Advanced Large Deformations

This training allows participants to deepen their knowledge of the nonlinear mechanics of materials, using the finite element method for large deformations, with the Z-set software and its Z-mat material library.

This course introduces the formulations commonly used to model behavior laws under large deformations. It highlights the theoretical distinctions between these approaches and their application to structural calculations. This training is intended for engineers who wish to perform structural calculations beyond the scope of small deformations, particularly for large rotations and deformations.

LEVEL

Advanced

PREREQUISITES

Knowledge of the fundamental principles of continuous medium modeling in small deformations.
Understanding of tensor calculations.
Familiarity with finite element modeling.
Basic knowledge of scientific programming.

GOALS

- **Mastering the formulations for large deformations widely used in finite element codes**
- **Setting up data preparation for large deformation calculations (choice of finiteelement formulation and behavior law).**
- **Comparing and interpreting results obtained with different large deformation formulations.**
- **Identifying a behavior law under large deformations, considering both material and geometric nonlinearities.**
- **Implementing a behavior law under large deformations with Z-set (implicit/explicit**
- **integration of the behavior law, consistent tangent operator).**

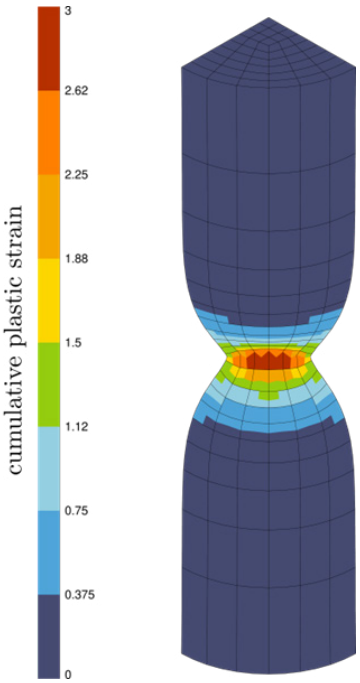
TRAINING	DURATION	PRICE EXCL. TAX	PARTICIPANTS
In-company	2 days	€3200 per training	1 to 3 people

DAY 1 > 8.30 a.m. to 12.00 p.m. & 1.30 p.m. to 5.00 p.m.

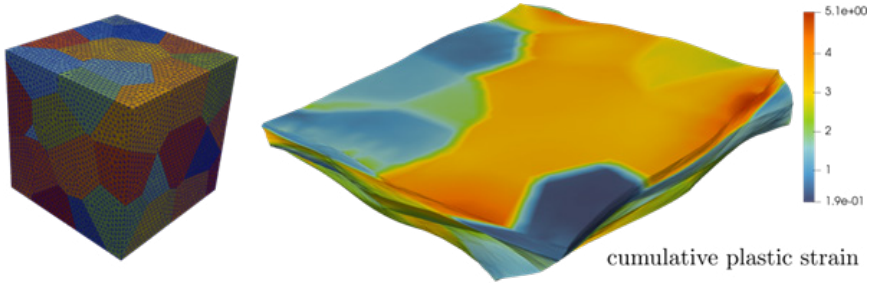
Introduction	· Transvalor presentation · Course goals
Presentation of the Z-mat material behavior law library	· The generic interface for behavior laws · Basic building blocks for constructing a behavior law (elasticity, plasticity criteria, flow laws, ...)
Elastoplasticity in Z-set (gen_evp)	· Recap: small deformations. · Extension to large deformations: hypo-elastoplasticity · The concept of "modifiers" in Z-set · Hypoelastic models (behavior law, deformation rate decomposition, ...) · Extension to large deformations: hyper-elastoplasticity · Hyperelastic models, multiplicative decomposition. · Case study: Anisotropic plasticity (crystalline, ...).
Finite element formulations and tangent operators	· Updated_lagrangian/total_lagrangian · Lagrangian_pk1
Integration of behavior laws	· Explicit integration of behavior laws. · Implicit integration of behavior laws.
Interfaces with external codes	· Abaqus · Ansys

DAY 2 > 8.30 a.m. to 12.00 p.m. & 1.30 p.m. to 5.00 p.m.

Implementation of behaviors laws in Z-set	· Linux / Windows compilation environment, reminders and prerequisites · Introduction to Zebfront · Impelment an elastoplastic law for small deformations
Exercises	· Operators required for tensor calculations · Implement a hyporelastoplastic law (for large deformations) · Implement an hyperelastoplastic law (for large deformations)
Conclusion	· Questions and course assesment



Calculation of tensile stress on a cylindrical specimen and the formation of necking.



Compression of an elastoplastic polycrystal under large deformations.

A NEW GENERATION SIMULATION EXPERIENCE

TRANSVALOR