Description for the General Public

The ever-increasing demand in electric power industry has made modern power systems usually operating close to stability limits. Stability problems may not occur frequently in practice, but when they do, their influence would be catastrophic. Thus, power system stability assessment plays an important role in determining the system operating limit and operating guidelines, and has been recognized as one of the most important problems in power engineering research. Traditionally, transient stability has been the dominant stability problem for most systems, and has been the focus of much research interest. Transient stability refers to the ability of an electric power system, given an initial operating condition, to remain synchronism after being subjected to a large physical disturbance, such as loss of a load, or loss of a generator just to name a few.

There are two approaches for the transient stability analysis. The first one is through step-by-step computer simulations, in which a large number of mathematical and algebraic equations are solved. However, this approach is time-consuming and not feasible for intermediate decisions taken at the industrial application. On the other hand, another approach uses the computer simulated data base as a training data set, and use artificial intelligence/ machine learning methods to build up models that are to predict future occurrences. This is the approach we are taking in our research. Our previous work have implemented various linear models solved by the celebrated Lasso algorithm. Our proposed research project is to examine more advanced techniques of machine learning methods in the context of large-scale power systems. With the aid of machine learning algorithms, at the instance when the transient instability event occurs, the industrial operator will get an idea how long it takes before the system regains synchronism, and make an judgment whether this fault is stable or not. In the case when a transient instability event occurs, part or the whole of the entire power system may run into a black-out. Therefore an early stage alarm can prevent that by isolating that part of the power system from the rest. Therefore better prediction of the transient stability problem can potentially save tens or hundreds of millions of dollars for the power industry.