Energy Conversion and Management

Volume 82, 2014, Pages 11-26

Modeling, control and fault diagnosis of an isolated wind energy conversion system with a self-excited induction generator subject to electrical faults

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Abstract: In this paper, a contribution to modeling and fault diagnosis of rotor and stator faults of a Self-ExcitedInduction Generator (SEIG) in an Isolated Wind Energy Conversion System (IWECS) is proposed. In orderto control the speed of the wind turbine, while basing on the linear model of wind turbine system about aspecified operating point, a new Fractional-Order Controller (FOC) with a simple and practical designmethod is proposed. The FOC ensures the stability of the nonlinear system in both healthy and faulty conditions.Furthermore, in order to detect the stator and rotor faults in the squirrel-cage self-excited inductiongenerator, an on-line fault diagnostic technique based on the spectral analysis of stator currents ofthe squirrel-cage SEIG by a Fast Fourier Transform (FFT) algorithm is used. Additionally, a generalizedmodel of the squirrel-cage SEIG is developed to simulate both the rotor and stator faults taking iron loss,main flux and cross flux saturation into account. The efficiencies of generalized model, control strategyand diagnostic procedure are illustrated with simulation results.

Keywords : Wind energy conversion systems, fault detection and diagnosis, SEIG, Fractional-Order Controllers