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An approach for Fuel Cell Balance of Plant design and its electronic control for modular flexibility

M. López[1], F. Loyola[1,*], U. Cano[1]

[1]Instituto de Investigaciones Eléctricas. Reforma 113, Col. Palmira, Cuernavaca, Morelos, México, 62490.
Tel: +527773623811; e-mail: felix.loyola@iie.org.mx

ABSTRACT

A fuel cell stack operating for a specific application needs a particular additional stage for its control and instrumentation known as balance of plant (BoP). In this work, the design of a BoP and its electronic control for a fuel cell stack is proposed. The main components in a BoP are typically sensors and actuators. The sensors acquire electronic signals to know system parameters such as: temperature, voltage, electric current and hydrogen gas pressure. Actuators on the other hand, drive actions on process elements, such as turning on or turning off input/output valves. Also, they manage velocity of oxidant gases and cooling fans.

The approach in the BoP design and control proposed in this article resides in the versatility approach used for fuel cells with potentially different electric power capacity. This is possible by changing a minimum of electronic components. The BoP design also is includes a communication port where a graphic interface is connected to monitor and change operating parameters of the fuel cell stack. Moreover, with a master control is possible to connect more than one fuel cell stack providing flexibility for modularity. This configuration allows varying the power plant capacity. In this work the BoP and electronic control of a four stack system is developed, where each stack has a 750 watts capacity to supply electric power in a hybrid all-electric utility vehicle.

Keywords: Balance of plant; Control; Fuel Cells.