Analysis of electrical power and energy systems

Programming Assignment 2

20 October 2022

The objective of this assignment is to study the impact of phase shifting transformers and generators' reactive power limits on the solution of a power flow. In programming assignment 1, you were asked to solve a power flow using Newton-Raphson method. You were given an electrical network composed of 1 PV bus, 2 PQ buses and a slack bus. You are now asked to include in your previous algorithm, and based on the given template named *pf2_template.py*, a limit on the reactive power of the PV bus generator. The topology of your electrical network is the same as for programming assignment 1, **except one line that has been replaced by a phase-shifting transformer** (PS TO BUSX). The impedance associated with the phase shifting transformer is equal to $Z_{pst} = 0.310^{-3} + 1j9.995410^{-3}$ pu.

Your final code should take as arguments the reactive power limit *q_lim* as well as the phase shift in degree *phase_shift*. After filling in the template, you are asked to upload it on *Gradescope* (**do not forget to rename your file** *pf2.py*). A power flow for a 3-bus system has already been solved, and comes with the other files that you have received (*pf2_example.py*). In the tables below, you will find the type of buses, and the topology of the electrical network corresponding to your case number.

Your case number is: 0

BUS0		BUS1		BUS2	
V	θ	P	V	P	Q
1	0	2	1.05	5	1

Table 1: Bus information. Values are given in pu and in radians. PV buses are generator buses : P is the active power produced. PQ buses are considered as load : P and Q are the active and reactive powers consumed.

	BUS0	BUS1	BUS2
Coordinates (xy) in km	(0, 0)	(100, 111.8034)	(200, 0)
Connections	PS TO BUS1	BUS2	BUS0

Table 2: Bus information. Position given in km along the x and y-axis. The Connections row gives the buses to which the current bus is connected.

The due date is: 3 November 2022