Electrical/Computer Engineering Design Project Proposal

Title: Embedded Fuel Cell Simulator

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Description

This project targets the design and development of a fuel cell simulator. The objective is to successfully reproduce the electrical steady and dynamic behavior of a configurable fuel cell stack. A conceptual block diagram of the system is presented in Fig. 1, where 3 components can be identified: numerical processor of the dynamic system, communication interface, and high bandwidth power amplifier.

The system should include a software user interface to allow the selection of the number of cells in series and the main parameters for each cell. A computer model of the single cells should calculate the output voltage of the selected stack configuration as a function of the effective area and loading condition. The high-speed communication interface is responsible for sharing information between the external hardware (programmable power supply) and the processor to reproduce the electrical behavior of the FC stack.



Fig 1: Conceptual block diagram of the Embedded Fuel Cell Simulator

Roles

The proposed project requires a team of 3 students (Electrical or Computer Engineering). The team will be responsible for coordinating the tasks and ensuring the successful integration of the system.

Member #1

Systems modeling and user interface designer. Responsible for designing a computer based simulation platform to model the electrical behavior of a fuel cell, including the effective area of the cell and number of cells in series. Design a user-friendly interface to configure, scale-up, and monitor the status of the simulator system. Implement and organize case scenarios and generate combination of scenarios.

Member #2

Embedded system developer. Responsible for designing and developing a real-time high-speed communication channel between the computer and the external hardware. Establish a robust communication protocol, store information in a memory, and perform precision D/A and A/D conversion. Program numerical methods to compute the behavior of the dynamic system in real-time.

Member #3

Embedded system developer. Responsible for integrating a high-bandwidth power amplifier and protections. Develop a strategy to control the apparent output power and create peak current protections. Integrate the power amplifier with the rest of the system.