Special Session on Digital Technologies and AI Solutions for Electromechanical and Power System Applications

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Abstract

Digitalization is the key to fighting climate change and achieving the objectives of the European Green Deal, while contributing to the green energy transition, energy efficient buildings, sustainable transportation and industrial digital transformation. Digital technologies and Artificial Intelligence (AI) solutions can deliver operational efficiencies and reduced costs in many industries, enable the development and implementation of smart energy/transport/building systems and components, increase the connectivity of people and systems.

In electromechanical systems (EMS), performances prediction, as well as parameter estimation and environmental impact evaluation along the whole lifecycle of a component or system represent some of the main challenges to be faced and answer. The trade-off between accuracy and computational time and effort, under the pressure of the sustainable development and circular economy principles limits the application of standard analytical and numerical methods used in the design, analysis, modelling and testing of electromechanical systems and components. Recently developed algorithms based on AI, could overcome the existing trade-off. Physics-based models are hindered by the uncertainties arising from the complex constitutive behavior. Data-based models are limited by the amount of data available relative to the model complexity. The learning of system behavior as well as that of optimal strategies and decision-making will need to be based on heterogeneous data as well as constitutive model information from science domains. AI for engineering systems will need to integrate and balance the effective use of these resources. In addition, it should actively maintain models of systems behavior and optimal strategies, as well as provide learning strategies. On another side, digitalization is the next big thing in clean energy transition, and digital technologies will be indispensable along the way. Solution like digital twin, flexible and adaptable AI and digital technologies for different energy sources and loads integration in smart grid, interconnection and interoperability digital platforms, AI-based demand energy management, advanced business models for scaling-up and market replication can be developed and adopted to help operators, customers, owners gain the full picture of their facilities and increase the efficiency of energy systems and of their components.

Special Session Topics

- ✓ Flexible and adaptable AI & digital solutions for renewable-based electrical energy sources, storage, and smart household and building equipment and devices integration in smart building, houses and nanogrids
- ✓ AI-based demand side management (DSM) architecture based on virtual energy community and living labs in compliance with the national and European regulations and markets
- ✓ AI-based electrical machines and drives (design, analysis, control, testing)
- ✓ Data driven condition monitoring and predictive maintenance in EMS