EE303 — Energy Systems and Power Electronics

Lecture 8. Three-phase circuit analysis

Prof. Dionysios Aliprantis

Electrical & Computer Engineering

Sep. 17, 2008

Iowa State University

Today's objectives

- ☐ DESCRIBE **power factor correction** and COMPREHEND why it is necessary

Power factor correction example (a)

Problem

A symmetric three-phase 2400-V source is connected to a symmetric Δ-connected load via a transmission line. The line's impedance is $Z_L = 0.5 + j3\ \Omega/\phi$, and the load's impedance is $Z_\Delta = 24 + j12\ \Omega$. Compute:

1. *The load voltage (phasor)*
2. *The line current (phasor)*
3. *The real and reactive power consumed by the load, and the power factor*
4. *The power from the source, and the power factor*
5. *The power loss on the transmission line as a percentage of the load's active power*

Power factor correction example (b)

Problem

In order to improve the load's power factor (from previous problem), and make it equal to 1, we connect a Y-connected capacitor bank in parallel to the load. Compute:

1. *The susceptance* B_C *of each capacitor*
2. *The load voltage (phasor)*
3. *The line current (phasor)*
4. *The real and reactive power consumed by the load, and the power factor*
5. *The reactive power produced by the capacitor bank*
6. *The power loss on the transmission line as a percentage of the load's active power*

Reading material

The material we covered today corresponds to:

- Chapters 7.7.6–7.7.7, pp. 167–174 of textbook