

# ELEC0447 - Analysis of electrical power and energy systems

## Programming Assignment 1

Thursday, 12 October 2023

In programming assignment 1, your task is to use the Newton-Raphson method for solving a power flow on a small electrical network. You have been assigned a specific case number that defines both the electrical network topology and the known physical quantities at the buses. In the tables at the bottom of the page, you will find the physical quantities given at buses in the network and the topology of the electrical network corresponding to your case number. Start by inserting your case number (*CASE = your case number*) at the beginning of the provided template named `pf1_template.py`. Then, complete the rest of the template. Once done, submit your resulting Python code as `pf1.py` on **Gradescope**. Ensure consistency with the bus indices; for instance, in the bus admittance matrix, column 1 and row 1 correspond to the self-admittance of bus 1, and so on. A power flow for a 3-bus system has already been successfully solved and is included in the files you received (refer to the file: `pf1.py`). Feel free to draw inspiration from this example. Additionally, take note that the **pandapower** package follows the generator convention when dealing with power quantities.

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Your case number is: **0**

BUS 0		BUS 1		BUS 2	
<i>V</i>	<i>θ</i>	<i>P</i>	<i>V</i>	<i>P</i>	<i>Q</i>
1	0	2	1.05	5	1

**Table 1. Given physical quantities at buses in the network.** Values are given in **per-units** and in **radians**. PV buses are generator buses : P is the active power produced. PQ buses are considered as loads : P and Q are the active and reactive powers consumed.

	BUS 0	BUS1	BUS2
Coordinates ( <i>x, y</i> )	(0, 0)	(100, 111.8034)	(200, 0)
Connections	BUS 1	BUS 2	BUS 0

**Table 2. Topology of the electrical network.** The position of buses is described by *x* and *y* coordinates expressed in **kilometers**. The **Connections** row indicates the buses to which a bus is connected.

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The due date is: **Sunday, 22 October 2023**