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Analytical Model of Multiphase Machines Under Electrical Faults: Application on Dual Stator Asynchronous Machine

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Abstract : The rapid advancement in electrical technologies has underscored the increasing importance of multiphase machines across various industrial sectors. These machines offer significant advantages in terms of efficiency, compactness, and reliability compared to their single-phase counterparts. However, early detection and diagnosis of electrical faults remain critical challenges to ensure the durability and safety of these complex systems. This paper presents an advanced analytical model for multiphase machines, with a particular focus on dual stator asynchronous machines. The primary objective is to develop a robust diagnostic tool capable of effectively detecting and locating electrical faults in these machines, including short circuits, winding faults, and voltage imbalances. The proposed methodology relies on an analytical approach combining electrical machine theory, modeling of magnetic and electrical circuits, and advanced signal analysis techniques. By employing detailed analytical equations, the developed model accurately simulates the behavior of multiphase machines in the presence of electrical faults. The effectiveness of the proposed model is demonstrated through a series of case studies and numerical simulations. In particular, special attention is given to analyzing the dynamic behavior of machines under different types of faults, as well as optimizing diagnostic and recovery strategies. The obtained results pave the way for new advancements in the field of multiphase machine diagnostics, with potential applications in various sectors such as automotive, aerospace, and renewable energies. By providing precise and reliable tools for early fault detection, this research contributes to improving the reliability and durability of complex electrical systems while reducing maintenance and operation costs.

Keywords : faults, diagnosis, modelling, multiphase machine
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