Oleksandr KYRYLENKO, Oleksandr BUTKEVYCH, Volodymyr CHYZHEVSKYI

Institute of electrodynamics of NAS of Ukraine

About one approach to monitoring of Interconnected Power System operational condition parameters

Abstract. *One approach to solving of the most urgent problem of monitoring of Interconnected Power System operational condition parameters consists in the detection of the threat to Interconnected Power System in the form of oscillatory instability is considered.*

Keywords: power system operational condition, monitoring, low-frequency oscillation, Phasor Measurement Unit

Introduction

The detection of the threat to Interconnected Power Systems (IPSs) in the oscillatory instability form is the urgent problem the solution of which can be achieved at the IPSs control centers by processing of information provided by modern Wide Area Measurement Systems (WAMSs), the main components of which at the object level are Phasor Measurement Units (PMUs).

An onset of low-frequency oscillations of IPS operational condition parameters can leads to the IPS oscillatory instability. That is why in the world practice to damp the low-frequency oscillations of IPS operational condition parameters the power system stabilizers (PSS) as well as some other means including some of the Flexible AC Transmission Systems the functional capabilities of which are not restricted with low-frequency oscillations damping are used. And with it, according to the data, for example, given in [1], the duration of low-frequency oscillations in IPSs can be significant that enables the dispatch staff to undertake the necessary operations in order to prevent the IPS oscillatory instability.

For this purpose it is necessary not only to process on-line the measurements received from PMUs, but also to define off-line in advance the composition of corresponding groups of generators and their role in the occurrence of such oscillations [2, 3] in order to prepare precise instructions about the operations in such situations and to provide the dispatch staff with it.

In order to detect a threat of IPS oscillatory instability one approach to dynamic information extraction from PMU measurements is presented below.

Processing of PMU measurements related to monitored cutset of IPS

The analysis of PMU measurements concerns, first of all, the modes which characterize the antiphased oscillations on corresponding eigenfrequencies of IPS of some groups of generators (let us denominate such modes and corresponding eigenfrequencies as dominant). An onset of low-frequency oscillations of IPS operational condition parameters is not always caused by occurrence of emergency disturbances. In case of the amplitude increase of such oscillations the cutsets of IPS monitored by dispatch staff become the most sensitive. As the increase of the oscillation amplitude of IPS operational condition parameters is conditioned with the increase of the "contributions" of low-frequency dominant components, than the detection and the control of a "specific weight" change of such low-frequency components of IPS operational condition parameters' oscillations in the time intervals, the length of which meets the conditions of quasistationarity of IPS processes should be secured.

The results of the investigations indicate that for reliable solution of indicated problem it is expedient to apply different information handling procedures, using preliminary filtration of received from PMU data, determination of the frequencies of dominant oscillation components of IPS operational condition parameters, determination of "contributions" of low-frequency components in relative units bringing them to the basic component of oscillations (50Hz). The usage of running window with the width of 1 second and the sampling frequency of 200Hz give an opportunity either to fulfil the conditions of process quasistationarity and to determine all hypothetically possible dominant modes. The "parallel" usage of several methods gives an opportunity to control not only the "dynamic" of amplitudes of dominant modes but also the "dynamic" of their frequencies, ensuring the reliability of the solution of this monitoring problem.

REFERENCES

[1] Arango O.J., Sanchez H.M., Wilson D. H. Low Frequency Oscillations in the Colombian Power System – Identification and Remedial Actions, *2010 CIGRE Session*, Paper C2-105

[2] Butkevych O.F., Bulanaya V.S., Rybina O.B., Chyzhevskyi V.V., Experimentally-model researches of the power systems' dynamic behavior, (ukr.), *Subject Issue of Tekhnichna elektrodynamika* „The problems of present-day electrical engineering", 2008, Part 4, 37-40

[3] Butkevych O., Kyrylenko O., Power system operation control based on synchronized phasor measurements, *Przegląd Elektrotechniczny*, R. 85 NR 4/2009, 77-79

[4] Butkevych O.F., Problem-oriented monitoring of the IPS operational conditions of Ukraine, (ukr), *Tekhnichna electrodynamika*, 2007, No. 5, 39-52

Authors: *Member of NAS of Ukraine Oleksandr Kyrylenko, Institute of electrodynamics of NAS of Ukraine, av. Peremohy 56, 03680 Kyiv, E-mail: kyrylenko@ied.org.ua.*

Prof., Dr. Sc. (Eng.) Oleksandr Butkevych, Institute of electrodynamics of NAS of Ukraine, av. Peremohy 56, 03680 Kyiv, E-mail: butkevych@ied.org.ua;

Master Volodymyr Chyzhevskyi, Institute of electrodynamics of NAS of Ukraine, av. Peremohy 56, 03680 Kyiv

E-mail: vchizh@bigmir.net