



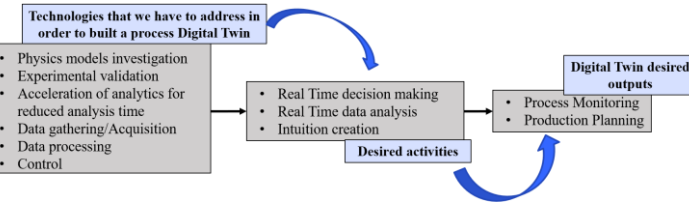
Abstract

The current Diploma thesis focuses on the integration of theoretical and empirical process models on a software platform that act as a Digital Twin of the FDM process. The software platform undertakes the production scheduling as well as aims to optimize the process performance and efficiency. During this work, several theoretical models have been investigated. The selected models calculate the Build Time, the Energy Consumption as well as the Extrusion Forces. These models have been implemented on MATLAB. Apart from the theoretical process models, an experimental work has been done in order to study how the different process parameters affect the product quality and the process efficiency. A monitoring system has been integrated in order to find out how the process parameters affect performance indicators such as energy consumption, surface roughness and dimensional accuracy. The acquired knowledge is going to be integrated on a platform that undertakes the production planning and ERP scheduling.

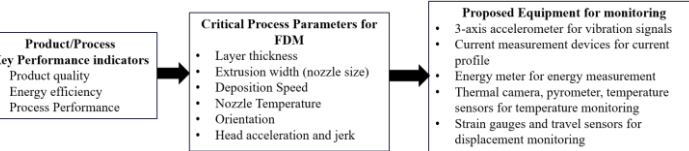
Diploma Thesis Goals

- Brief Description of AM processes, critical process parameters and post processing
- FDM process monitoring
- Development of a software platform that can act as a Digital Twin
- Integration of FDM theoretical /empirical models
- Connection to production and EPR scheduler

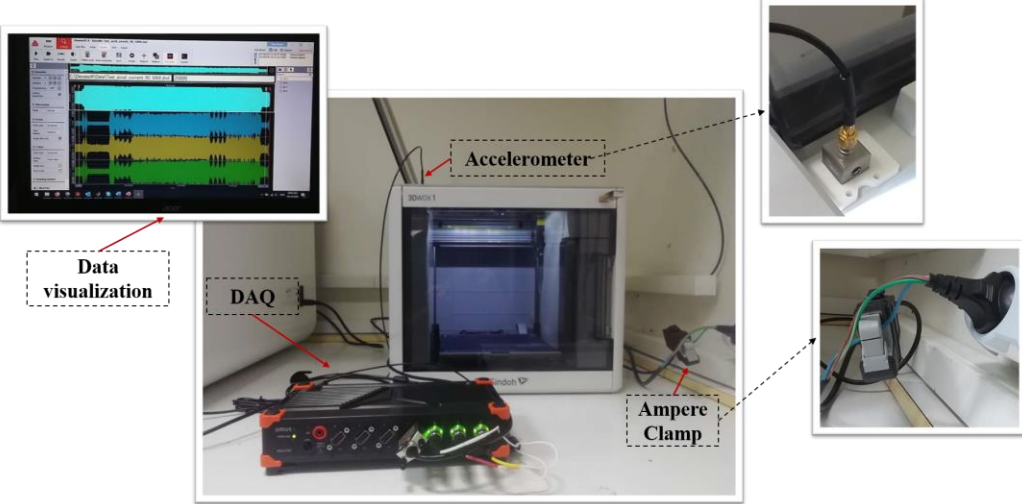
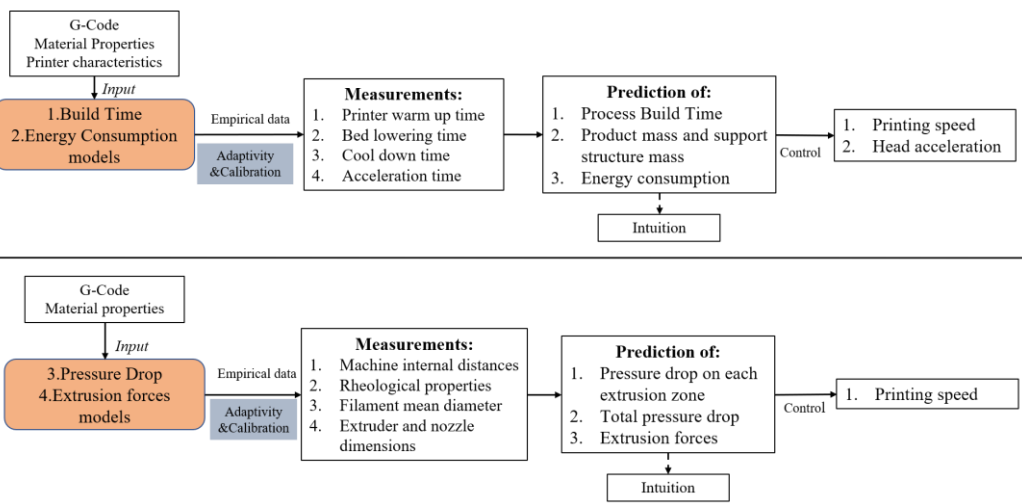
Digital Twin Involved Technologies



FDM Process Monitoring



FDM Theoretical Models Integration



FDM: Integration of Empirical models and connection to production planning

- Step by step guide for the proper set up of the printer as well as guidelines for the initialization of the experimental work in order to take meaningful results.
- Description of the experimental set up and the monitoring system
- Detailed analysis of the design of experiment procedure.
- Presentation of the results and discussion. Correlation between the process parameters (acceleration, printing speed, orientation and layer height) with the surface quality (roughness), energy consumption (efficiency) and dimensional accuracy.
- Development of a software that can act as a Digital Twin in order to undertake the production planning based on the integrated theoretical and empirical process models.

