Analysis of Subsynchronous Resonance Using Neural Networks

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Abstract

Artificial Neural Networks (ANNs) are being advantageously applied for power system problems. They possess the ability to establish complicated input-output mappings through a learning process, without any explicit programming. In this paper, two ANNs for Subsynchronous Resonance (SSR) analysis are presented. The designed ANNs measure the possibility of SSR occurrence. The effectiveness of this approach is tested by experimenting it on the first bench mark model proposed by IEEE Task Force on SSR. I. INTRODUCTION Series capacitor compensation is employed in electric power systems to raise the power transmission limit of long EHV lines. This, however, may lead to the phenomenon of subsynchronous resonance (SSR) [1-2]. SSR occurs when a natural frequency of a series compensated transmission system aligns with the complement of one of the torsional modes of turbine-generator [3-5]. This happens at sub-synchronous frequencies. Under such circumstances, the turbine-generator oscillates at a frequency corresponding to the torsional mode frequency, and unless corrective action is taken, the torsional oscillations can continue for a long time and may result in the failure of the turbine-generator shaft [6-8]. There are several countermeasures proposed in the literature to avoid such a condition like torsional motion relay, armature current relay, static block filter and generator circuit series reactance [9-12]. Eigenvalue analysis is computationally intensive and the modeling complexity required for this method of analysis is quite high. Hence, it is necessary to design effective technique for eigenvalue analysis for the study of SSR which could avoid the conventional computation of eigenvalues and alleviate the modeling complexity as well. Note that there are two modes of oscillations corresponding to the electrical network one in subsynchronous range and the other in supersynchronous range; we only interested with the subsynchronous range. In this paper, two multi-layer feed forward ANN's are presented and used to detect and analyse the SSR conditions .

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