Seminar "An Efficient Method to Analyse Large Floating Structures in the Spectral Domain"

Long-span bridges and tunnels supported by floating supports are usually considered for completing projects which consist in crossing wide and deep water channels, such as fjords in the context of the E39 coastal highway in Norway or straits like the one of Messina in Italy. However, traditional time and frequency domain analysis methods actually struggle to evaluate the extreme responses to the hydrodynamic actions of such large floating structures in a reasonable amount of time because the characteristic frequencies associated to either the resonance of the structure in its multiple modes, either the energy content of the waves, are most often clearly separated.

Fortunately enough, the Multiple Timescale Spectral method actually turns this major drawback into an advantage by hinging on perturbation theories. It typically allows to derive semi-analytical approximations for computing the statistics of the responses at least 100 to 1000 times faster than before, with a small and controllable discrepancy. Being also simple to understand, these expressions could be used at the early stage of design, in order to guide engineers with graspable information and to provide them with the possibility to test rapidly many layouts, configurations and eventually optimize the structures while a heavier time domain simulation (as performed today) would be used for the final design.