**Code_Aster Professional Network**

aims to spread and to acknowledge the benefits of **Code_Aster** and **Salome-Meca**

Ten issues since July 2015 and now in Spanish with the help of SCOPE Ingeniería and in Italian with the help of SimulEase

Information content:
- Training, Meetings, Cloud computing
- Code_Aster as an industrial platform
- Code_Aster as an educational platform
- Project being planned on Rotating machines

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**Code_Aster Open source for sustainable development**

Join the network!
Training and meetings in the world

- **United Kingdom**

  **Code_Aster User Day** – 11th September 2018 – Manchester
  **Organized by EDF Energy R&D UK Centre**
  - Updates on Code_Aster and Salome-Meca, including AsterStudy
  - Presentation of Code_Aster next generation version with HPC
  - Several technical presentations
  - Discussion with Code_Aster developers and experts
  **Contact Philippe Martinuzzi** Philippe.Martinuzzi@edfenergy.com

- **Italy**

  **Code_Aster and Salome_Meca Italian User Day**
  23rd November 2018 – Modena
  **Organized by Kobe Engineering and ConoscereLinux**
  Two sessions (research and opensource in the morning and professional networking context in the afternoon) brought together about 60 participants
  **Contact Vladimir Cerisano Kovacevic** vladimir.kovacevic@kobe-ie.com

- **Germany**

  **Code_Aster introduction**
  10-11 September 2018 – Rostock
  **Organized by FoamAcademy - Professional engineering with free software**

  **Contact** info@foamacademy.com

In 2018 several training sessions for Code_Aster and Salome-Meca are proposed.

**TRAINING**

**TUTORIALS**

The course materials used by EDF for in-house training are online and written directly in English.

**New release 2018**

Webinars - Online courses - Blogs

FEA & CAD
https://www.youtube.com/user/anirudhnehra

Anisim Open Source Engineering Software

Cloud computing by web interface

Simright 2018.11.30更新:Code_Aster计算结果支持动画显示

Simright provides cloud-based tools for modeling, simulation and optimization, which users can easily access through web browsers: Release 2018.11.30: Support for using animation to display the results of Code_Aster

CONTACT www.simright.com/en/blogs

Contact Richard SZOEKE-SCHULLER rszeke-schuller@simscale.com

Code_Aster is an open source software package for simulation in structural mechanics, including fatigue, damage, fracture, contact, geomaterials, porous media and multi-physics coupling. The software has been evaluated through independent comparisons in regards to analytical and experimental results and was benchmarked against commercial codes (red curve). Code_Aster is used for various applications by industry-leading companies.

Post doctoral job offer

The grid shell structures are similar to shells obtained by elastic deformation of a bidirectional plane mesh structure without initial rigidity in shear and stiffened after deformation.

The post-doc is part of the GERBOISE project. The partners are Quaternion (start-up at the origin of the project specialized in the manufacture, assembly and rental of gridshell structures), Terrell (engineering and design office), and INSA-LMDC (laboratory of research).

The contribution of the post-doc within Terrell offices is on one hand the implementation of the behavior of the assembly (force-displacement relation) in the global model of the structure (under Code_Aster) and on the other hand the use of probabilistic methods to estimate the reliability of a grid shell structure with respect to the dominating limit states identified by Terrell. The OpenTurns platform, or other reliability tools, will be used.

Contact Frederic DUPRAT duprat@insa-toulouse.fr
Starting from about 2010, Code_Aster has been introduced at the Department of Civil and Environmental Engineering (University of Florence, Italy) as an effective numerical code to teach (and to learn, on the student side) the basic principles of the computational mechanic for civil engineers with respect to the finite element method.

The goals of the introduction of Code_Aster in University classes were:

i) to provide students with a real-world software engineering experience (that can be freely employed after their study);

ii) to introduce students to the Open Source developmental model;

iii) to provide students with knowledges for a conscious use of the numerical codes to be subsequently employed in their future (against the “click-philosophy”);

iv) to attract a wider variety of students into computing due to the real-world and the ethical nature of the Code_Aster project. The (ambitious) goal was to facilitate the creation of a new generation of civil engineers with the strong computational background (and the robust instrument) needed to approach the challenges of the future.

Apart homework for University classes, Code_Aster has been also employed as the finite element code to support the numerical part of several bachelor thesis. The topics of the theses are wide, and range from the seismic risk assessment of historic buildings to the numerical simulation of cyclic tests on concrete slabs.

The knowledge of Code_Aster constituted, for some students, a great opportunity to create a new company (University of Florence spin-off).

Based on this positive feedback, starting from this academic year (2018/2019), a specific two-weeks seminar about the use of Code_Aster, Salome_Meca and OpenTURNS is offered within two classes: “Computational Mechanics” (where the basis of the finite element methods is provided) and “Structural analysis of existing structures” (where the basis of the structural assessment of old constructions is approached).

This was possible thanks to the support of Eng. Vladimir Cerisano Kovačević from Kobe Innovation Engineering (a newly born spin-off of the University of Florence which covers the usage of the Code_Aster and Salome_Meca platform on a professional level).

Within the seminar, dedicated to the typical civil engineering approach for numerical analyses (including 1D, 2D and 3D finite elements), the four fundamental phases of the FE modelling have been presented: 1) Geometry handling with the GEOM module; 2) Mesh generation with the SMESH module; 3) Analysis creation with the ASTER STUDY module; and 4) Post-processing with the PARAVIS module. Thanks also to the Windows package of the software, released by SimulEase (which is helpful to tear down the “Linux barrier” for newbies, especially in very compressed timing), the seminar has received a very positive feedback from the students. This suggests new challenges for the future: i) Set-up the seminar for more skilled activities (Python programming and non-linearities) and ii) Start building a dedicated laboratory for Computational Mechanics and Simulation with Salome_Meca and other Open Source packages.”
**Code_Aster as an industrial R&D platform**

**Feasibility study of cross laminated bamboo panels (G-XLam) for low-rise buildings in Europe**
Ioannis P. CHRISTOVASILIS – Lorenzo RIPARBELLI – AETHER ENGINEERING

As part of an on-going R&D+I project on product development by Amphibia Base [www.amphibiagroup.com], Aether Engineering used Code_Aster and its in-house software Aetherium to model a typical detached two-store house, shown in Figure 1, featuring G-XLam panels as load-bearing walls. Generic loads and load combinations according to Eurocodes were used to evaluate the structural performance of G-XLam panels as wall elements and to perform and visually illustrate the verification results for six different failure mechanisms.

The first structural configuration for the load-bearing walls of the modeled house (configuration i) consisted of a single face five-layer G-XLam panel where the majority of the walls are not verified with some exceptions at the roof level (Figure 2a). Configuration ii considered double face walls with five-layer G-XLam panels working independently. This improved the situation, but still the ground-floor walls and some of the first store walls are not verified, as shown in Figure 2b.

A composite wall with double face five-layer G-XLam panels that collaborate in bending was the proposed and most straightforward option for a feasible solution. The verification results for the final option (configuration iii) are displayed in Figure 3. This is still new ground, but results obtained from this study at this early stage of the R&D+i project show that composite G-XLam walls can be a feasible structural component for a typical European low-rise structure.
**Code_Aster as an industrial platform**

**Chamo_3D: using Code_Aster to design standard bridges**
Jean GUAL – jean.gual@cerema.fr

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**Evolution of design of standard bridges in CEREMA**
(cross under or over high-ways or roads)

- New rules: Eurocodes
- New chain: Fortran 90/C++
- New calculator: FEM analysis

**Analysis specifications:**
- Finite Elements: Elements DSQ
- Permanent loads: Load functions f(x,y)
- Variable loads: Influence area + Cerema internal component: Trafic (moving loads on the bridge)
- Code_Aster and Trafic Parallelization

**Board parallelization of Code_Aster**

<table>
<thead>
<tr>
<th>Process Chamo3D</th>
<th>Shell Aster Parallelized</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Program C++)</td>
<td>(Back ground task)</td>
</tr>
<tr>
<td>• Generate files .com</td>
<td>• Waiting for files .com</td>
</tr>
<tr>
<td>• waiting for results</td>
<td>• launch Code_Aster + Trafic by file and by processor (*)</td>
</tr>
<tr>
<td>• Read files (.med)</td>
<td>• End of Trafic process</td>
</tr>
<tr>
<td>• Reinforcing design</td>
<td>(*)with 100 multitasks threads in same time</td>
</tr>
</tbody>
</table>

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**FEM tool criterion choice:**
- Launched by «shell script» in batch mode
- Civil engineering scope
- Known
- Open
- Free
- Supported
- Documented

➢ **Code_Aster conforms to all items**
**Code_Aster as an industrial platform**

Heat Treatments (HT) are a necessary step for many metal industrial parts. By acting on HT process parameters like treating temperature, holding times and even the heating or cooling rates, it is possible to achieve particular mechanical properties (hardness, UTS, toughness,) to make the component better withstand its duty cycle. Since during HT the alloy can be subjected to severe thermo-mechanical stresses, non-optimized process conditions lead to distortions, part cracking, inadequate or inhomogeneous properties.

Commonly, industrial parts are not intentionally designed to withstand HT side effects so it is necessary to calibrate the treatment for each part in order to avoid costly production wastes. With Code_Aster we can design the HT for each component.

Among HTs, quenching is famous for bringing many issues like deformations or cracks since the material phase transformation to martensite (Ms) requires severe cooling and it is hard to control. Despite these issues, quenching is almost an unavoidable treatment to increase steel hardness and UTS. Code_Aster has a set of equations to model the steel phase transformations under the keyword META_ACIER, their usage is widely described in the related documentation. However, it is very important to note that, to correctly simulate a steel quenching HT, a detailed modeling of heat transfer has to be employed before starting to think about transformation kinetics. Indeed cooling rate is the driving force of almost all metallurgical transformations during quenching.

Heat transfer is modeled with the help of Heat Exchange Coefficient (HEC) [W/m²K] applied to the part surface. HEC is strongly non-linear in liquid quenching and so will be the consequent cooling (Figure 1), it is thus necessary to experimentally measure HEC in real representative conditions. Experimental HEC curves are applied in Code_Aster non-linear thermal calculation as surface BCs function of surface temperature (T) with FORMULA + FLUX_NL commands, since ECHANGE subroutines can only handle HECs function of time (INST).

In Figure 3 it is shown that martensite fraction is lower when using degraded quenching oil, wear on the gear tooth with lower martensite will be more severe. This is a real example of how simulations and Code_Aster can help to solve real industrial issues in HT sector.

**Code_Aster for rotating machines**

**Lifetime of hydraulic turbine runners**

Vienna University of Technology (Austria) – [https://busy.inso.tuwien.ac.at/](https://busy.inso.tuwien.ac.at/)

The Research Group for Industrial Software (INSO) in collaboration with the Institute for Energy Systems and Thermodynamic present a work for numerical flow simulations via the open source software OpenFOAM are used to establish the lifetime of hydraulic turbine runners by determining compression forces.

To establish the lifetime of hydraulic turbine runners, numerical flow simulations are conducted via the open source software OpenFOAM to determine the occurring compression forces. The recorded data is then used for a finite element analysis with the freely available program **Code_Aster**.

To minimize the duration of FE-Simulations, the cyclical symmetry of the impeller geometry is utilized to reduce the size of the model. This however requires consideration of periodic edge conditions of the cut surface of the reduced model. **Code_Aster** currently only has limited functionality in this regard.

During the course of this project, these cyclical/periodic edge conditions should be implemented into **Code_Aster** and validated by means of test examples of parts of the model as well as the model as a whole.

**Creation of a working group “Rotating machines”**

During the last ProNet meeting (2018/12) a first discussion was opened on the interest of a collaborating work between several members in the application domain of Rotating Machines. More informations in the next issues of ProNet report.

Several forms are possible for these collaborations:

- Preparation of submission for an Horizon 2020 project
- **Bilateral or multilateral exchanges** on:
  - methodology, specification of dedicated tools,
  - specification for development of scripts or software components and particular GUI
  - validation and qualification of different tools (with or without experimental tools)
  - sharing of industrial results (failure risks; vibrations and noise, bearing parameters …)
- **distribution of dedicated tools** with open source or private license

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**Contributing Members**

- EDF R&D - France
- Imperial College - UK
- CEVAA - France
- Gmech computing - Denmark
- Nobo Solutions - Poland
- SIMXON - Denmark
- Gantner Instruments - Germany
- Gantner Instruments - Denmark
- Gantner Instruments - Poland
- PHIMECA Engineering - France
- ANDRITZ Hydro - Switzerland
- ANDRITZ Hydro - Switzerland
QUARTERLY REPORT OF CODE_ASTER PROFESSIONAL NETWORK