The conference theme invites us to reflect on the continuously evolving and interchanging roles of testing and simulation. Hence let’s take a walk through the rich history of structural dynamics, focusing on main achievements and industrial applications as well as highlighting new and promising research areas.

Understanding product behavior and designing products to behave as desired is the underlying ambition of most if not all engineering disciplines. This is definitely the case for structural dynamics analysis, having given cause to a multitude of powerful approaches. Testing “the real thing” and predicting through simulation the performance of not-yet built systems have for decades gone hand in hand to do an as good as possible engineering job. This basically comes down to master design complexity, which simply means decreasing uncertainty and increasing confidence in the product designs.

Interaction between Test and Simulation was mainly confined to the identification of “difficult” model parameters such as material parameters or damping and to the validation of models. Tests supporting simulation. The GVT validation of aircraft FE models to increase the confidence in the aero-elastic simulations before getting qualified for test flights is a nice example how test and simulation workflows are interacting.

Over the years however, new ways to combine experimental and numerical procedures have been emerging. Hybrid approaches, combining test-based and numerical models allow to bring in information obtained on those parts of the system that are physically available while maintaining the power of simulation for predicting the effects of a new design. Applying real loads, measured or identified, to prediction models considerably improves their effectiveness. Inversely, with increasing simulation capabilities, test efficiency is enhanced through proper test design with the Test-Analysis Models in the space industry as a nice example.

More recently, we see that simulation models are not only combined with test-based models, but even with the physical structure itself. Applications such as hybrid testing and hardware-in-the-loop testing are potentially very powerful but put severe constraints on the simulation performance. Complex physical environments can be taken into account as they are without any approximation. Verifying and fine-tuning controlled systems and optimizing the overall control-plant system becomes feasible. Combining selected measurements with simulation models furthermore allows deriving “virtual sensor” test data which cannot be measured or which otherwise would require extensive and expensive testing. Applications are multifold, ranging from load and internal variables identification to model-based monitoring. Models that can run in a real-time environment and still maintain associativity with the design parameters pose however a huge challenge. Research on model reduction, equivalent models and high-performance computing platforms interacts with the classical structural dynamics approaches.
Designing proper tests with all observability and controllability issues becomes more important than ever, opening the way to incorporating testing and test design in the upstream and design and systems engineering methodology. Central to many of these new approaches is the evolution from test supported simulation to simulation based testing.

Combining testing and simulation hence goes far beyond the traditional validation-updating paradigm, opening many new and promising routes but also putting forward a number of major research challenges to address in the coming years.

**Biography**

Herman Van der Auweraer holds an MSc (1980) and PhD (1987) from KU Leuven (Belgium). In 1986, he joined LMS International, one of the earliest spin-offs of the KU Leuven, developing advanced testing and simulation tools for product design engineering. Since January 2013, LMS became part of Siemens. Renamed Siemens Industry Software (SISW), it constitutes the “Simulation and Test” Business Segment of the Siemens PLM Software Business Unit. Herman is Director Global Research at SISW, responsible for the definition and implementation of the technology strategy, involving the definition of strategic research programs, IPR policies and the participation to international research initiatives. His personal research interests include advanced signal processing, system identification, noise & vibration and mechatronics simulation, the results of which have been shared through a large number of conference presentations and journal papers. Recent research activities include the study of the vibro-acoustic performance of low-emission vehicles including those with electric powertrains, the development of a model based system engineering approach for designing complex and/or mechatronic systems and the integration of testing and modeling in a virtual sensing approach. Herman is furthermore responsible for cooperation with universities and research institutes with a particular interest in technology transfer, translating academic findings into industrial applications and inversely, using application practice to steer academic research into directions of strategic relevance. He regularly participates in PhD Committees and teaches seminars in various university and industry programs in Belgium and abroad. He is affiliated as part-time professor at the Mechanical Engineering Department of the KU Leuven teaching a course on advanced vibro-acoustic analysis methods. He is active in sectorial, regional and EU organizations involved with innovation and is member of the board of Leuven Inc, the KU Leuven spin-off organization. In 2013, he was awarded the Doctor honoris causa of the Technical University of Cluj-Napoca in Romania.