Compulsory Exercise for all students, ELEC-E8460 2024

This exercise is an introduction to a power flow GUI tool started by Project Work Course group EPE-01 and further developed by group member Joona Kukkonen who worked as my assistant in the summer of 2023. You should complete this simple exercise by hand, and then verify your results using the Power flow software tool.

You start with a primary substation as parametrised in Table 3 of the Assignment, i.e.:

Table 1 HV grid and primary substation parameters (Table 1 here)

110 kV grid	Main transformer	
S_k (MVA)	u_k (p.u.)	S_N (MVA)
2400	0.1	2x40

Table 2 Node load parameters, subject to 2% growth per year for 20 years

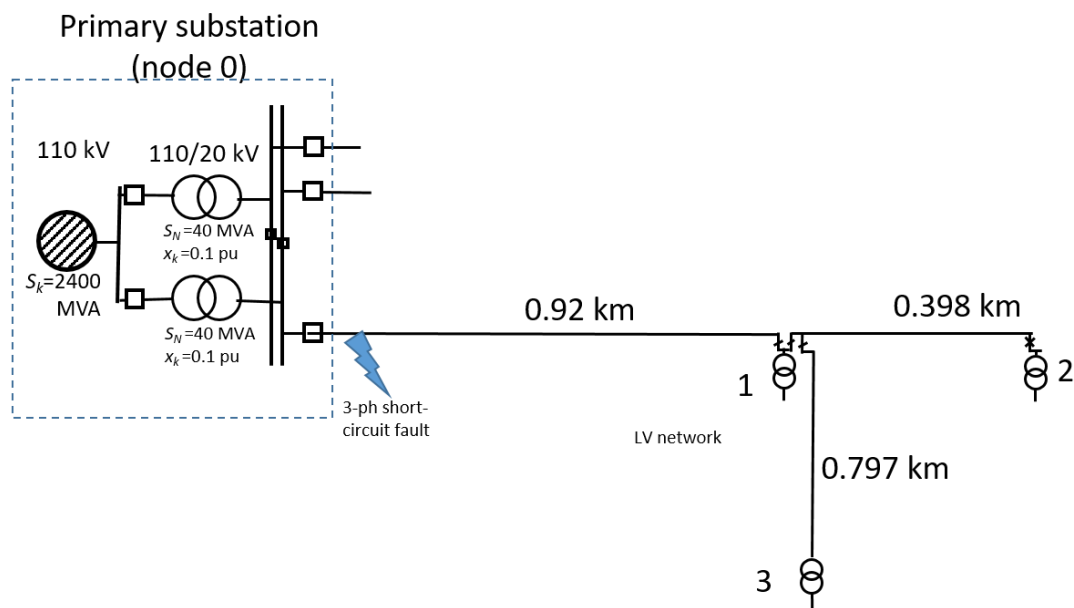| Node	P_{max} (kW)	Q_{max} (kvar)
1	2200	350
2	1600	200
3	1500	150

Figure 1 Section of MV network

All lines are underground cables with 240 mm^2 cross-section area:

Table 3 Line parameters

	Resistance (Ω/km)	Reactance (Ω/km)	I_{max} (A)	$I_{k,1s}$ (kA)
AHXAMK 240 mm^2	0.150	0.110	385	22.6

Task: Is this network section OK in terms of <u>voltage</u> and <u>thermal ratings</u> (<u>steady-state normal operation</u> and <u>maximum 3-phase short-circuit</u> if the circuit breaker operates in 100 ms)? **3.5 p**

Verify your hand calculations with a simulation using the Power flow software tool. **1.5 p**

Due before you get your grade! Let's say a week before the exam: 12.4.2024! It's good revision!