Cyber-Physical Energy Systems Modeling, Test Specification, and Co-Simulation Based Testing

The gradual deployment of intelligent and coordinated devices in the electrical power system needs careful investigation of the interactions between the various domains involved. Especially due to the coupling between ICT and power systems a holistic approach for testing and validating is required. Taking existing (quasi-) standardised smart grid system and test specification methods as a starting point, we are developing a holistic testing and validation approach that allows a very flexible way of assessing the system level aspects by various types of experiments (including virtual, real, and mixed lab settings). This paper describes the formal holistic test case specification method and applies it to a particular co-simulation experimental setup. The various building blocks of such a simulation (i.e., FMI, mosaik, domain-specific simulation federates) are covered in more detail. The presented method addresses most modeling and specification challenges in cyber-physical energy systems and is extensible for future additions such as uncertainty quantification.

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