

Internship Master

An Evaluation Framework for Process Modeling Languages: An Extension Incorporating the Flexibility, Resilience, and Trustworthiness of Industrial Processes

Advisors

- Luis Gustavo NARDIN (gnardin@emse.fr)
- Fábio LEVY SIQUEIRA (levy.siqueira@usp.br)
- Khaled MEDINI (khaled.medini@emse.fr)

Location : MINES Saint-Étienne, Institute Henri Fayol

Start date : March 2026

Application deadline : Open until filled

Duration : up to 6 months

Scholarship : around 650€ / month

Keywords : Modeling Process Languages, Design Science Research, Industrial Engineering

Description

This internship takes place in the context of the ANR/FAPESP international collaboration project Normative Artificial Intelligence for regulating MANufacturing ([NAIMAN](#)).

Modern manufacturing industries are compelled to become more flexible, adaptable, resilient, sustainable, and human-centred in order to evolve and remain competitive. The digital transformation of the manufacturing systems, from business models to machines at the shop floor, provides a nurturing environment for the implementation of these necessary properties. However, these properties also influence the requirements imposed on process modeling techniques used to represent and analyze these industrial processes.

Process modeling encompasses a wide array of concepts, methods, and graphical notations designed to represent and analyze the behavior of complex processes. Fundamentally, process modeling serves as a cognitive design instrument that facilitates understanding current organizational practices and exploring potential future processes. Process models are created using modeling languages (also referred to as notations) that define constructs and rules for using these constructs. Selecting a suitable process modeling language that can accurately express the characteristics of industrial processes still presents a challenge because of the large number of alternatives, each with numerous features.

Some process modeling languages have been extended to support the representation of flexibility, resilience, trustworthiness and sustainability and several approaches have been proposed to evaluate these properties of industrial processes. But, to our knowledge, there are no studies that evaluate the ability of process modeling languages to represent these properties of industrial processes.

We have proposed an evaluation framework to assess process modeling languages in terms of their expressiveness for representing the resilience of industrial processes. This framework was developed to formulate clear and specific requirements regarding the resilience characteristics that process modeling languages should be able to represent.

Objective

This internship aims to extend this evaluation framework to assess process modeling languages in terms of their expressiveness for representing the flexibility, trustworthiness and sustainability of industrial processes. Then, this extended evaluation framework will be used for assessing a set of industrial process modeling languages. The outcome of this assessment will be used to select a language for modeling an educational skateboard manufacturing assembly line implementing a product-centric production approach (i.e., [Fábrica do Futuro@USP](#)).

Responsibilities

- Extend the conceptual evaluation framework for flexibility, trustworthiness and sustainability of industrial processes
- Define metrics for measuring the expressiveness of process modeling languages concerning resilience, flexibility, trustworthiness and sustainability of industrial processes
- Evaluate existing process modeling languages using the proposed evaluation framework
- Model the Fábrica do Futuro@USP assembly line using a process modeling language
- Write reports about the evolution and final outcomes of the framework development and application

Application Procedure

If you are interested in this internship, apply to this position by sending a **Letter of Motivation** highlighting your main strengths and interests for this position, a **CV**, the **Master transcripts**, and any additional information you deem relevant to Luis Gustavo NARDIN (gnardin@emse.fr).