

Massachusetts Institute of Technology
 Department of Electrical Engineering and Computer Science

6.11s: Design of Motors, Generators and Drive Systems

Class Notes 1: Electromagnetic Forces and Loss Mechanisms
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1 Introduction

This section of notes discusses some of the fundamental processes involved in electric machinery. In the section on energy conversion processes we examine the two major ways of estimating electromagnetic forces: those involving thermodynamic arguments (conservation of energy) and field methods (Maxwell's Stress Tensor). In between these two explications is a bit of description of electric machinery, primarily there to motivate the description of field based force calculating methods.

The section of the notes dealing with losses is really about eddy currents in both linear and nonlinear materials and about semi-empirical ways of handling iron losses and exciting currents in machines.

2 Energy Conversion Process:

In a motor the energy conversion process can be thought of in simple terms. In "steady state", electric power input to the machine is just the sum of electric power inputs to the different phase terminals:

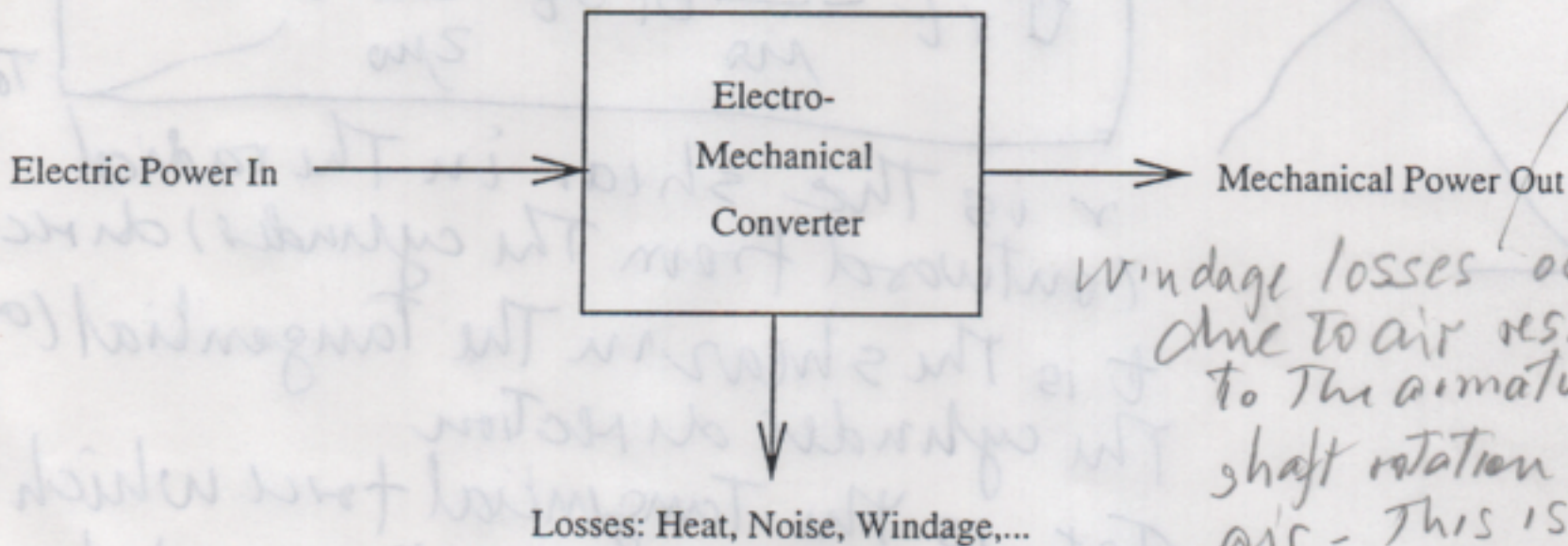


Figure 1: Energy Conversion Process

$$P_e = \sum_i v_i i_i$$

depends on density of fluid
 skin friction coefficient
 Reynolds # dynamic viscosity