MECHATRONICS BOOK SERIES

SYSTEM DESIGN AND SIGNAL PROCESSING

VOLUME 2

Editors
Md. Raisuddin Khan
Md. Mozasser Rahman
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Chapter 7

MODELING OF DISC ROTOR INDUCTION MOTOR

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7.1 Introduction

In a conventional induction machine, the output is usually a function of the size of machine. As bigger as the size of the machine, the bigger its output power. The use of samarium–cobalt disc multi polar magnet in the stepper motor enables the constraint implied above apparently to be refuted. High energy content in samarium cobalt results comparatively high torque/inertia ratio, and hence fast acceleration. An example of a motor using samarium- cobalt disc rotor is a stepper motor which has a diameter of 5 mm and output of 30 watt. In this following analysis investigation had been carried out develop the effect of physical size of the rotor on the torque. A machine designer has to adjust the size of shaft and also the amount of conductors on the stator which is near the shaft. Assuming the rotor and stator have a common shaft of the same diameter, a fixed outer radius of the rotor is assumed in the following analysis. This is usually the case in the analysis of small motors. Hence the size of rotor shaft is a factor to be considered seriously to develop maximum torque.

7.2 Formulation of torque equation as a function as a function of R_1 and R_2

Considered the element of disc (annulus) as shown in Figure 7.1, the resistance of the element

$$\partial\theta = \frac{\rho dR}{2\delta\theta.rh} \tag{7.1}$$

Resistance of the path between R_1 and R_2,

$$R = \int_{R.1}^{R.2} \frac{\delta.dr}{2.d\theta.r.h} = \frac{\delta}{2hd\theta}\ln\left(\frac{R_2}{R_1}\right) \tag{7.2}$$

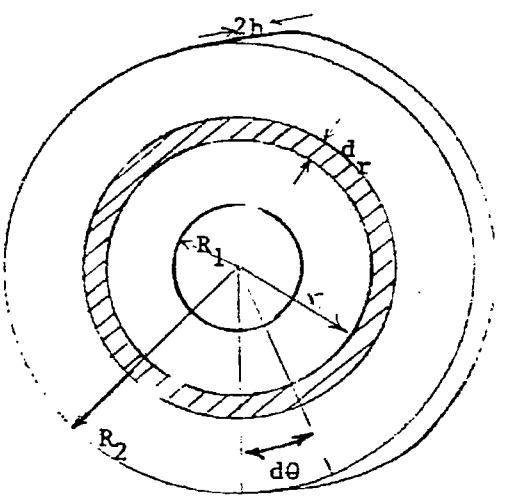

Figure 7.1: Disc Rotor