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ADVANCED MODELLING OF DYNAMICAL EFFECTS IN ELECTRO-MECHANICAL SYSTEMS

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ABSTRACT

The dynamics of electromechanical systems is a classical source for coupled problems stemming from the interaction of mechanical, electrical, and electro-magnetical sub-systems. Typical coupling effects range from magnetic and electrical forces to constitutive behavior due to piezo-effects or magnetostriction. Applications range from MEMS, sensors, actuators, and energy harvesters over electric motors (e.g. in e-mobility applications), to large switches in electric power grids. Moreover, many modern applications involve power-electronics and thus additional sources of dynamical excitation, e.g. due to PWM-signals, additional super-harmonics, etc.

Holistic models of such dynamics must account for highly dynamical, nonlinear multiphysical effects on different time and length scales - and must on the other hand be able to predict the dynamics over long time horizons. Thus, integrated modelling approaches as well as efficient numerics are crucial.

Advancing this field the proposed session shall gather researchers from mechanical, electrical, and mechatronical engineering, as well as experts from industry to share their knowledge on this topic. As a non-exhaustive list of potential topics and applications we propose:

- Advanced systems' modelling with special focus on electro-mechanical interactions including aspects of control and power electronics.
- Approaches may be based on first principles (e.g. coupled Multi-Body Dynamics & FEM, circuit models, etc.), as well as on data-driven methods or hybrid combinations.
- Applications may address machine dynamics and acoustics of electric motors, actuators, power switches, electro-mechanical damping, MEMS, …
- Interactions of power electronics and electromechanical dynamics, including acoustic emissions due structural vibrations stemming from power electronics