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Review

Improving squirrel cage induction motor efficiency: Technical review

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Studying and improving of Squirrel Cage Induction Motor (SCIM) efficiency is a continuous area of interest not only among the researchers but also the industry, manufacturer and government. However, until today there are still struggles to find the most holistic environment of the SCIM which achieve its efficiency at the most lowest cost and at the same time sustaining the performance of the motor. This paper will focus on the method on improving SCIM efficiency. The first discussion presented the main importance of efficient motors and its drive systems. These are partly conceptual, partly concerning circuit topology and current commutation technique. The second discussion ooptimization of SCIM efficiency using intelligent techniques which are of particular interest. The third discussion describes the energy efficiency of SCIM standards and most effect motor parameters on SCIM efficiency.

Key words: Induction motor, efficiency, maximization.

INTRODUCTION

As the Squirrel Cage Induction Motor (SCIM) drives have been the traditional alternating current (ac) workhorses in the industries, and their widespread acceptance makes this study very important not only for its evaluation but to provide comparison with other drive systems. The maximum efficiency point occurs when the SCIM magnetizing flux level is properly regulated according to the motor load. However, in some industrial sectors, most SCIM are operated under rated condition due to under load or the motor is over sized and as a result, the efficiency of the motors is low. The immediate effect of low efficiency is low power factor which then becomes the main cause of poor power factor in industrial installations. Therefore, to retain the maximum efficiency operation of SCIM while driving a partial load, the controller must search for the maximum efficiency operating point and then operates the SCIM at this point (Lingshun et al., 2009; Fernando and Anibal, 2008; Hasan et al., 1997).

Issues on controlling the speed and the torque of SCIM have drawn great attraction to the research since twenty years ago. It is the most preferable motor to be used in industries and tertiary sectors are responsible for approximately 32% of total electricity consumption in the EU (Nailen, 1989) and almost 2/3 of total electricity consumption in the US (Stroker, 2003). According to the latest survey, more than half of the electricity generated is consumed by the electric motors and since most of the power-generating systems produce ac, a majority of the motors used throughout the globe are designed to operate on ac, specifically SCIM (Ali, 2004; De Almeida et al., 1997; De Keulenaer et al., 2004). Therefore, study in increasing energy saving of SCIM is very important as a small percentage increase in efficiency, will save huge percentage amount of energy (Auinger, 2001; Gang, 2004). Results from research have been done, to improve the efficiency of SCIM drives: (1) the use of high-efficiency (premium efficiency) motors instead of standard motors, (2) replacement of constant speed mechanically controlled processes with variable or adjustable speed control, and (3) replacement of direct current (dc)-motor drives with induction motor adjustable speed drive (ASD) in industrial processes where the adjustable speed is necessary for the process, typically conveyors, textile and paper industry, and machine tool. The variable-speed drive system coupled with premium efficiency motor capable in matching the power consumed to the work completed.

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