

## **Challenges in mechanics for nuclear plants**

**Pierre Verpeaux (CEA) – Stéphane Andrieux(EDF)**

The big stakes in the flourish of the nuclear industry - to be economically attractive and accepted by the public - require the capability:

- to conceive successful installations for systems of the future (high burn-up capable fuels, high temperatures) and to make them durable probably by using new materials.
- to estimate the safety of existing and future installations, to maintain them and to use them in a safe way.

In the field of structural analysis, it ensues the following scientific challenges:

- Characterization of damage and break of structures. It requires, in coordination with mechanic of materials, to widen the transition of the characteristic scales of material from the micro structure to the macro structure.
- Characterization of the ultimate behaviour of structures under extreme loads. This requires a better estimation of real loads and couplings within the structures, and mastering the numerical methods to handle localization of damage.

In particular, one can mention:

- Calculation of mechanical resistance and lifetime of nuclear fuel, in particular in case of transient of loads.
- Calculation of propagation of cracks, in particular in welded assemblies, to demonstrate the integrity of the components and to evaluate their lifespan.
- Calculation of ultimate behaviour of civil engineering structures (reactor containments, plants, storage containers) under extreme loadings.
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- multi physic analysis, for example for welding simulation.

To take up these challenges, it is essential to develop advanced numerical methods which are validated on experiments described as analytical, the recourse to direct experimentation on prototypes being extremely complex and expensive in the nuclear field. The objective of this symposium is to review the last improvements of the numerical technics and demonstrate their industrial applications.