WHY IS THERE A NEED FOR MECHANICS AND COMPUTATIONAL MECHANICS AT EDF

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ABSTRACT

At first glance it may seem strange for Electricité de France (EDF) to have a resource of several hundreds of engineers and researchers working in the different fields of physics (fluids, hydraulics, mechanics, materials, robotics, risk management, environment) that are not directly related to the production of electricity. This situation is very specific to EDF and due mainly to its installation park composed of numerous nuclear and thermal power plants as well as dams. As EDF owns its installations it is responsible of their maintenance, safety and lifetime and has to support associated costs. Moreover investments are so huge that insurance against defects cannot be guaranteed. Hence EDF may be associated to codification, conception, industrial assembly and perform technical and commercial counter-evaluations of projects proposed by external project management companies. For on-going realizations maintenance expertise is necessary which ranges from the behavior of fuel assembly components, to plant and electric network designs. At last we find contributions to decommissioning and fuel treatment at the end of the industrial cycle. On all these subjects, fluid and mechanical engineers are often called-up in order to guarantee safety, competitiveness and forecast future evolutions. In general engineers and researchers have to face three distinct problems:

- understand events which were not forecasted at the conception stage, such as unpredicted local vibrations on kilometers of pipes,
- quantify residual margins with respect to conception procedures when codification or external constraints are modified, such as seismic reevaluation,
- justify that a material, a structure or a process can be used after repair, such as welding.

The presentation will focus on four different types of structures or components in order to understand the complexity of the physics at stakes:

- civil engineering of plants,
- core vessel and primary loop of nuclear plants,
- secondary loop of nuclear plants,
- turbine generator lines.

These examples will help us clarify the need of advanced research and computational capabilities in very traditional fields of physics, focusing here on mechanics, but still with a lot of open problems. We'll show at last that in order to guarantee the quality and evaluation of our research, academic partners are often associated via traditional partnerships but also recently via more complex research structures such as the Laboratory of Mechanics for Sustainable Industrial Structures associating an industrial partner, two public research centers and hopefully an academic partner in the near future.