Coupled Multibody and 3D Structural Dynamics Simulations with MBDyn, CalculiX, and preCICE

Claudio Caccia, Pierangelo Masarati
Politecnico di Milano, Italy

Abstract
Multibody dynamics (MBD) provides an efficient framework for simulating flexible structures, especially when using beam or shell elements. However, in regions where complex stress distributions occur, simplified models fail to be informative, and a full 3D structural model is required. This presentation outlines a methodological approach for integrating the multibody solver MBDyn with the finite element solver CalculiX through the use of preCICE. The integration of these approaches allows the execution of simulations that are both efficient in terms of computational resources and detailed in their representation of structural dynamics.

This coupling strategy can also reproduce well-established structural modeling techniques, such as RBE2 or RBE3 elements, but applied across different solvers. The presentation will include case studies that demonstrate the methodology in action, emphasizing its capacity for fast and efficient structural dynamics simulations.

Beyond structural simulations, preCICE also enables coupling with computational fluid dynamics solvers, extending this methodology to fluid-structure interaction problems, such as helicopter blade aeroelasticity. Furthermore, the adaptability of this methodology ensures its efficacy in a broad spectrum of coupled problems, thereby facilitating the simulation of intricate engineering systems while maintaining optimal computational efficiency.