Design Portfolio

Selected Research Projects

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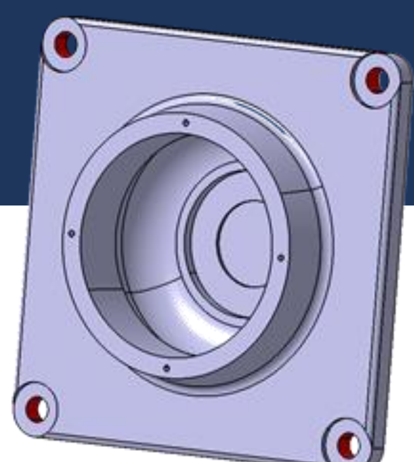
Aluminum part manufacturing

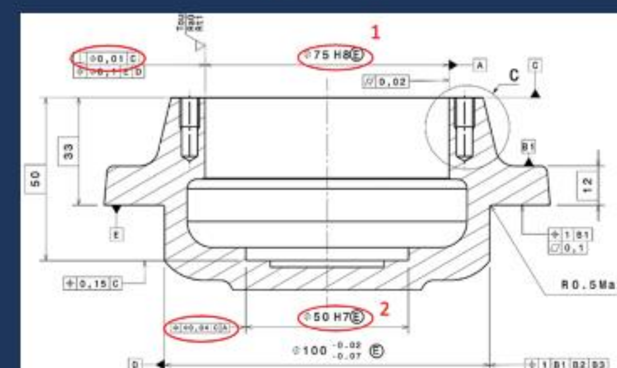
Development Project

Sand casting

Machining with conventional lathe and CNC



Verification of geometric tolerances



Objective

Full industrial development of an aluminium part, from casting design to verification of geometric tolerances.

- Casting the AlSi7 alloy in a sand mold with casting allowances, draft angles, risers.
- Roughing and finishing operations with conventional lathe followed by CNC machining. Chose tools, cutting speeds, feed rates and workholding setup.
- Inspected final tolerances using a CMM: flatness, perpendicularity, location. Filled the GPS tolerancing sheet.

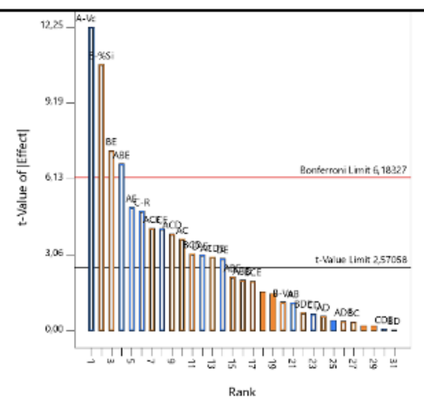
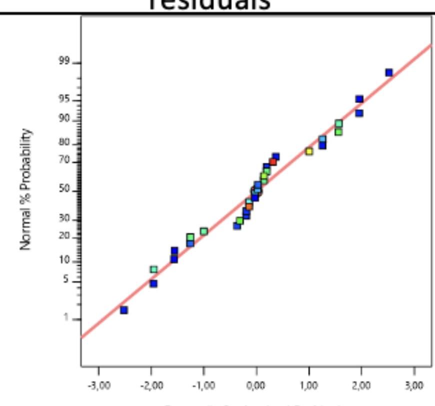
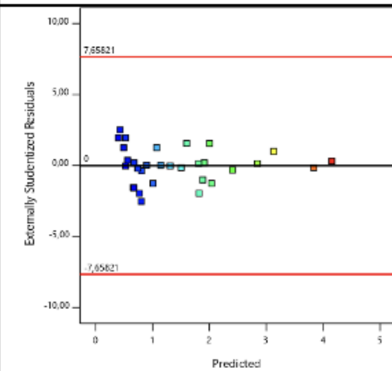
Optimization of drilling an aluminum block

Research Project

Curry spirals to study castability

Drilling of 36 holes with varying Cutting speed and feed rate

Measurement of the sample's hardness using a microhardness tester

Si	Pareto chart	Normal probability plot of residuals	R^2	Residuals and predictions
7-13%			R^2: 0,9906 Adjusted R^2: 0,9420 Predicted R^2: 0,6165 Adeq Precision: 17,0410	

Output from Design Expert software to evaluate the influence of factors on surface quality (Rdq)

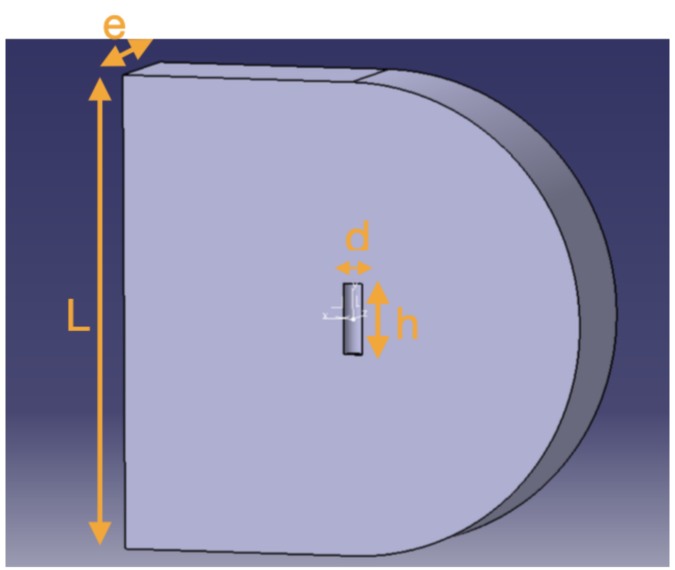
Objective

Optimizing drilling parameters for aluminum involves several key factors that affect hole quality.

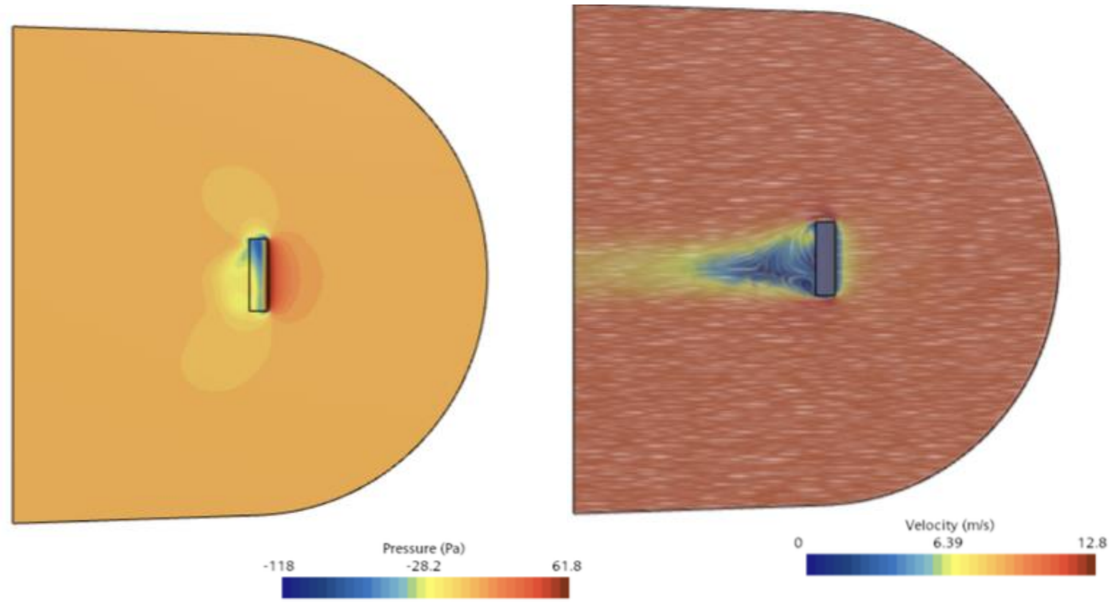
- Casting of aluminum blocks with different silicon contents Higher silicon content improved castability according to Curry spiral tests.
- Drilling of 36 holes using various cutting speeds (Vc) and feed rates (f) based on tool manufacturer recommendations.
- Measurement of hole hardness using a microhardness tester
- Analysis of the influence of different factors on the root mean square of the local slope (Rdq) using Design Expert
- Conclusion : cutting speed (Vc) and silicon content significantly affect Rdq.

Cylinder in a flowing fluid

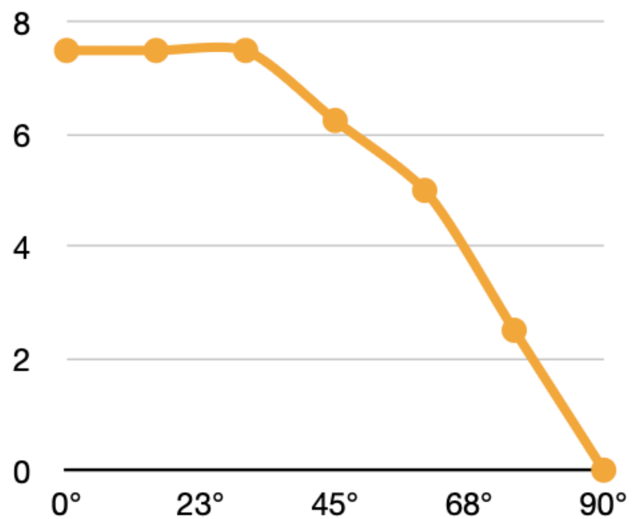
Research Project



CAD on Catia V5

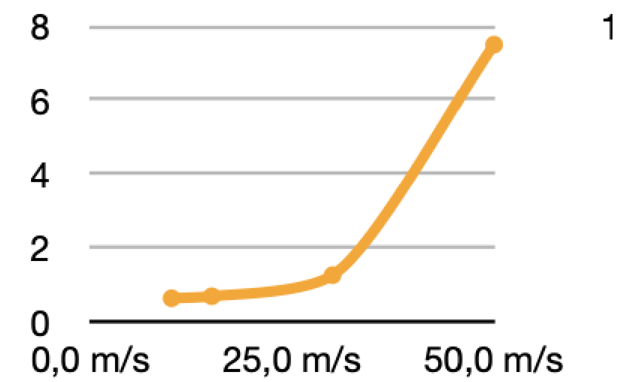


Velocity field for a 0° angle of attack



Cx as a function of the angle of attack

50 ms^{-1}



Cz as a fonction of velocity

60°

Objective

Analyze the fluid flow around a cylinder using STAR-CCM+.

- Modelled the cylinder in Catia V5.

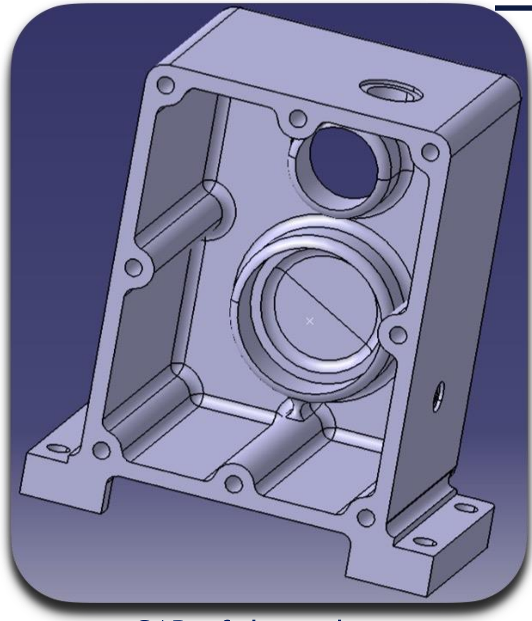
STAR CCM +

- Divided geometry into a control surface with steady-state flow and constant density assumptions
- Studied included fluid velocity, angle of attack, and fluid density.
- Visualized the pressure and velocity field, tthe lift coefficient (Cz) and drag coefficient (Cx).
- Concluded Cx depends on the effective surface geometry and increases with fluid density. Cz increases significantly with fluid velocity.

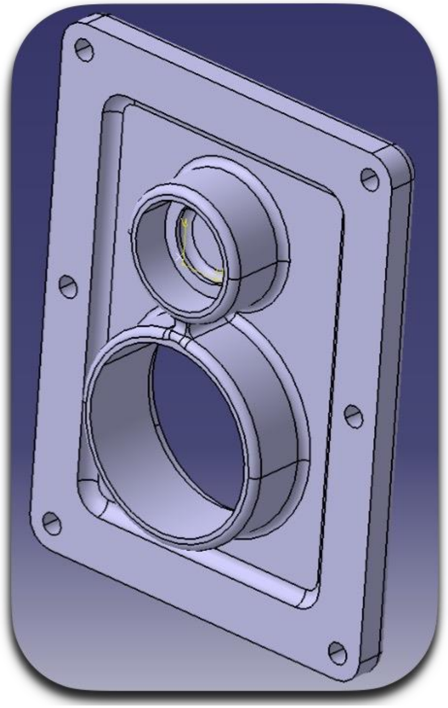
Industrial Power Reducer Design

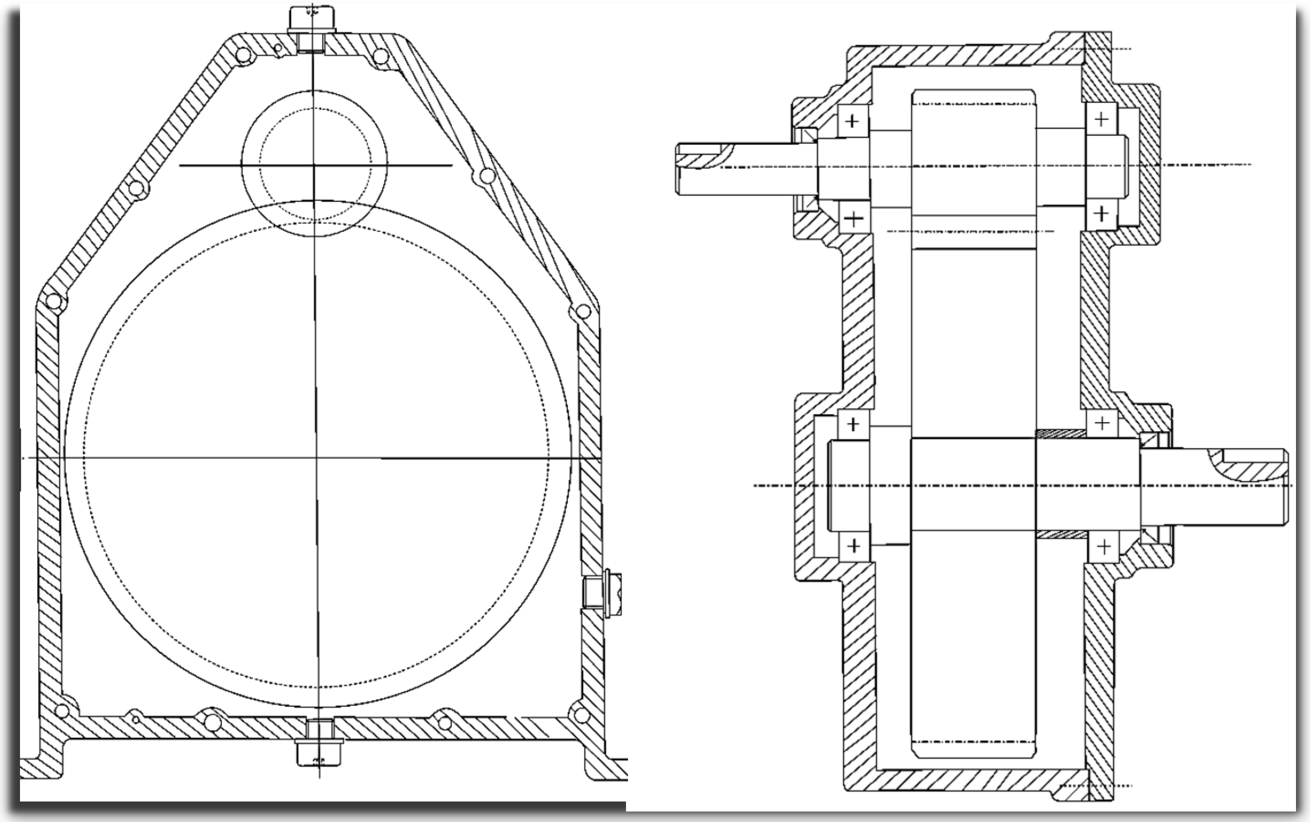
Research Project

Arts et Métiers Institute of Technology

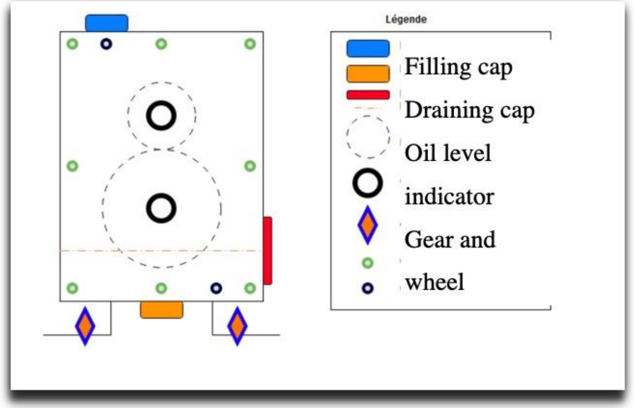


CAD of the reducer





Detailed plan of the reducer



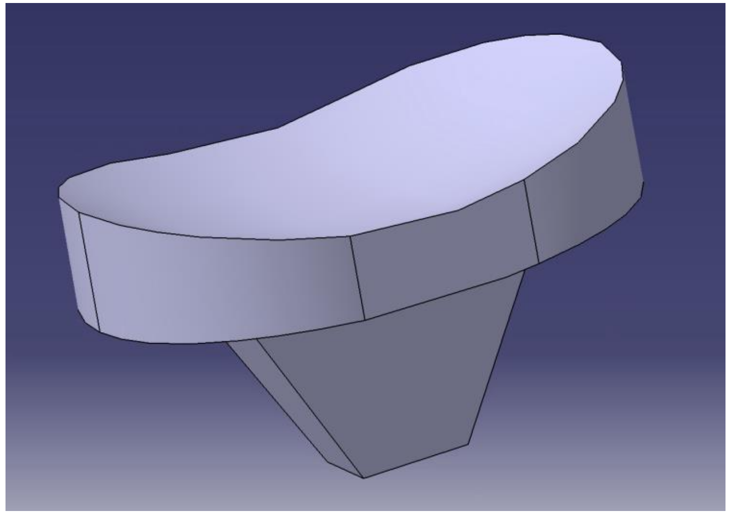
Objective

Design and develop a mechanical reducer, including its architecture, components, and assembly.

- Developed kinematic and technological schemes for the reducer design.
- Sized study for shaft and gear diameters and designed the casing, cover, and shaft structure.
- Selected appropriate bearings, keys, and joints for optimal functionality.
- Conducted a study to determine the appropriate lubrication system for efficient operation.
- Created detailed assembly drawings and CAD models for the complete reducer.

Shoulder implant design

Biomécanique project



CAD on Catia V5

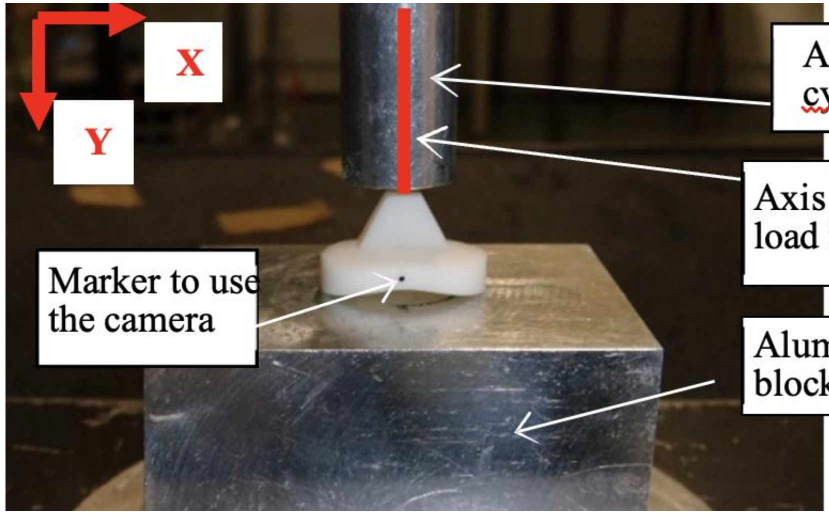
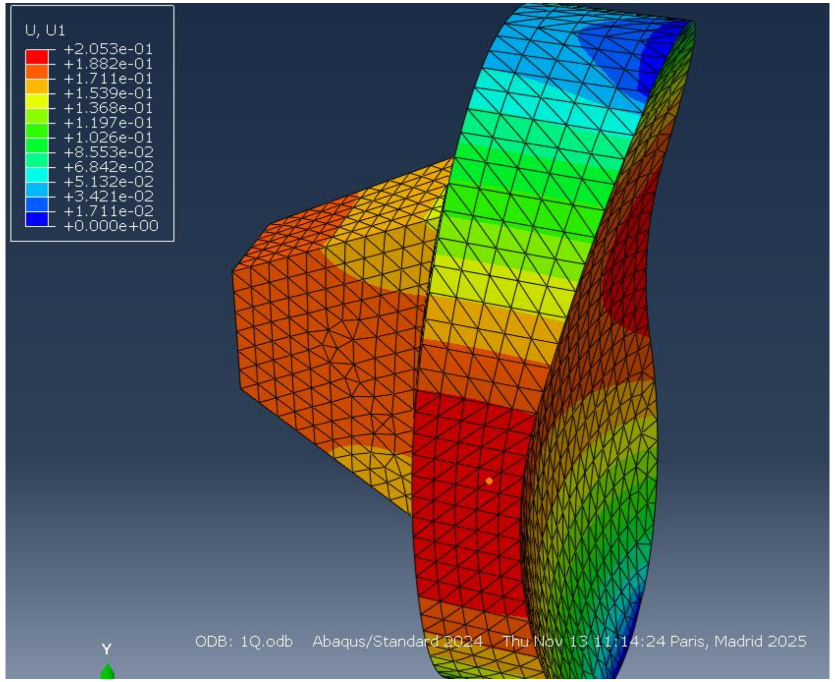


Diagram of the compression test



Abaqus simulation

Objective

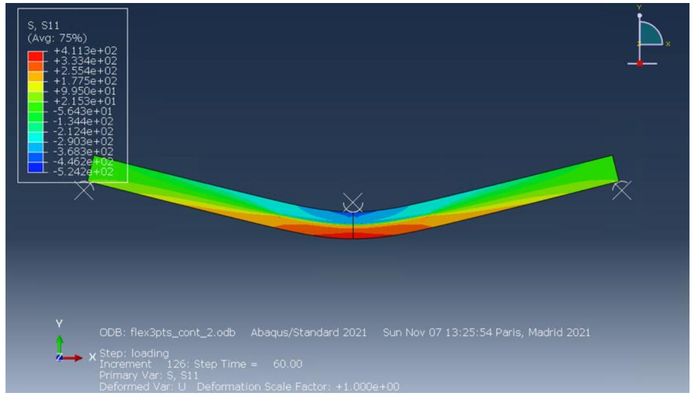
Design and Testing of the Glenoid Component of a Shoulder Prosthesis.

- Designed the glenoid component of a shoulder prosthesis using Catia V5.
- Manufactured the component with a polyethylene 3D printer.
- Performed a compression test using a high-precision camera to measure marker displacement and determine the mechanical properties (E, v).
- Simulated the compression test in Abaqus to obtain a validated mechanical model and conduct finite element analyses.

Plasticity tests: three-point bending and frame structure

Research Project

Three-point bending test using hydraulic press



CAD three-point bending

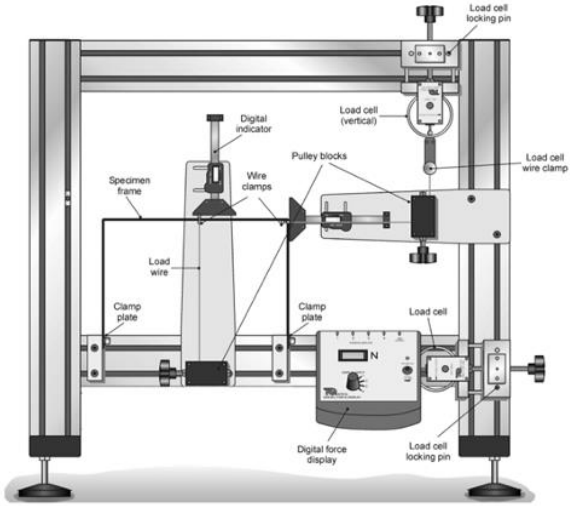
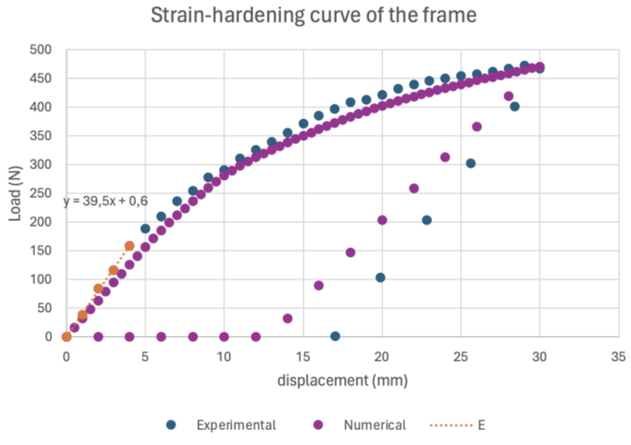
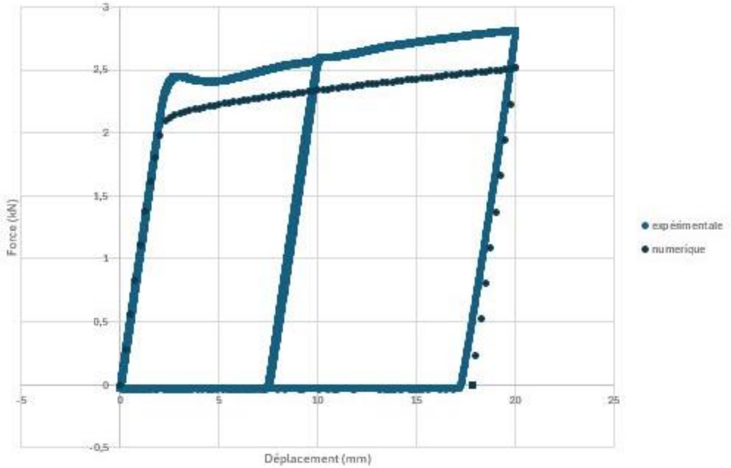


Diagram of the frame test





Strain-hardening curves obtained by varying elastic modulus , strain hardening coefficient, yield strength

Objective

Plasticity tests on a three-point bending beam and a frame structure with theoretical, experimental, and numerical analysis

- Experimental: applied sufficientload to induce plastic deformation , displacement was measured using sensors. In results, we obtain 2 strain-hardening curves.
- Theoretical: determined plastic moment and ultimate load using the virtual power principle, failure mechanisms and Varignon's relation.
- Numerical: used a Python script to compute the deformed shape in Abaqus. Identified Plastic hinges and iterated material parameters (E, n, $Rp_{0,2}$ (to match the experimental and the numerical curve in Excel.