Open Invited Track

Advanced Evolutionary Computation for Operation and Planning in Distribution Networks

Proposed by

Hiroyuki Mori
Dept. of Network Design, Meiji University
Nakano-City, Tokyo 164-8525, Japan
E-mail: hmori@meiji.ac.jp

Hirotaka Takano
Dept. of Electrical, Electronic and Computer Eng., Gifu University
Gifu 501-1193, Japan
E-mail: takano@gifu-u.ac.jp

Submission Code: **h29pm**

IFAC technical committee for evaluation: TC 6.3(Power & Energy)

Abstract

This open invited track provides new methods for distribution network operation and planning with Advanced Evolutionary Computation. In recent years, distribution networks are faced with a lot of uncertainties due to the emergence of Renewable Energy, EV Charging/Discharging, Power Markets, and DR under Smart Grid circumstances. As a result, distribution network operation and planning become much more complicated so that the mathematical formulations result in nonlinear optimization problems with uncertainties. Evolutionary Computation repeatedly makes use of simple rules or heuristics to evaluate highly approximate solutions to a global minimum in nonlinear optimization problems. However, the conventional Evolutionary Computation algorithms such as PSO (Particle Swarm Optimization) and its variants do not necessarily provide good solutions due to the influence of the initial solutions on the final ones in power systems. There is still room for improvement in solution accuracy. Thus, it is necessary to develop the Advanced Evolutionary Computation algorithms which are better than PSO and its variants. Also, well-thought-out approaches are required to deal with the uncertainties.

Detailed description

This track provides new approaches that apply Advanced Evolutionary Computation to distribution network operation and planning. In recent years, renewable energy（RE）has been introduced into distribution networks to reduce carbon dioxide, but the emergence has brought about uncertainties to distribution networks because the generation output is affected by weather conditions. Additionally, there exist other uncertainties such as electricity prices in power markets, load variations, demand response (DR), electric vehicle (EV) charging/discharging, *etc.* As a result, distribution network operation and planning become much more complicated. To overcome the challenges, new methods are required to deal with distribution networks with uncertainties. This track focuses on Advanced Evolutionary Computation algorithms that are effective for solving nonlinear optimization problems in distribution network operation and planning. Evolutionary Computation is defined as one of the optimization methods which repeatedly makes use of simple rules or heuristics to evaluate highly approximate solutions to a global minimum. However, the conventional Evolutionary Computation algorithms such as PSO (Particle Swarm Optimization) and its variants do not necessarily provide good solutions due to the influence of the initial solutions on the final ones in power systems. There is still room for improvement in solution accuracy. Thus, it is necessary to develop the Advanced Evolutionary Computation algorithms which provide better solutions than PSO and its variants, where by Advanced Evolutionary Computation, we mean high-performance Evolutionary Computation algorithms which are robust for a set of initial solutions in a sense that the obtained solutions are better while the dispersion of the solutions is small for a set of initial solutions. Also, well-thought-out approaches are required to deal with uncertainties. Advanced Evolutionary Computation efficiently allows decision makers to evaluate optimal solutions in distribution network operation and planning. It is challenging to develop new Advanced Evolutionary Computation techniques in distribution network operation and planning. Thus, this track is calling for papers with the following topics:

- Distribution automation with Advanced Evolutionary Optimization
- Loss Minimization with Advanced Evolutionary Optimization
- Network reconfigurations with Advanced Evolutionary Optimization
- State estimation with Advanced Evolutionary Optimization
- Voltage and reactive power control with Advanced Evolutionary Optimization
- Distribution network expansion planning with Advanced Evolutionary Optimization
- Active distribution networks with Advanced Evolutionary Optimization
- Optimal □PMU allocation with Advanced Evolutionary Optimization
- Applications of D-FACTS to distribution network operation with Advanced Evolutionary Optimization
- Optimal scheduling of EV charging/discharging with Advanced Evolutionary Optimization

• Probabilistic or Stochastic methods for Distribution automation with Advanced Evolutionary Optimization
• Risk minimization techniques with Advanced Evolutionary Optimization
• Robust optimization for distribution automation with Advanced Evolutionary Optimization
• Parallel or distributed scheme of Advanced Evolutionary Optimization for distribution network operation and planning
• Multi-objective Advanced Evolutionary Computation for distribution network operation and planning
• Optimization of Local Markets with Advanced Evolutionary Optimization, etc.

Link to a web page

https://hmori2911.wixsite.com/tc6-3-oit