NSGA-II Optimized Multiobjective Predictive Energy Management for Fuel Cell/Battery/Supercapacitor Hybrid Construction Vehicles

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Fuel cell/battery/supercapacitor hybrid vehicles have shown good prospects. Energy management strategies (EMSs) are proposed to solve the complex energy management issues associated with the fuel cells/batteries/supercapacitors of construction vehicles, and to optimised economy and performance. Here, we develop a multiobjective predictive EMS. In the predictive control framework, a non-dominated sorting genetic algorithm (NSGA-II) enhances fuel cell and battery durability while minimising economic cost. NSGA-II optimises cost functions in real-time and generates a Pareto front, the data of which are screened by fuzzy logic algorithm to obtain optimal control solutions. Simulations indicated the superior feasibility and effectiveness of our proposed EMS compared to conventional benchmarks. The EMS ensures that fuel cell/battery/supercapacitor hybrid construction vehicles not only receive adequate power under complex working conditions, but also reasonably distribute the power demand among fuel cells/batteries/supercapacitors; this extends the lifespan of these devices and ensures high efficiency.

Keywords: fuel cell; hybrid system; energy management; model predictive control; multiobjective optimization.

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