Eccentricity Fault Diagnosis based on Wavelet Transform and Neuro-Fuzzy Inference System in Doubly-fed Induction Generator

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Abstract : he development of wind turbine system is becoming very influential, in conditions of power qualityand very interesting for ecological protection. However, their potential is considerable in the world, thewind energy sources have drawn more and more attention all over the world recent years to improve theserious environment problems and deal with the shortage of fossil fuels in recent years [1]. The doubly-fedinduction generator (DFIG) is one of essential part of wind turbine system and has dominated in the field ofelectromechanical energy conversion system because of robustness and low cost [2]. So, for a substantialprofit, the diagnosis should be properly developed to ensure a production system more make safe.Production systems must be provided with reliable protection systems as any failure can lead to inevitabledamage [3].The occurrence of different faults can be completely in damage this machine type and inevitably cause theprocess to stop, resulting in loss of production consequently [4]. Therefore, it is necessary to develop amodel machine allow to detect the presence of the faults.Wind turbine is prone many failures and because of their size and localization, it is very costly to repair oremplace their component. In generally, mechanical faults are the most encountered in wind turbinessystems at the gearbox. These faults can occur at the level of ball, inner and outer race bearings, andflanges of the machine shaft. In scientific research tasks shows that rotor faults are more frequentbreakdowns, [5, 6]. In this paper we are interested to study the rotor eccentricity faults types [7].The DFIG in this type of faults can be subjected to counteract between the center of rotation of the shaftand the center of the rotor resulting the oscillations in the electromagnetic torque, uneven distribution of thecurrents in the rotor and the unbalance of stator current. This phenomenon is called static or dynamiceccentricity, and both at the same time creates the fault mixed eccentricity, whose origin may be related toincorrect positioning of the bearings during assembly or bearing failure [8, 9].Eccentricity Fault Diagnosis based on WaveletTransform and Neuro-Fuzzy Inference System inDoubly-fed Induction GeneratorMerabet. HichemResearch Center in Industrial Technologies (CRTI) P.O.Box 64, Cheraga, Algeria.h.merabet@csc.dzBahi. TaharElectrical Department, University of Annaba, Algeriatbahi@hotmail.comBedoud. khouloudResearch Center in Industrial Technologies (CRTI) P.O.Box 64, Cheraga, Algeria.k.bedoud@csc.dzDrici. DjalelResearch Center in Industrial Technologies (CRTI)P.O. Box 64, Cheraga, Algeria.d.drissi@csc.dzTSeveral methods of diagnosis are based on spectral analysis of the electromagnetic quantities, using themagnetic flux, stator current and the neutral voltage vibration signal analysis and especially the statorcurrent which requires only a current sensor [10, 11]. Therefore most of the recent research has bennedirected towards non-invasive techniques such as stator current and vibration signal analysis, motorsignature analysis with wavelet transform, courant envelope, Artificial Intelligence such as NeuralNetwork, Fuzzy Logic and Fuzzy Neural Network. The analysis of the stator currents in the waveletdomain remains the most commonly used because the spectrum results contains a source of information onthe majority of electrical and/or mechanical faults and magnetic properties can appear in the machine [12,13].The artificial intelligences based on fuzzy logic system inference, artificial neural network (ANN) orcombined structure techniques of artificial neural fuzzy interference system (ANFIS) are widely used in thenew monitoring[14, 15].Therefore, in order to increase the efficiency and the reliability of the monitoring in the field of the(DFIG) supervision, the proposed technique is based on wavelet transform and Neuro-Fuzzy inferencesystem (ANFIS).In this paper, the investment interest in wind turbine conversion system based on DFIG is presented.Then, we focus on the study of their designs and the development of a global model for doubly-fedgenerator in case of rotor eccentricity faults.Finally, in order to validate the considered method, the proposed model has been simulated and validatedby numerical simulations using MATLAB/Simulink.