Stochastic model of wind-fuel cell for a semi-dispatchable power generation

Hybrid systems are implemented to improve the efficiency of individual generation technologies by complementing each other. Intermittence is a challenge to overcome especially for renewable energy sources for electric generation, as in the case of wind power. This paper proposes a hybrid system as an approach for reducing and overcoming the volatility of wind power, by implementing storage technology, forecasts and predictive control. The proposed hybrid system, which is suitable for the distributed generation level, consists of a wind generator, an electrolyzer, hydrogen storage and a polymer electrolyte membrane fuel cell, which are embedded in one complete system with the wind power. This study uses historic wind speed data from Mexico; the forecasts are obtained using the recursive least square algorithm with a forgetting factor. The proposed approach provides probabilistic information for short-term wind power generation and electric generation as the outcome of the hybrid system. A method for a semi-dispatchable electric generation based on time series analysis is presented, and the implementation of wind power and polymer electrolyte membrane fuel cell models controlled by a model predictive control approach is developed.

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