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Optimization of a Low-Voltage Load Switch for a Smart Meter Based on a Double Response Surface Model

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Abstract: The existing electric energy meter load switches have issues such as a low electrical life, poor resistance to short-circuit currents, high contact point resistivity and severe heating. Research has thus been conducted on the optimization of the electric energy meter built-in load switch mechanism to establish a double response surface model for the electromagnetic attractive force and reed reaction force. The model introduces a niche fitness sorting strategy and a Gaussian mutation mechanism that are based on the standard particle swarm algorithm and form an improved multiobjective particle swarm optimization algorithm in which the static attractive force is regarded as the optimization objective. The multi-objective optimization of the structural parameters of the electromagnetic system and the reed system was carried out, and the optimization results were applied in the devices' design and implementation. The new structure improves the electromagnetic suction and reed force at the suction position. And the results from simulation show that the proposed method exceeds that of the back propagation neural network method in achieving the optimization goal and the new structure can effectively improve the performance of meter built-in load switch by avoiding the recoil phenomenon.

Keywords: Electric energy meter; Load switch; Double response surface model; Particle swarm algorithm; Optimization