

University of Baghdad	
Department	Electrical Engineering
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Thesis Title	A Real-Time Fuzzy Flow and Contingency Analysis Based on Gaussian Distribution System
Year	2014
Abstract	<p>This thesis explored and solved most issues relating to load (power) flow analysis under different loading and contingent conditions. The solution of the load flow problem and contingency analysis are some of the most essential items in power system operation, planning and control. In addition to the increasing loading and due to the complex nature of power generation, transmission and distribution systems, problems related to voltage instability and voltage collapse received a wide interest.</p> <p>Recent studies show that the voltage collapse and instability are associated with the multiple load flow solution problem due to the nonlinearity of the algebraic simultaneous equations of the load flow problem. Thus, the search for methodologies for solving the multiple load flow solution problem and the presence of local and global optima solutions in addition to finding them numerically is important.</p> <p>This thesis presented robust minimization method for solving the load flow problem and contingency analysis in on-line applications. Because the electrical power networks are complicated systems, traditional (numerical) minimization methods may encounter difficulties in solving the load flow problem and contingency analysis due to nonlinearity, singularity, non-convexity, continuity, and/or non-differentiable properties of the problem. Also, they are not efficient for real-time load flow solution of large power systems and for real-time contingency analysis and security assessment.</p> <p>Thus, the fuzzy logic applications represented by the fuzzy load flow (FLF) and fuzzy contingency analysis (FCA) methods share the best selection in-stead of the traditional methods because the artificial intelligence (AI) methods do not use the characteristics of the problem to determine the next sampling point.</p> <p>The obtained results are very accurate with outstanding computation time, which made the FLF suitable for real time application. In addition to these features, the FLF also able to solve load flow problem of ill-conditioned power system and contingency analysis efficiently. The FLF method using Gaussian</p>

	<p>membership function requires less number of iterations and less computing time than that required in the FLF method using triangular membership function, its alternative solution methodology is simpler and faster than some AI and traditional methods.</p> <p>All the obtained results show that the computation time of the Fuzzy Load Flow (FLF) is less than the Fast Decoupled Load Flow (FDLF). Using sparsity technique for the input sparse matrix data without complicating the algorithm's programs gives reduction in overall computation time and storage requirements.</p> <p>The contingency ranking process by calculating the active power and voltage performance indices (PIP and PIV) are required for real power problems and voltage problems respectively for two typical test systems being the IEEE 14-bus and 30-bus systems. The performance of the used methods was tested on two typical test systems being the IEEE 14-bus and 30-bus systems in addition to the 362-bus Iraqi National Grid.</p>
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