Abstract

All power systems are prone to electromechanical oscillations between generators which can become unstable under certain conditions. This instability can have catastrophic consequences such as plant damage or loss of power supply and it is therefore important to monitor these oscillations and ensure that the risks are mitigated through corrective operational actions or automatic control. Whilst this behaviour can be observed in a generators' terminal voltage phase and magnitude, the internal rotor angle (load angle) of a synchronous machine is useful for understanding the true severity and interaction of electromechanical oscillations in a power system. Both the Chinese and IEEE PMU standards mention a proposed method of measuring the rotor angle directly using a phasor measurement unit (PMU) on the machine terminals and a KeyPhasor measurement system [1,2]. KeyPhasors are usually installed on the turbine of large synchronous machines as an aid to vibration monitoring. Whilst this measurement method is mentioned in these standards, little is currently documented around its physical implementation and accuracy. This research aims to evaluate the viability of such a method within both simulation and laboratory environments. Laboratory tests using a miniature synchronous generator and typical relay techniques were executed and the results proved positive, but exposed challenges around the sampling resolution of the KeyPhasor signal. A simulation environment was then used to improve these results and a sufficient method of mitigating the resolution issue was proposed with accurate results to prove this method. The rotor angle produced yields an error of around *±0.03°,* which is well below the TVE requirement of *±0.573*° as per the IEEE C37.118.1-2011 standard.