METAFOR
OBJECT-ORIENTED FINITE ELEMENT CODE FOR THE SIMULATION OF LARGE DEFORMATIONS OF SOLIDS
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Software Development

METAFORE: an object-oriented Finite Element code for the simulation of solids submitted to large deformations
- 2D/3D elements (large strains).
- Implicit/explicit time integration (HHT, Chung Hulbert, ...)
- Thermomechanical coupling (staggered or fully coupled schemes).
- Frictional contact between deformable bodies or analytical surfaces.
- Arbitrary Lagrangian Eulerian formalism.
- Meshing and remeshing procedures.
- Large set of constitutive laws (thermo-elasto-visco-plastic, damage, ...)
- Crack propagation (erosion method).

- C++/Python interface
- Graphical User interface
- Multicore solvers

Biomechanics

Brain Model
- Unstructured FE mesh generation from medical images (MRI scans).
- Simulation of neurosurgery (brain shift / tumor resection).
- Simulation of injuries (head impact).

Orthodontics
- Development of complex constitutive models for bones and tissues.
- Simulation of teeth motion and jaw deformation.

Bone Fracture Simulation
- Prediction of human and animal bone fractures (in collaboration with CHU Liège and the faculty of Veterinary Medicine of ULg).

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Metal Forming Simulations

Springback Prediction in Roll Forming
- Development of a fast 3D model of industrial forming mills.

Cooling and Straightening of Sheet Piles
- Prediction of the final product shape and the residual stresses.

Other Processes
- Deep drawing - drawbeads
- Hot/cold rolling and lubrication.
- Forging - extrusion
- Hydroforming
- Thixoforming
- Superplastic forming

Crash, Impact & Fracture Simulations

Blade Impact on the Casing of an Aeroengine
- Study of the behaviour of titanium alloys at very high strain rates.
- Composite casings.
- Fan Blade Out simulations.

Damage & Fracture Tests
- Development of thermo-elasto-visco-plastic material models.
- Composite materials

Shock Absorber Devices
- Development of accurate numerical time-integration schemes and fast 3D contact algorithms.