framatome

Detailed Coupled Dynamic Analysis

Coupling between Building Structure Model and NSSS Model

Obtaining less conservative, more reliable and closer to reality results of dynamic analysis through detailed coupling between building structure and primary circuit components.

Challenge

Historically, due to the different nature and the size of the problem, NPPs (e.g. reactor building) and their main internal components (e.g. NSSS) were analyzed separately and often using different simulation software. This is especially true when the soil-structure interaction (SSI) plays a significant role, because the specialized software which can handle SSI effects properly and the software which is used for the design of NSSS typically do not have a common interface, and direct integration (coupling) of the NSSS model into building model in civil simulation software was not possible.

Solution

Framatome utilizes different methodologies in order to overcome compatibility issues between different software platforms and make use of advantages which stem from the coupled dynamic analysis. Depending on capabilities of certain civil simulation softwares, primary circuit components can be integrated into building model in the following forms:

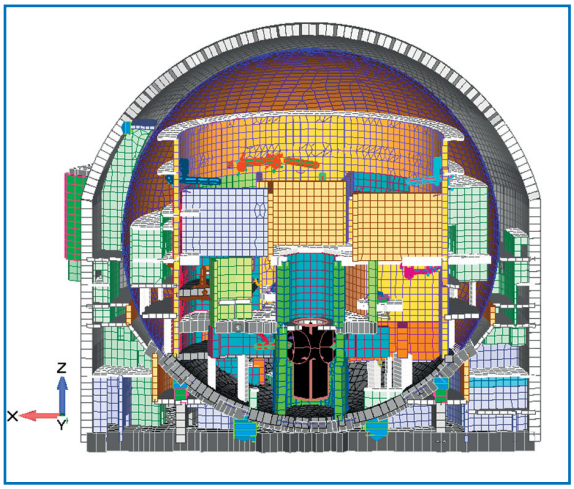
- Explicit modeling
- Superelement
- Matrix Elements

The second and third option are a linearized approximation of the original NSSS model where components are represented by their mass, stiffness and damping properties and connection with the building is made through interface nodes.

Customer benefits

- Increased reliability and optimized Nuclear Building and NSSS design and performance under dynamic loading conditions (reduced design conservatism, increased results reliability).
- Shortened product development time (reduction of the modeling and validation overhead and increased workflow efficiency).
- Increased competitive advantage (quick and efficient reaction to market demands, state-of-the-art in NPP's dynamics design).

Your performance
is **our** everyday **commitment**



Coupled Finite Element Model of the detailed NSSS model and the building structure

Technical information

Recent trends in industry tend to remove the unnecessary conservatism in dynamic SSI analysis of the NPPs subjected to dynamic loading conditions by trying to model the coupling between NPP and NSSS as realistic as possible and not with simplified representations of NSSS components (lumped masses, beams) as before.

Because of all benefits of the coupled dynamic analysis, customers and regulatory authorities require more and more the consideration of the more detailed coupled model already during the dynamic analysis of the building.

By enabling detailed coupled dynamic analysis, other advantages of different civil simulation softwares (e.g. ground motion incoherency, design of concrete or steel structures, etc.) can be fully utilized.

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