Engineering Internship Proposal – UTT-LASMIS

Title: Development of a Simulation Model Library for Benchmarking Numerical Methods

1. Context

Scientific research is very active in the field of numerical methods for solving engineering problems, for instance in design or process optimization. New algorithms are regularly published, claiming improved performance (accuracy, computation time, etc.) compared to existing ones. Such performance is typically demonstrated using a *benchmark*, i.e. a set of more or less complex problems that are solved both with the new method and with well-known existing methods in order to compare the results.
The choice of benchmark has a major influence on the validity of the conclusions of such studies, and defining a satisfactory benchmark is not straightforward. One important characteristic of a benchmark is its level of dissemination within the scientific community. In other words, if a benchmark has already been widely used, it provides a common ground for comparing many different methods. It is also often appreciated when benchmarks include a few problems inspired by industrial applications, for example finite element models. Such models are difficult and costly to develop and calibrate, which is why they are rarely used, and even more rarely shared.
Through numerous research projects, the LASMIS laboratory has developed several simulation models of industrial processes, materials, and components. These models could serve as a foundation for a physical-model benchmark made available to the scientific community to help address this issue.

2. Objectives

The goal of this internship is to develop a ready-to-use benchmark of industrial process models. Depending on the progress made during the internship, up to five models may be included in the benchmark, based on the work of I. Khoury, F. Meng, and V. T. Dang.

The models simulate different forming processes such as forging (see Figures 1 and 2), stamping, and hydroforming. The student will have to become familiar with these models (Abaqus) and possibly improve their parameterization. To make the benchmark accessible, it will be necessary to develop automation tools for running the simulations and collecting output quantities. The objective is to make each simulation executable through a simple function call, for example from a Python script. It may also be possible to apply standard numerical methods from the literature to obtain reference results for the benchmark problems. Finally, a user guide will be written to facilitate use of the benchmark by non-specialist teams.

3. Skills to be Developed

This internship will allow the student to develop several useful and sought-after skills for both research and engineering positions, including:

- Mastery of Abaqus, in particular scripting tools such as macros;
- Familiarity with collaborative development tools such as Git;
- Understanding and numerical resolution of forming problems;
- Python development skills for simulation control and data extraction;
- Familiarity with numerical benchmarking issues;
- Writing clear and concise software documentation.

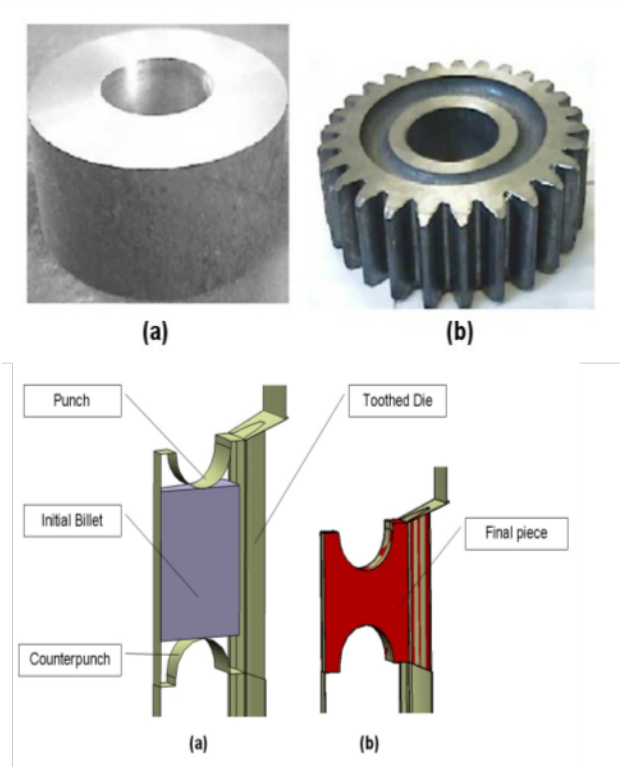

Figure 1. Example of a gear forging operation: part and process at the initial state (a) and after forming (b).

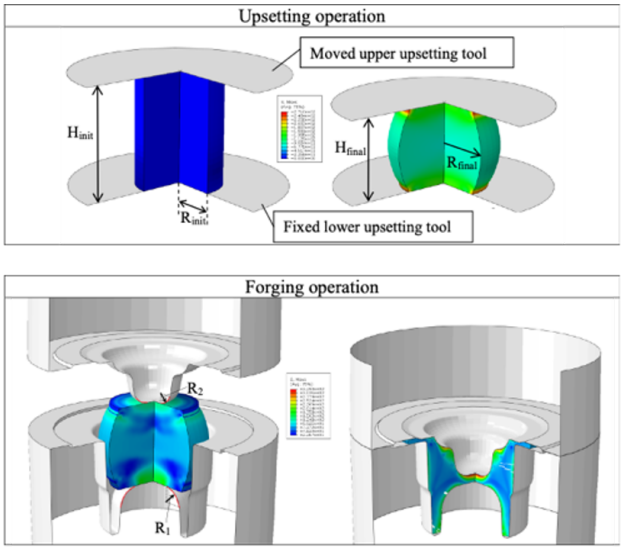

Figure 2. Example of a two-step forging process.

4. Required Skills

- Master's level (M2) or equivalent in Mechanical Engineering;
- Good knowledge of the fundamentals of finite element simulation;
- Programming skills (Python);
- Rigor, autonomy, and initiative.

The internship will be conducted in close collaboration with researchers.

5. Internship Details

Start date:	January 12, 2026
Duration:	6 months
Allowance:	approximately €600 per month
Location:	UTT, Troyes, France
Level:	Master 1–2 / Engineering School (4–5 years of higher education)
Field:	Numerical simulations, Mechanics

6. Contact

To apply, please send your CV and cover letter to Pascal Lafon, Carl Labergère, and Augustin Persoons at: `pascal.lafon@utt.fr`, `carl.labergere@utt.fr`, and `augustin.persoons@utt.fr`.