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Title : Computational Intelligence Based Technique for Solving Economic Dispatch Problem

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Electrical industry is no longer seen as a service to fulfill electrical requirement. Nowadays, the industry is more on business, and the utilities seek profits through efficient energy generation and supply. In order to maximize profits, the energy providers or utilities conduct economic load dispatch (ELD) process, where energy is feasibly generated and delivered to satisfy consumers' needs. However, the method is restricted by several constraints that cause challenges in providing satisfying energy dispatch. Therefore, this research proposes a new computational technique termed as Differential Evolution Immunized Ant Colony Optimization (DEIANT) as an approach to solve the complex economic dispatch process. DEIANT is developed through hybridizing Ant Colony Optimization (ACO), Differential Evolution (DE) and Artificial Immune System (AIS) together. The coding were written in MATLAB (Matrix Laboratory) software. The development of DEIANT technique is consequently utilized to solve ELD, which is performed on IEEE 30, 57 and 118 Reliable Test Systems (RTS). These test systems are also used to perform the study for the whole research. New economic emission dispatch (EED) solving techniques termed as pollutant-based and fuel-based EED have been consequently developed. This is to address the emission release during energy producing process. For this study, three fossil-fuels namely petroleum, coal, and natural gas are highlighted. These fossil-fuels combustion produces different pollutants including carbon oxides (CO_X), sulphur oxides (SO_X), and nitrogen oxides (NOx). The pollutant-based EED determines the type and level of the pollutants. On the other hand, fuel-based EED determines the emission level based on the type of fuel consumed by a particular generator. DEIANT is utilized as the optimization engine to minimize the emission level. Combined load-emission dispatch (CLED) technique, which combines ELD and EED simultaneously is proposed. Multi-objective approach is used to solve the CLED through the implementation of weight-sum technique. This approach allows utilities to create trade-off relations or preferences between the operating cost and emission level. DEIANT technique is also utilized to optimize the operating cost and emission level. Next, this research proposes fuzzy logic multi-fuelled dynamic economic load dispatch (FzMF-DELD) to solve multi-fuel selection process. Multi-fuel selection occurs on generators that consume more than one type of fuel. However, different level of output power requires different type of fuel. FzMF-DELD uses fuzzy logic to select the suitable fuel based on the fuel price and required output power. This technique is proven to provide better fuel-selection as compared to conventional piecewise fuel-selection method. DEIANT is utilized to optimize the operating cost and emission level based on the selected fuel. Based on the comparative studies between DEIANT, ACO, PSO, and EP, it is revealed that the proposed optimization technique is superior and more reliable in terms of computing lower operating cost, emission level, power loss, and computation time.