorcet Charleroi, Belgium	Guest
Pr. EL ALAJI Rachid	ENSA of Tangier, UAE	Supervisor

*Host Research Structure:* Laboratory of Innovative Technologies (LTI), National School of Applied Sciences (ENSA TANGIER)

## Abstract



Additive manufacturing (AM) has gained growing attention since its introduction in 1980s, moving from prototyping toward the fabrication of functional parts. The most widely employed AM technology for the production of polymeric materials is fused deposition modeling (FDM) and selective laser sintering (SLS). These two technologies enable the manufacturing of complex geometries, but differ in energy input, material feedstock and achievable performance of the printed components. Besides, SLS and FDM are continuously advancing with industrial developments to match the recent and developed specification. In spite of technological progress in both processes, difficulties persist in manufacturing parts that meet strict quality requirements.

In this regard, SLS parts try to prevent weak dimensional accuracy, poor surface finish, incomplete densification and voids and reduced mechanical strength.

However, the uncontrolled process parameters are the main cause of quality characteristics introduction, so any variation of these parameters prone to weak performance of 3D printed parts. This necessitates systematic research to optimize the SLS process for improved part performance by investigating the effect of unexplored parameters (print surface bed temperature and powder heating temperature) that impact structural integrity. It is also a question of understanding how process variables affect the moisture content of 3D parts in order to fill a gap that has not yet been filled in the SLS field. FDM, on the other hand, suffer from introduced internal defects during printing and this limit the performance of polymer components. Despite extensive research on FDM parameter optimization, the understanding of the dynamic behavior of FDM parts containing internal defects remains limited. This necessitates a systematical application of non-destructive characterization methods for defect analysis to deeply understand the impact of defect size and position on the dynamic mode responses.

The specific objectives of this research include identifying conventional and unexplored parameters in SLS that impact structural integrity (dimensional accuracy, surface roughness, porosity, humidity content and compression properties). As well as, analyzing the behavior of FDM parts with defects located at neutral bending line through vibrational and acoustic responses. In terms of SLS analysis, laser power ratio and print bed surface temperature were identified as the dominant parameters influencing the physical properties, dimensional accuracy, compressive behavior, moisture content, and surface quality of the printed specimens. Layer height also exhibited a measurable effect on surface quality.

Although its effect is intricate, powder heating temperature shows only a minor overall impact on process–quality relationships. Regarding the FDM results, the amplitude and peak frequency are both lower and stronger for the non-defective samples for both detectors. Acoustic detectors mainly quantify defect position and amplitude, whereas vibration-based detection offers enhanced capability for identifying localized reinforcement and delamination. These results provide guidelines for parameter optimization, defect characterization, and process monitoring, thereby contributing to greater reliability of polymer components for industrial applications.

**Keywords:** *Additive manufacturing, Selective laser sintering, Process parameters, Surface roughness, Dimensional accuracy, Compression properties, Porosity, Density, Humidity content, Fused deposition modeling, Defect characterization, Non-destructive technique, Impulse excitation, Bending mode, Polyamide and Fast Fourier Transform.*

