LTCALCOLI

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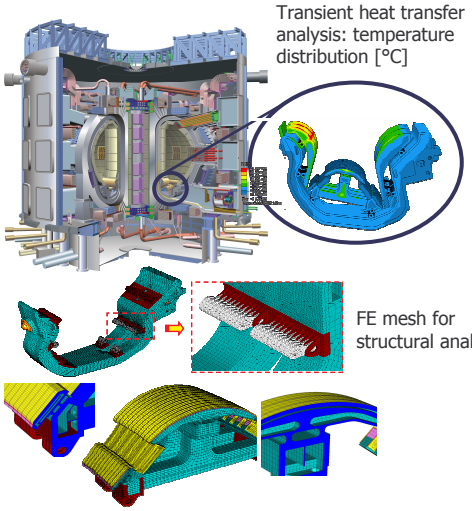
Thermo-Nuclear Fusion Engineering

ITER

ITER is the experimental reactor whose mission is to demonstrate the scientific and technologic feasibility of nuclear fusion as an energy source. After more than a decade of design and R&D activities carried out by Europe, Japan, United States and Russia in collaboration, the ITER project is now definitive and its construction is started.
Electromagnetic and thermo-mechanical FE analyses for the structural assessment of the Divertor Cassette have been performed following various analysis procedures:
•neutronic analyses
•transient heat transfer analysis under the effect of the neutronic heat deposition
•electro-magnetic analyses
•static and dynamic elastic analysis under different load conditions: dead weight, Cassette pre-load, thermal strain due to neutronic heat deposition, Electromagnetic (EM) loads

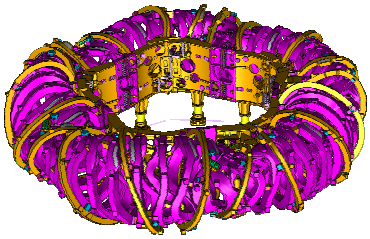


Transient heat transfer analysis: temperature distribution [°C]

FE mesh for structural analyses

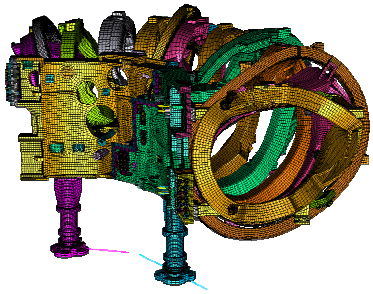
W7X – Stellarator Fusion Machine

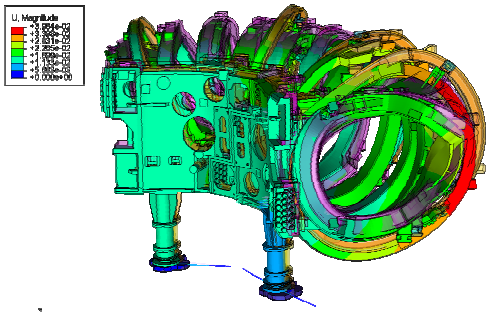
Global model for the simulation of the structural behavior of the Wendelstein 7-X magnet system in the framework of the finite element method (FEM). The magnet is a coil system, composed of the assembly of five identical modules, covering a sector of 72° each.



FE model of the 72° sector

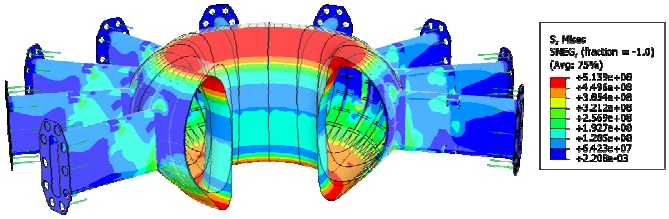
NUMBER OF ELEMENTS: 600533
NUMBER OF NODES: 939668
TOTAL NUMBER OF DOF: 2.6 millions





IGNITOR

IGNITOR is a compact high magnetic field Tokamak machine aimed to produce the ignition of the Nuclear Fusion reactions. IGNITOR is part of a line of research that began with the Alcator machine at MIT in the 1970's which pioneered the high magnetic field approach to plasma magnetic confinement, and continued with the Alcator C/C-Mod at MIT and the FT/FTU series of experiments. Electromagnetic as well as structural analysis have been performed for the structural assessment of the machine during disruption events. Dynamic elastic-plastic analysis of the IGNITOR vacuum chamber were performed in order to assess the low-cycles fatigue behavior of the structure.



FE model of the plasma chamber: Mises stress contour map