Abstract

The penetration of renewable energies is challenging network operators in terms of planning, operation, and control of the power system. They introduce new dynamics, which require the adaption of modeling and simulation methods of the network, in order to cope with these challenges. The traditional modeling and simulation of quasi-stationary grid states, using classical static phasors should be revised in the context of modern power systems, due to the new dynamics. In the scope of large scale dynamic simulations, such as large signal rotor angle stability or transient stability, it is important to guarantee high computational efficiency, and at the same time to deliver accurate results, in order to realistically assess system security. For this matter, Static Phasors are compared in transient stability studies to the alternative modeling technique of Dynamic Phasors, which is based on shifted frequency analysis. Dynamic Phasors incorporate more dynamics into the models, while at the same time responding to the high computional requirement of large scale studies, by allowing large step sizes. The accuracy comparison of the two modeling approaches for transient stability analysis is carried out, in classic and low inertia system configurations, for two test systems, a SMIB and a three bus system. The simulation's step size is taken into account as a performance indicator. Besides, the evaluation is conducted for the critical clearing time and the accuracy of rotor angle transients, which are considered the variables of interest in transient stability. The results support the usage of Dynamic Phasors in transient stability analysis, both for classic and low inertia systems. At the same time, the limitation of Static Phasor for low inertia systems is demonstrated.

Keywords: Power System Modeling, Power System Simulation, Dynamic Phasors, Transient Stability Analysis, Low Inertia