MODELING OF DISTURBANCE IN INTERCONNECTED POWER SYSTEM

Ing. Milan KRÁTKÝ, Doctoral Degree Programme (2)
Dept. of Power Electrical and Electronic Engineering, FEEC, BUT
E-mail: xkratk05@stud.feec.vutbr.cz

Supervised by: Dr. Evžen Haluzík

ABSTRACT

This paper deals with computer simulation of extensive disturbance from November 19th 2004. This disturbance was arisen on border profile Moravia-Poland. There is introduced compare simulation with real measurement on border profiles, which were most hit by the disturbance. The introduction of this paper deals with structure of the European interconnected system. The characteristic of interconnected power systems on the area which is important for the simulation of disturbance is included in this paper.

1 DESCRIPTION OF EUROPEAN INTERCONNECTION SYSTEMS

Nowadays, there are several synchronously live working areas on the continent of Europe. It is concerned - UCTE –the great deal of continent of Europe, NORDEL – Northern states, UKTSOA – Great Britain, ATSOI – Ireland , UPS/IPS – The former Soviet Union. The partnership among these countries is restricted and is realized by direct transmissions or via radial operation. The big reactive power flows, produced from high voltage undersea cables, don't allow using AC system. In the near future is calculated on the synchronous connection of the countries of the former Soviet Union, which was impossible in the past, because of different conditions of regulation. For this connection can be used the remained conduction from the time of reciprocal cooperation in MIR system, including the conduction of 750 kV flowing to the stations in Poland and Hungary.

Polish power grid is rather sparse in compare with neighbouring power systems. Poland is as well as Germany interconnected to the Czech Republic with two double lines 220 and 400 kV. To the Slovakia is interconnected with one 400 kV double lines.

There is also the interconnection to the Ukraine, but this interconnection is unimportant as well as DC cables between Nordel and Poland because of the Ukraine's cooperation with Poland in radial operation.

From Poland grid is exported big power especially through the Czech and the Slovak net to east and west regions. Tie lines between Poland and Czech Republic are very loaded which caused big problems during the disturbance. Due to the appropriate dispatching action further enlargement of the disturbance was not caused.

Fig. 1: *Damaged Tower*

2 CHRONOLOGY OF DISTURBANCE

There was switched off 400 kV line Albrechtice-Dobrzen due to the fire in substation Albrechtice on November 16th.

This line was out of order even on November 19th at 12.14 am/pm.The windstorm had destroyed 400 kV line Wielopole-Nosovice (on the Czech side). This line was transporting 1000 MW at the moment. The 2nd block of power plant Zarnowiec (179 MW) was shut down at 12.33 a.m.. This outage happened because of the weather conditions. Busbar fault in Poland substation Kopanina was at 12.32 a.m. Due to this busbar fault the 220 kV line Kopanina-Lískovec had to be switched off. This action caused overload line 220 kV Bujakow-Liskovec. This line switched-off by over current protection at 12.33 a.m.. In this short time shut down the whole border profile between Moravia and Poland. The power which flew through this profile at that time, flew through the border profiles Poland-Germany and Poland-Slovakia then. Poland dispatching switched off the 9th block of power plant Kozienice (566 MW) and the 3rd block of power plant Opole (334 MW) to reduce power flows on remaining border profiles. About 13.30 a.m. one 220 kV Line between Moravia and Poland was switched-on but one pylon/tower (on Polish side) was damaged at 13.59 a.m. and line was switched off again.

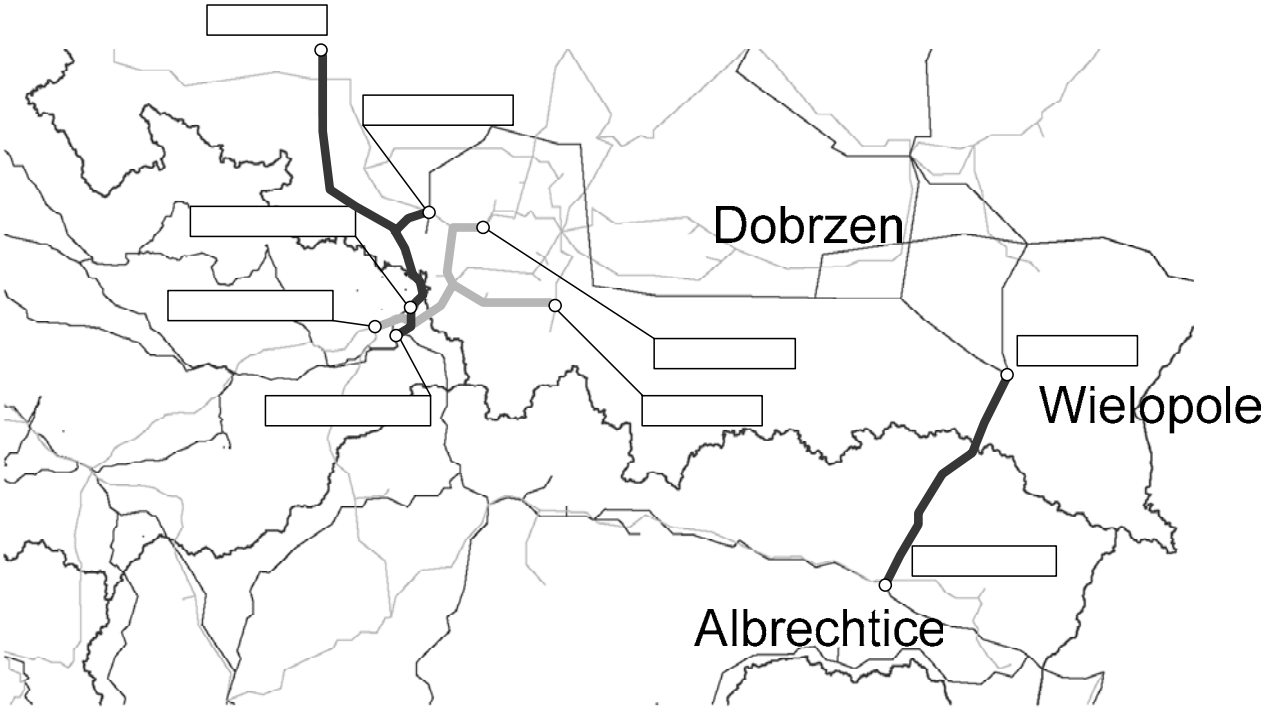

Fig. 2: *Czech Republic- Poland and Slovakia-Poland border profiles*

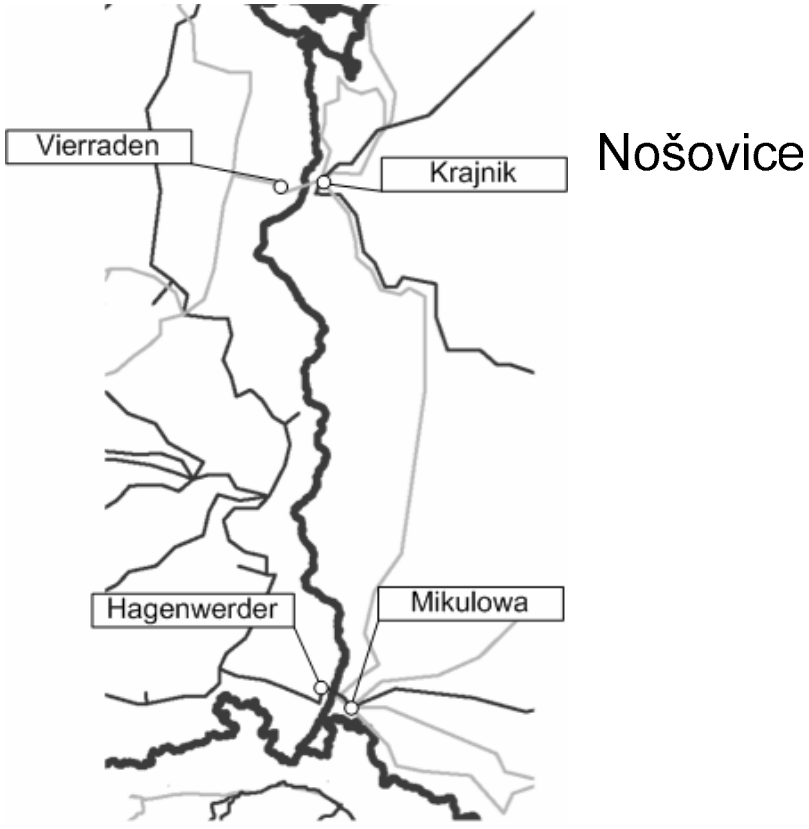

Fig. 3: *Germany-Poland border profile*

3 SIMULATION OF DISTURBANCE

Simulation of disturbance was carried out by software for analysis of electrical networks GLF. Grid model from EGÚ Brno was adapted to right distribution of generation and consumption in areas during disturbance. The steady – states were computed for each time frame. Border of each time frame was next disturbance. Results of simulation were compared with real measurements on border profiles. Differences between simulation and real measurements were induced by transient performances, noise of net and effect of regulation. These phenomenons are not possible to take into account without quality input parameters in computations.

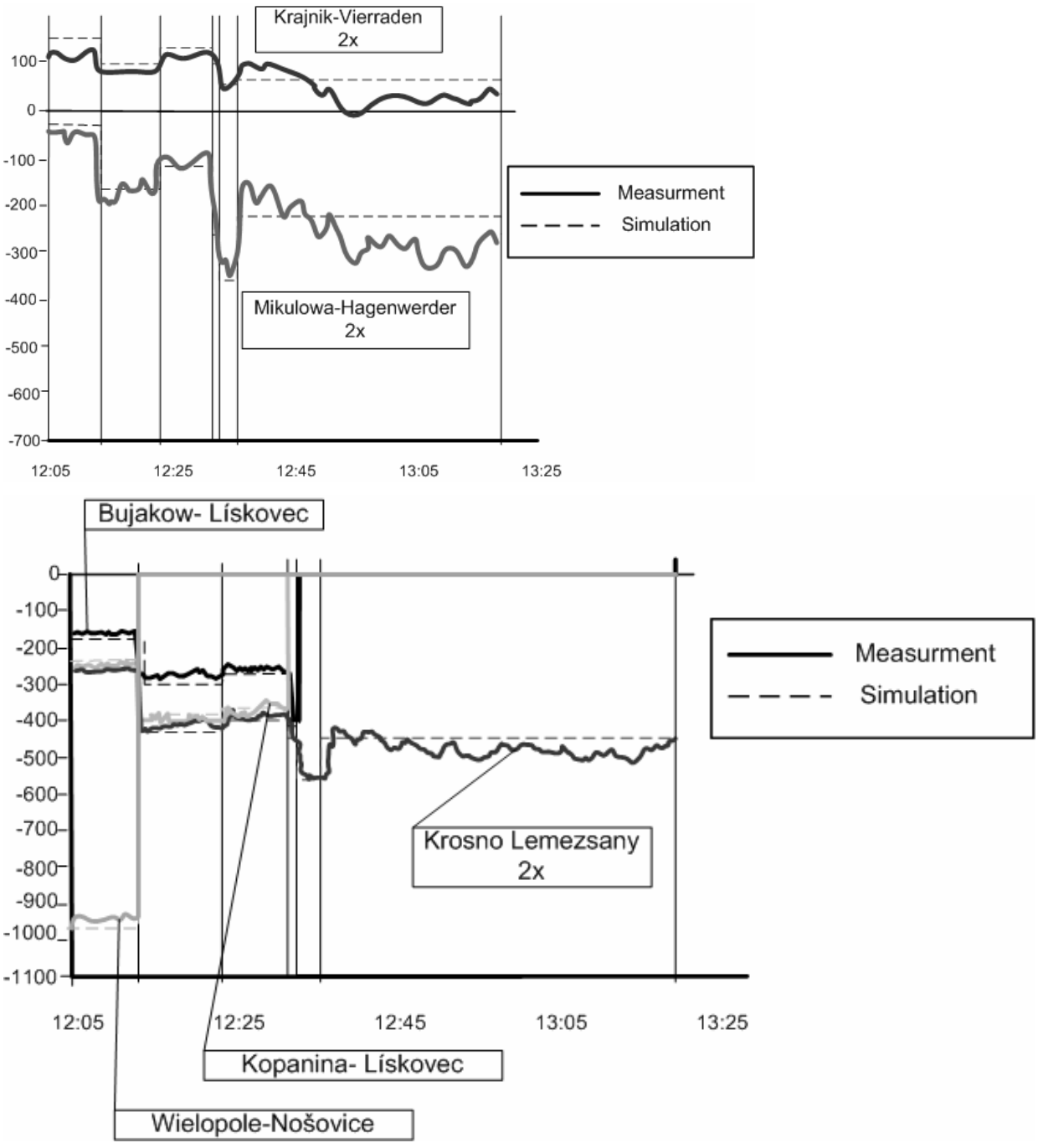

Fig. 4: *Time behaviors on border profiles*

ACKNOWLEDGEMENT

This paper contains the results of research works funded from project No. GA102/03/P033 of the Grant Agency of the Czech Republic

REFERENCES

[1] Van Custem, T.: A Method to compute Reactive Power Margins with respect to Voltage Collapse, IEEE Trans. on Power Systems,Vol. 6, No.1, February 1991

[2] Dudzik, J.: Emergency situation in Polish Power System on November 19th, 2004