Modeling of SOFC System and Development of Real-time Emulator

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In this study we develop a system-level model of Solid Oxide Fuel Cell (SOFC) system and construct a real-time emulator of the system, which is used to design the controllers and operation logics.

The SOFC system consists of a fuel cell stack and Balance-Of-Plant (BOP) components, which include heat exchangers, pre-reformers, after-burners, steam generators, pumps and blowers. In this study, each component is developed separately on the basis of material/energy balance equations and electrochemical equations. And then the whole components are integrated into a single system model.

Based on the system model, a real-time emulator is constructed and several virtual experiments are conducted. With the experimental results, dynamics of the system is analyzed and controller for this system is designed.