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(57) Abstract :
Voltage instability and collapse have catastrophic effect on modern life, with long outage of power and disruption of important services. For many years, research works have been directed towards finding ways to predict impending voltage collapse and to adopt appropriate control actions to avert the same. System protection schemes (SPS) have been implemented in many countries worldwide to handle voltage instability associated with power system disturbances and contingencies. The strategies are often based on reactive power compensation and load curtailments. Individual loads that are dispensable in the short-term can be curtailed with minimal consumer disruption, though at the cost of significant revenue loss for the power utility. Reactive power compensation, on the other hand requires additional capital investment and optimal sizing, location and control of these compensating devices is a challenge. The paper proposes the use of static capacitor bank and non-disruptive load control for improving voltage stability based on model predictive control (MPC). MPC uses trajectory sensitivity analysis to predict system's dynamic behaviour over a finite horizon. Control decisions are based on optimizing the size of capacitor bank and minimizing the load-disruption to stabilize the voltage. The discrete control strategy takes care of the inaccuracies in predicted voltage behaviour at the next control step. Voltage collapse prevention in heavily loaded IEEE 30 bus system has been used to illustrate the effectiveness of the control strategy.

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