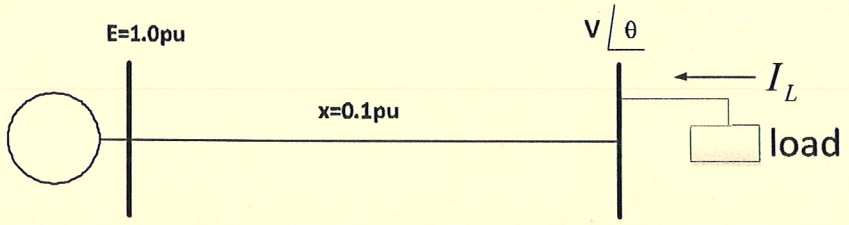
2 pts

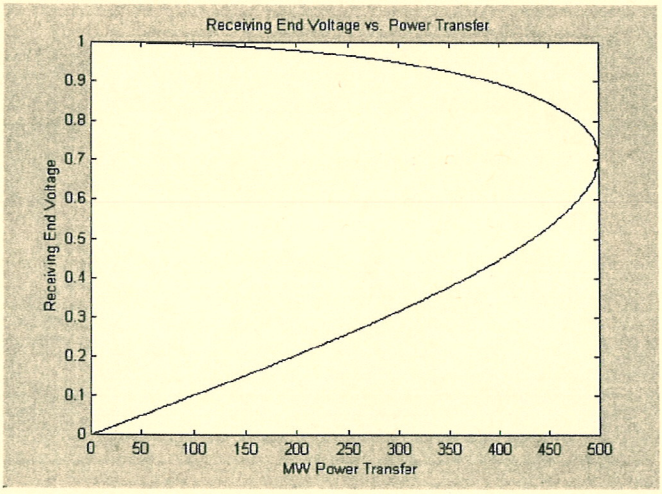
You are given a two bus power system, with a generator supplying load over a single transmission line.



Single Transmission Line Example

We assume that the voltage at the sending end is 1.0 per unit at zero degrees phase angle, and where *Qload* is assumed to be zero MVAR.

As the power to the load is increased we obtain a voltage characteristic at the receiving end that looks like the graph below.



The maximum transfer is 500 MW.

i) Solve for the bus voltage magnitude and phase angle at the load bus when Pload = 500 MW, and Qload = 0

ii) Solve for the Q generated by the generator

iii) Solve for the Q consumed in the transmission line

iv) Now assume, with Pload = 500 MW, that a variable capacitor is added to the load bus and it supplies enough reactive power to bring the magnitude of V up to 1.0 per unit, find the reactive power that would be supplied by this capacitor.

(2 pts) In a photovoltaic system, the voltage of the PV panel is first boosted to $250V$ across a capacitor. An inverter is used to interface this input dc voltage $V_{in} = 250V$ to the single-phase ac grid, whose sinusoidal voltage is $\bar{V}_s = 120\angle 0^0 V(rms)$ at 60 Hz. The power supplied to the grid is $500W$ at a unity power factor (assuming the ripple in the ac-side current to be negligible). At this operating condition, the inductor L_s between the inverter and the ac grid is such that the voltage drop across this inductor is $V_L = 5V(rms)$. Assume ideal components and the switching frequency to be much higher than 60 Hz.

Draw the inverter circuit consisting of IGBTs and diodes, label the IGBTs from one to four, and then calculate and draw the duty-ratios of the four IGBTs as a function of ωt. Label your graphs.