EE 340 – HW # 3

Consider a 3-phase, 370 km (230 mi) long transmission line that has a flat horizontal spacing with 7.25 m (or 23.8 ft.) between conductors. The conductor type is ACSR-*Rook* with resistance is 0.1603 Ω/mi, GMR = .0327 ft., diameter = 0.977 in, and ampacity = 785 A. The line-to-line voltage at the sending end is fixed at 245 kV.

1) Calculate the sending-end current and power, and receiving-end voltage under no load. Determine the shunt reactor that is needed such that V_R =1.05 V_S.
2) Assume the load is purely resistive (i.e., unity power factor). Calculate the following: a) power delivered to the load and load current when V_R = 0.95 V_S. b) Power delivered to the load and V_R when I_R reaches 785 A. c) V_R and I_R when the power delivered to the load reaches its maximum value. d) Plot V_R as a function of the power delivered to the load.
3) Repeat 2) after placing a series capacitor that compensates 70% of the line series reactance.

Note:

$$\sinh(x + iy) = \sinh x \cos y + i \cosh x \sin y$$
$$\cosh(x + iy) = \cosh x \cos y + i \sinh x \sin y.$$