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TRANSCRITICAL BIFURCATION IN A SQUIRREL-CAGE ROTOR INDUCTION MOTOR WITH FRICTION

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Abstract. The induction motors are principally used in the industry due to their simple and robust construction. To improve speed control is necessary to know the dynamic behavior of the motor. A mathematical model was proposed that includes air gap friction and friction on the bearings. The proposed model is defined by using a stationary reference frame and the study, presents the necessary conditions on the parameter to guarantee the existence of two equilibrium points and their stability. The behavior of the equilibrium points switches by the variations of the bifurcation parameter. The transcritical bifurcation occurs when the friction on the bearings is zero, and air gap friction is a positive number different from zero. A way to have zero friction on the bearings is using magnetic bearings that reduce the loose mechanic and improve the accuracy.

Keywords. Transcritical bifurcation, magnetic bearing, squirrel-cage rotor, induction motor, bearing friction, air gap friction.

AMS (MOS) subject classification: 37G10

1 Introduction

The importance of induction motors is due to their simple and robust construction. The squirrel-cage rotor gives an excellent service with little maintenance. Historically the disadvantage has been the limitation to regulate the speed. However, the spectacular development of electronic drives such as inverters and cycle converters has been possible the speed control [7]. To improve speed control is necessary to know the dynamic behavior of the motor. In this paper, we present a proposal for a model with friction for which a transcritical bifurcation exists.

A bifurcation analysis is adequate to determine the appropriate type of control to maintain the stability of the induction motor. An example of a bifurcation analysis on an indirect field control of a current-fed induction motor is that slight variations of proportional integral controller (PI) parameters affect the stability motor and show the mechanism of the chaos [5]. Then using the information about a bifurcation is possible to use a control to avoid