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Fault Analysis of Induction Machine Using Finite Element Method (FEM)

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Abstract : The paper presents a finite element (FE) based efficient analysis procedure for induction machine (IM). The FE formulation approaches are proposed to achieve this goal: the magnetostatic and the non-linear transient time stepped formulations. The study based on finite element models offers much more information on the phenomena characterizing the operation of electrical machines than the classical analytical models. This explains the increase of the interest for the finite element investigations in electrical machines. Based on finite element models, this paper studies the influence of the stator and the rotor faults on the behavior of the IM. In this work, a simple dynamic model for an IM with inter-turn winding fault and a broken bar fault is presented. This fault model is used to study the IM under various fault conditions and severity. The simulation results are conducted to validate the fault model for different levels of fault severity. The comparison of the results obtained by simulation tests allowed verifying the precision of the proposed FEM model. This paper presents a technical method based on Fast Fourier Transform (FFT) analysis of stator current and electromagnetic torque to detect the faults of broken rotor bar. The technique used and the obtained results show clearly the possibility of extracting signatures to detect and locate faults.

Keywords : Finite element Method (FEM), Induction motor (IM), short-circuit fault, broken rotor bar, Fast Fourier Transform (FFT) analysis
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