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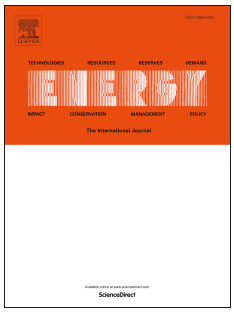

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Probabilistic Operation Cost Minimization of Micro-Grid

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Abstract—In recent years due to the increasing integration of Renewable Energy Sources (*RES*) into the Micro-Grid (*MG*), necessity of Battery Energy Storage (*BES*) has increased quickly and size of *BES* plays vital role in this regard. Present paper aims to minimize total operation cost of *MG* in presence of *BES* of optimal size, by considering uncertainties present in the *MG*. Here, 2*m* point estimate method (PEM) has been applied to model the uncertainties in load demand, market prices and available power from *RES* in the *MG*, as it is computationally efficient and reliable probabilistic method. Moreover, Gram-Charlier expansion is used to provide more accurate probability distribution of *MG* operation cost. Classical techniques may be applied here to solve the problem, but these techniques may increase complexity of the problem and hence may affect the accuracy. As evolvement of soft computing techniques are not restricted by the complexity of system model, therefore Swine Influenza Model Based Optimization with Quarantine (SIMBO-Q) and Whale Optimization Algorithm (WOA) have been applied here to minimize operation cost of *MG*. Simulation results obtained by SIMBO-Q and WOA prove the effectiveness of the algorithms. Here incorporation of *BES* of optimum size reduces operation cost of *MG* effectively.

Keywords:- Distributed Generation; Micro-Grid; Uncertainty; Battery Energy Storage; Swine Influenza Model Based Optimization with Quarantine; Whale Optimization Algorithm

Nomenclature:

Indices:

PV, WT	indices of Photo-Voltaic (*PV*) and Wind Turbine (*WT*) respectively
MT, FC	indices of Micro-Turbine (*MT*) and Fuel Cell (*FC*) respectively
BES, grid	indices of Battery Energy Storage (*BES*) and grid respectively

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