

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.622 Power Electronics
Problem Set 1

Issued: February 13, 2023
Due: February 22, 2023

Reading: KPVS Chapter 3

Problem 1.1 KPVS Problem 3.1

Problem 1.2

Figure 1.1 shows a circuit model for the utility (represented here as an ac voltage source) supplying one phase of an ac induction motor. The motor system parameters are $R_s = 0.08 \Omega$, $L_{ls} = 1 \text{ mH}$, $L_m = 40 \text{ mH}$, $L_{lr} = 1 \text{ mH}$, $R_r = 0.1 \Omega$, and $R_x = 33 \Omega$. (R_s and R_r represent parasitic resistances in the motor, while the energy delivered to R_x represents energy converted to mechanical form by the motor.)

- a. If the utility voltage is $170 \cdot \cos(377t)$, what is the current into the motor?
- b. At what power factor does the motor operate?
- c. It is desired to improve the power factor of the motor system at the utility interface. It is proposed to do this by placing a capacitor across the ac line in parallel with the motor. What value of capacitor would be necessary such that the utility would see a power factor of 1?

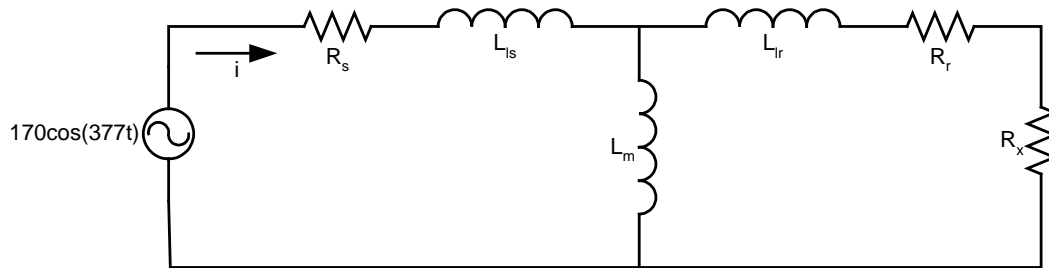


Figure 1.1 A Circuit model for one phase of an induction motor being driven by the utility.

Problem 1.3 KPVS Problem 3.16

Problem 1.4 KPVS Problem 3.17

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Spring 2023

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