# Voltage Stability Assessment of Multi-machine Power Systems using Energy Function and Neural Networks Techniques

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**Abstract**

Voltage stability problems have been one of the major concerns for electric utilities as a result of heavy loading of power system. Steady state voltage stability analysis is effectively used to determine a stability margin that shows how close the current operating point of a power system to the voltage collapse point. This article presents a generalized energy function for voltage stability assessment of multi-machine power systems. The formulated energy function provides an excellent indicator of the system vulnerability to voltage collapse. It is, also, used to rank the system buses according to their contributions to voltage collapse. The proposed technique is applied to a test system and Ontario-Hydro real power system. Also, an investigation on the application of artificial neural networks (ANN) in voltage stability assessment has been developed. A multi-layer feed-forward ANN with error back-propagation learning algorithm is proposed for calculation of voltage stability margins (VSM). Extensive testing of the proposed ANN-based approach indicates its validity for determination of power system voltage collapse.

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