Engineering Simulation Automation

Make numerical analyses more reproducible, transparent and controllable

Internship area: Computational Mechanics, Structural Engineering, Scientific Computing or Software Engineering
Level: challenging graduation or research internship at university of applied sciences / university level
Period: by agreement; 3 to 6 months

The assignment

Numerical analyses involve more than starting a solver. Input must be checked, calculations must be monitored, messages must be interpreted and results must remain traceable to the correct model version. In this internship, you investigate how this analysis chain can be automated reliably, reproducibly and in a controlled way.

You investigate and compare relevant solution directions, work with representative as well as deliberately faulty test cases, and use the findings to realise a coherent technical implementation. The proof of concept is the means by which the selected approach is tested and validated, rather than a standalone demonstration. Technical acceptance remains with engineers and reviewers.

Possible research themes

- input and preflight checks;
- reproducible job execution, status monitoring and recovery after failures;
- handle incomplete results, interruptions and unknown situations;
- structure, classify and trace solver messages;
- automatically process selected results and present them as engineering evidence;
- link evidence, artifacts and versions to the correct analysis;
- learn from validated failure cases and previous analyses.

What we are looking for

We are looking for a student who combines FEM insight with a strong interest in automation and technical research. You want to know not only that a calculation stopped, but also which input was used, what happened, how reliable the diagnosis is and what information is needed to assess the result.

Required skills

- basic knowledge of FEM or numerical simulation;
- ability to program, preferably in Python;
- ability to test, debug and analyse systematically;
- ability to link files, processes, artifacts and results carefully;
- ability to document technical warnings, assumptions and limitations clearly.

A plus

- Abaqus/CAE, Abaqus Python or comparable FE software;
- batch processing, HPC or job schedulers;
- log parsing and structured logging;
- postprocessing and scientific visualisation;
- regression testing;
- machine learning for classification or anomaly detection.

What we expect from you

- you work with valid and faulty reference cases from the start;
- you substantiate technical choices with experiments and measurable results;
- you distinguish objective process status from engineering judgement;
- you make failure modes, unknown situations and human review points visible;
- you take initiative independently and communicate blockers early;
- you deliver reproducible code, tests, documentation and a convincing demonstration.

What you will deliver

A substantiated and validated approach to reliable simulation automation, supported by a working proof of concept for the core analysis chain. The result demonstrably shows how reproducibility, error detection, traceability, result processing and human review are safeguarded. The exact reference cases, interfaces and technical choices are established at the start within this core assignment.