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Abstract
A probability-based model is proposed to simulate the hourly solar irradiation under different solar orbit/angle and meteorological information using daily solar irradiation as input. The instantaneous value of hourly solar irradiation can't reflect completely the temporal variability of meteorology. The model deals with meteorological uncertainty of photovoltaic generation by using fuzzy number, instead of binomial random number for cloudiness and constant for temperature implemented by the conventional probabilistic solar irradiation method. Fuzzy arithmetic is conducted to derive the intervals of current for photovoltaic generation. Three cases were tested and the results with feasible current intervals achieve the proposed model.
The fuzzy reliability index describing loss of load hour is developed to increase the capability of probabilistic reliability index. The optimal capacity of battery can be decided by the proposed index to match the installation of photovoltaic generation under different load. With uncertain load, the distribution of fuzzy reliability index for photovoltaic generation was well assessed to show its feasibility. The arithmetic algorithm of fuzzy loss of load hour subjecting the characteristics of "fuzzy comparison" and "interval operation" are also detailed analyzed by several operators and simulation methods. The results show a high accuracy, and the proposed fuzzy reliability index can be achieved by its feasibility comparing with the probability index.
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