

IMPLEMENTATION OF SENSORLESS SPEED CONTROL FOR TWO-PHASE INDUCTION MOTOR DRIVE USING ISFOC STRATEGY*

H. BEN AZZA^{***}, M. JEMLI[†], M. BOUSSAK[‡] AND M. GOSSA[†]

[†] Unité de recherche en commande, surveillance et sûreté de fonctionnement des systèmes (C3S)
Equipe Développement des Systèmes Electro-techniques (DES)
Ecole Supérieure des Sciences et Techniques de Tunis (ESSTT)
5 Avenue Taha Hussein - BP 56, Bab Menou 1008 Tunis - Tunisie
Email: benazza@chmi@voila.fr

[‡] Laboratoire des Sciences de l'Information et des Systèmes (LSIS) - UMR CNRS 6168
Centre de Recherche et Technologies (CMT)
Ecole Centrale Marseille (ECM) - Technopôle Château Gombert - 13451 - Marseille Cedex 20 - France

Abstract— This paper presents a new technique based on model reference adaptive system (MRAS) observer for sensorless speed control of Two-Phase Induction Motor (TPIM). The MRAS identification is performed by means of comparison of stator fluxes obtained from both stator and rotor equations with stator voltage and current measurements. Simulation and experimental results for a 1.1 kW TPIM set-up are presented and analysed using a dSpace system with a DS1104 controller board based on digital signal processor (DSP) TMS320F240. Simulation and experimental results at nominal, low and zero speeds confirm the effectiveness of the proposed sensorless speed controlled TPIM drive.

Keywords— Two-phase induction motor (TPIM), indirect stator-field-oriented control (ISFOC), model reference adaptive system (MRAS)

1. INTRODUCTION

Two-Phase Induction Motor (TPIM) is widely used in several industrial and domestic applications. In those applications the motor runs at constant frequency and is fed directly from the ac grid without any type of control strategy. The TPIM is found in air conditioners, washers, dryers, industrial machinery, fans, compressors, tools, blowers, vacuum cleaners, household appliances and many other applications. The reduction in the cost of the power electronic circuitry provides economically justifiable applications for adjustable speed Two-Phase Induction Motor Drives (TPIMD). In recent years, several methods that use inverters for the variable speed control of TPIM have been proposed [1]-[15]. An alternative approach is to use a 6 switch three phase Voltage-Source Inverter (VSI) bridge, connecting the two windings of the motor as an unbalanced load between the phases, as shown in Fig. 3. This is a more cost effective solution [1], [2], [9], [11], [16]. Recently, Stator Field Oriented Control (SFOC) of TPIMD has been gaining wide attention in literature [1]-[3]. In vector control, the flux linkage magnitude and the electromagnetic torque are controlled independently [14]-[15]. The SFOC represents a better solution to satisfy the industrial requirements. The field orientation is relatively straightforward in all operating conditions if the rotor speed is accurately known, which traditionally necessitates a sensor on the shaft of the motor. However, there are several reasons for preferring a system without the sensor. The cost of the speed sensor, at least for machines with ratings less than 10 kW, is in the same range as the cost of the motor itself. The

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**Corresponding author

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