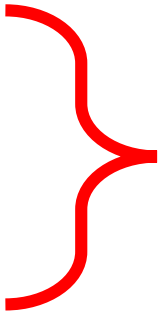
POWERLAB
SINCAL TUTORIAL

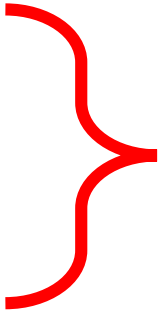
What will we do today?

- What we are doing in system analysis
- Some simple examples
- Some harder problems
- Some advanced problems



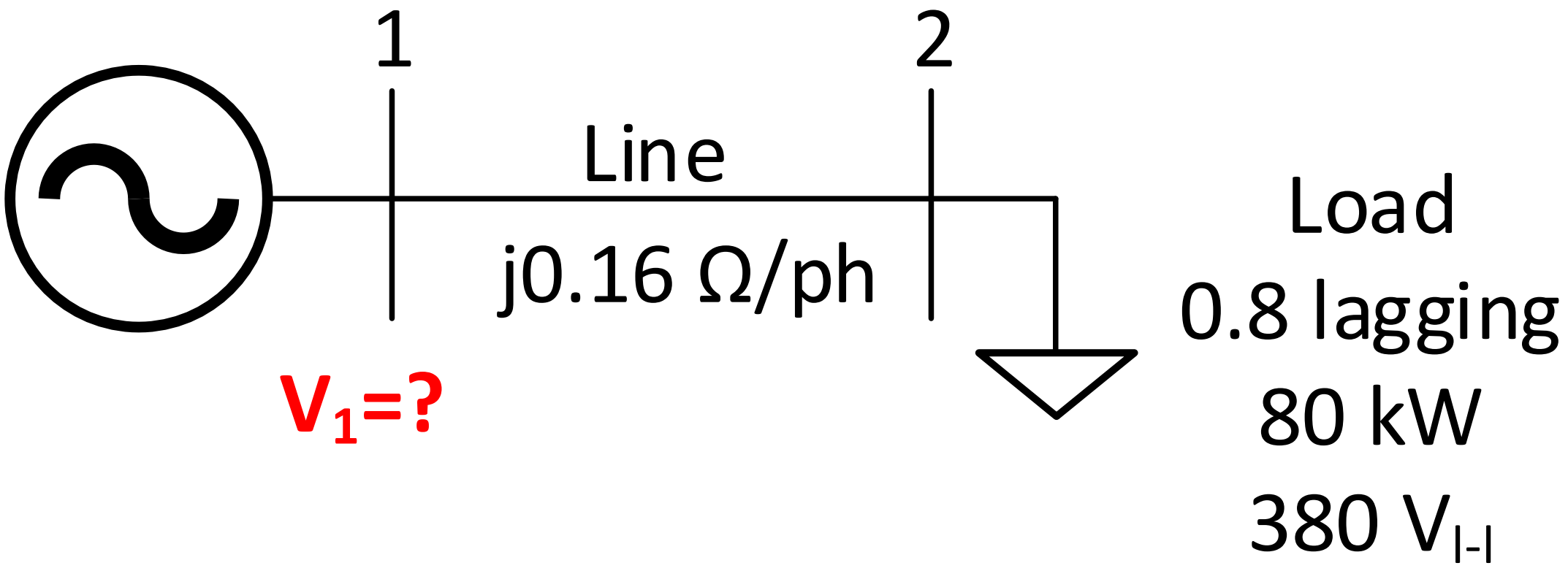
By hand

- Introduction to PSS Sincal
- Some simple examples
- Some harder problems
- Some advanced problems

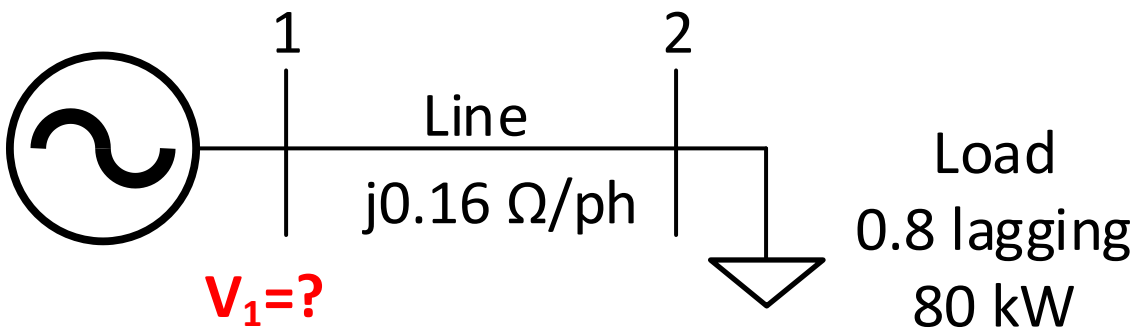


With PSS Sincal

PART 1: Let’s calculate by hand



PART 1: Let's calculate by hand



$$|S_2| = \frac{P_2}{pf_2} = \frac{80000}{0.8} = 100\ kVA$$

$$Q_2 = \sqrt{|S_2|^2 - P_2^2} = 60\ \text{kVAr}$$

$$|I_{Load}| = \frac{|S_2|}{\sqrt{3} \times V_2} = \frac{100\ kVA}{\sqrt{3} \times 0.38\ kV}$$

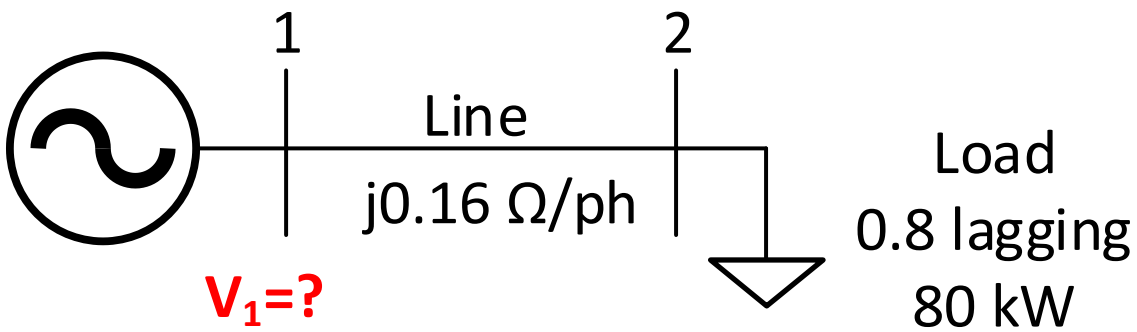
$$= 151.9343\ A$$

$$S_1 = S_2 + S_{losses} = (80 + j60)10^3 + 3 \times |I_{Load}|^2 \times Z$$

$$= (80 + j60)10^3 + 3 \times 151.9343^2 \times (j0.16)$$

$$= 80 + j71.08\ \text{kVA} = 107.02\angle 41.62°\ kVA$$

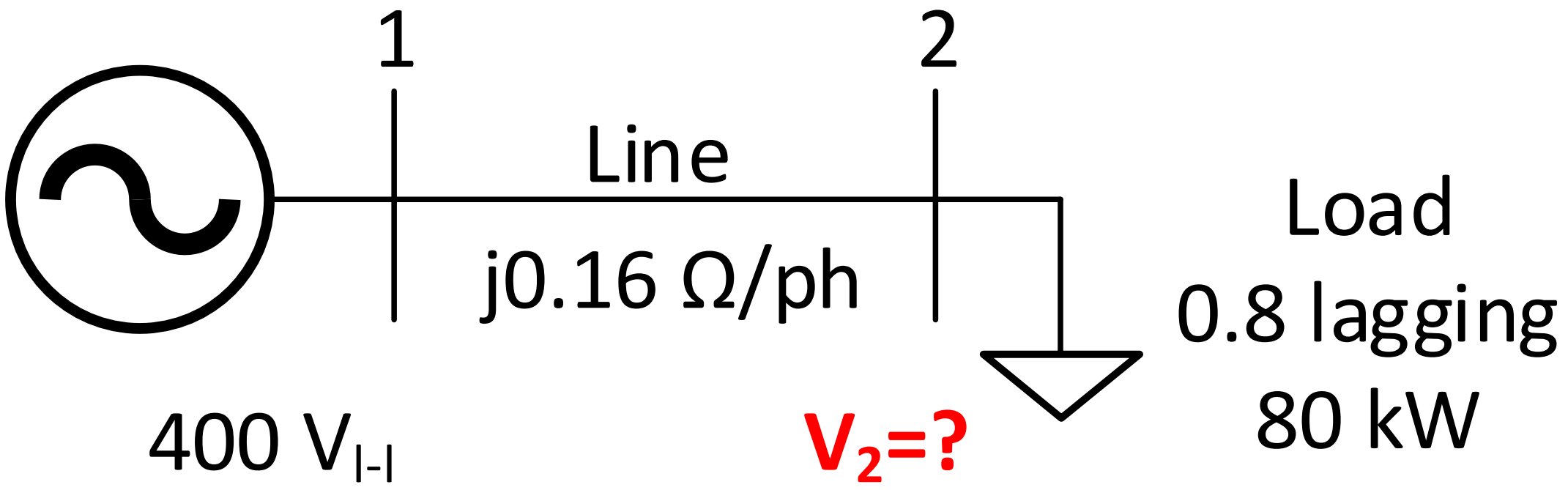
PART 1: Let's calculate by hand



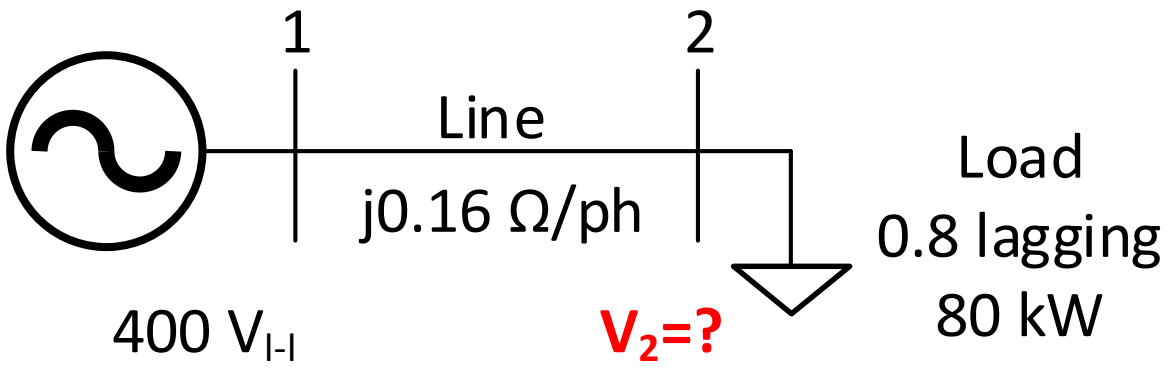
$$S_1 = 80 + j71.08\ \text{kVA} = 107.02\angle 41.62°\ kVA$$

$$V_1 = \frac{|S_1|}{\sqrt{3} \times I_{Load}} = \frac{107.02\ kVA}{\sqrt{3} \times 151.9343\ A} = 406.66\ V$$

PART 2: Let's calculate by hand
(mostly we know voltage set point of generators!)



PART 2: Let's calculate by hand



$$|S_2| = \frac{P_2}{pf_2} = \frac{80000}{0.8} = 100\ kVA$$

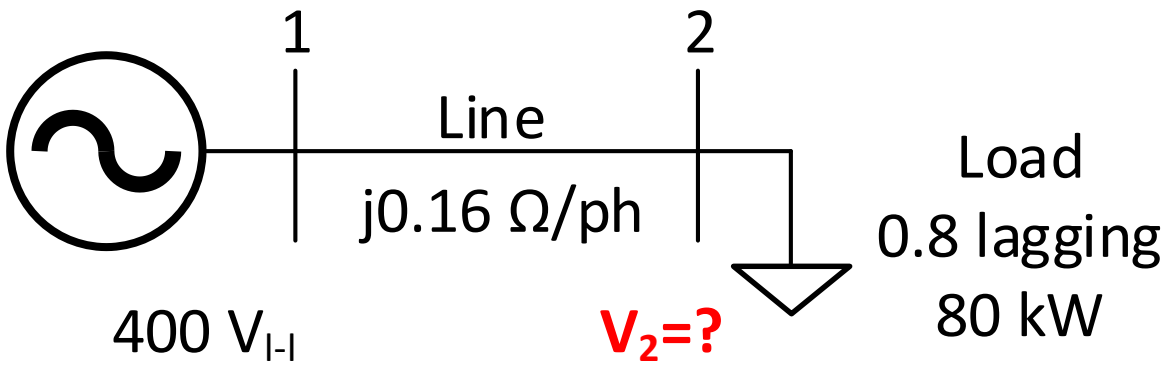
$$Q_2 = \sqrt{|S_2|^2 - P_2^2} = 60\ \text{kVAr}$$

$$|I_{Load}| = \frac{|S_2|}{\sqrt{3} \times V_2} = \frac{100\ kVA}{\sqrt{3} \times V_2}$$

$$S_1 = S_2 + S_{losses} = (80 + j60)10^3 + 3 \times |I_{Load}|^2 \times Z$$
$$= (80 + j60)10^3 + 3 \times |I_{Load}|^2 \times (j0.16)$$

$$|S_1| = \sqrt{3} \times 400 \times |I_{Load}|$$

PART 2: Let's calculate by hand



$$|S_1| = \sqrt{3} \times 400 \times |I_{Load}|$$

$$S_1 = 80 \times 10^3 + j(60 \times 10^3 + 3 \times |I_{Load}|^2 \times 0.16)$$

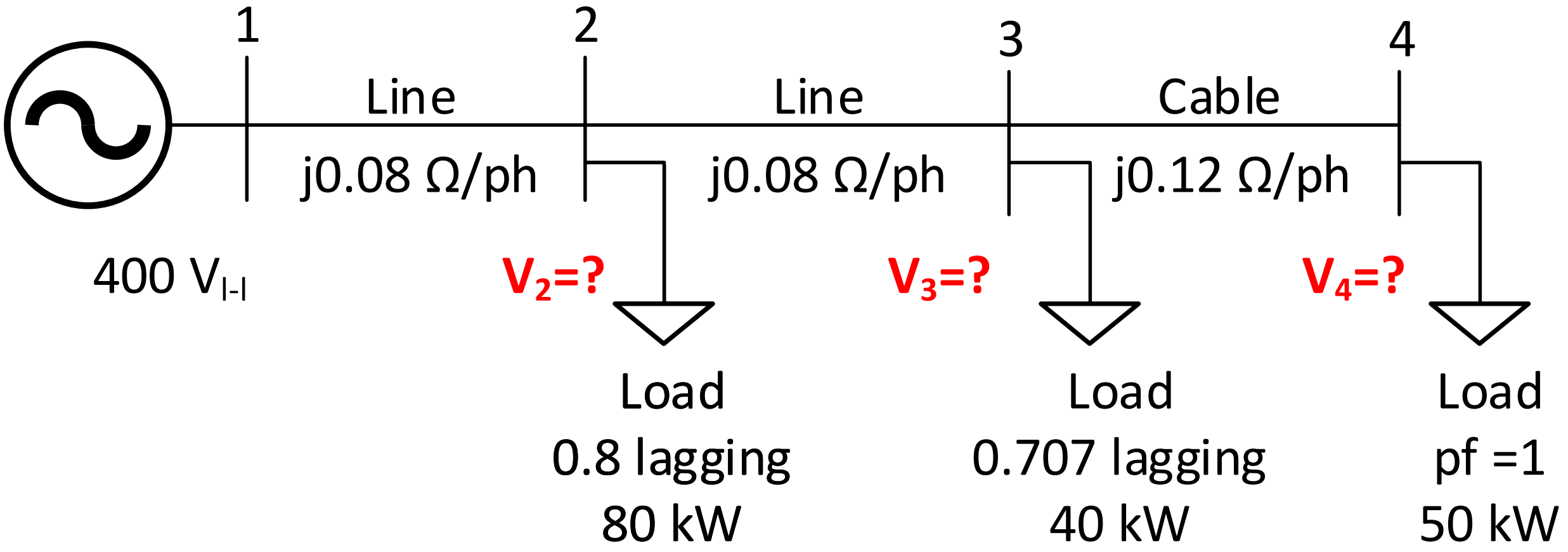
$$3 \times 400^2 \times |I_{Load}|^2 - (80 \times 10^3)^2 - (60 \times 10^3 + 3 \times |I_{Load}|^2 \times 0.16)^2 = 0$$

$$|I_{Load}|_1 = 154.88\ A$$

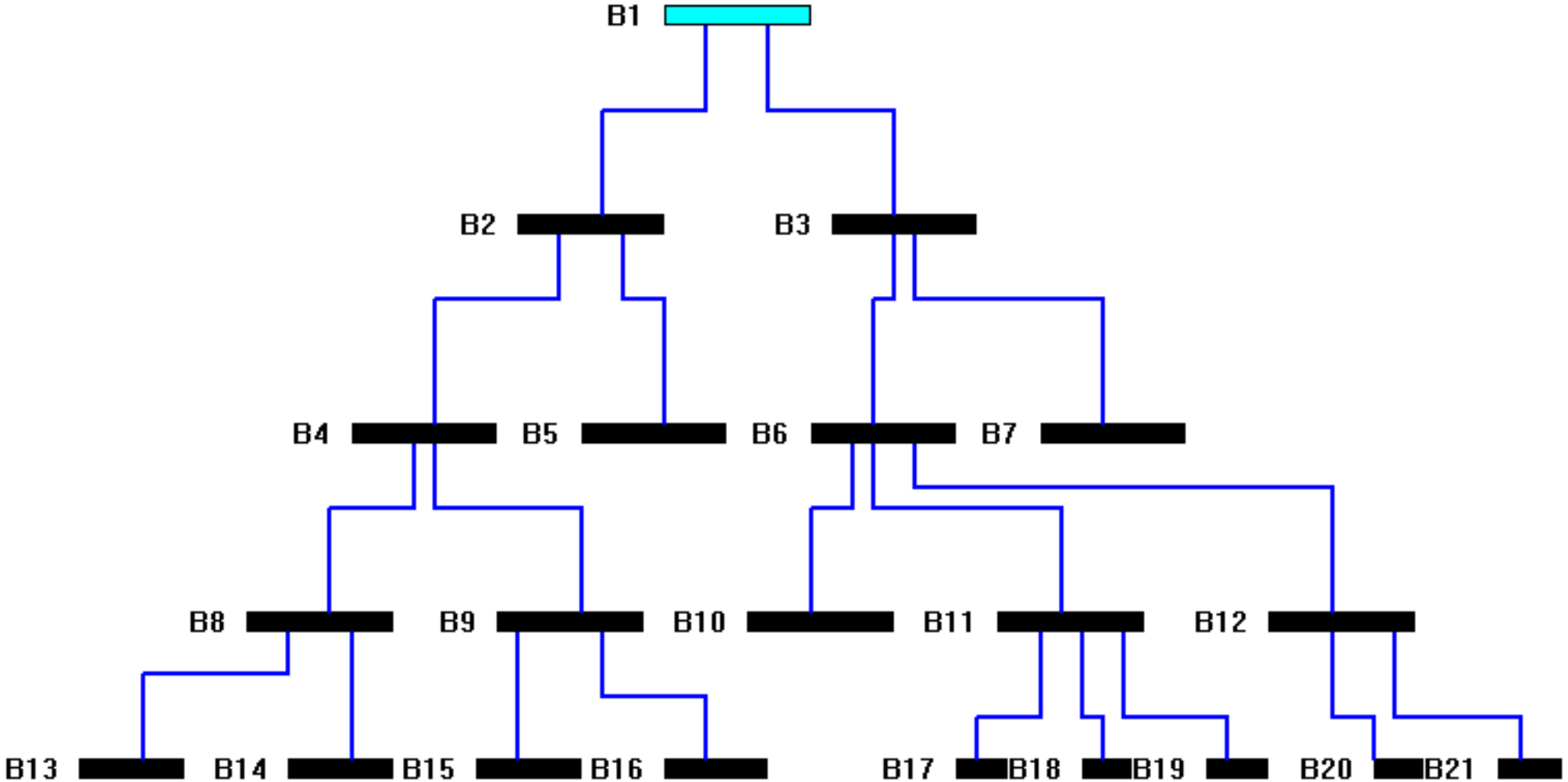
~~$|I_{Load}|_2 = 1345.12\ A$~~

$$V_1 = \frac{100\ kVA}{\sqrt{3} \times 154.88\ A} = 372.77V$$

PART 3: Don’t even try to calculate by hand!!

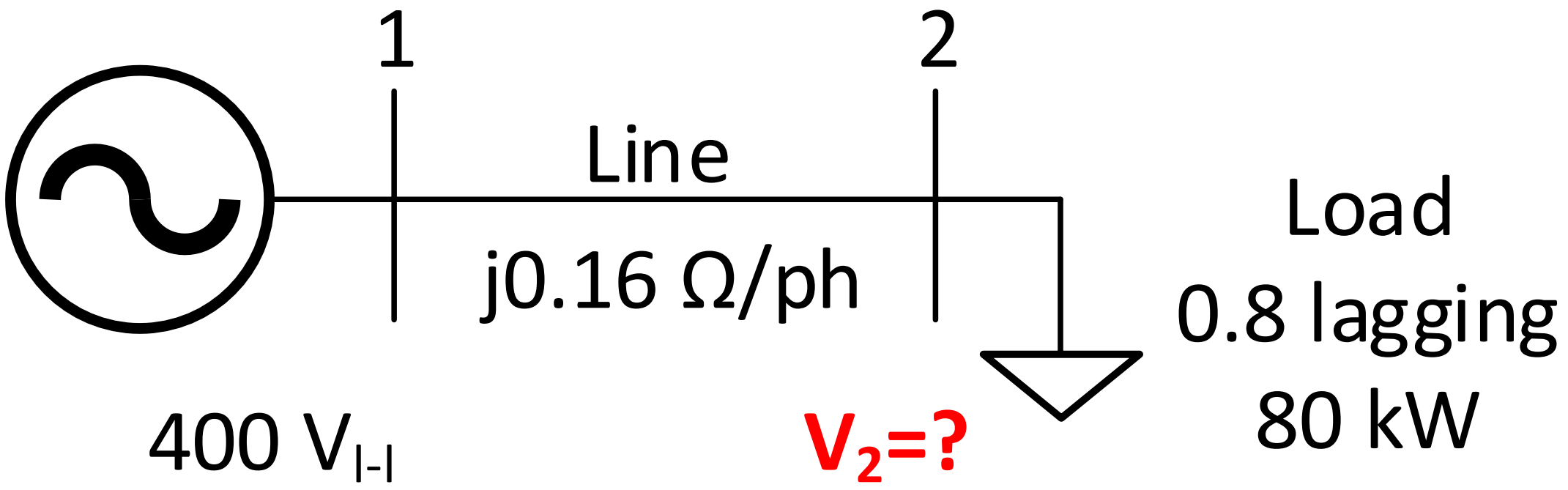


PART 4: You may encounter worse cases!!

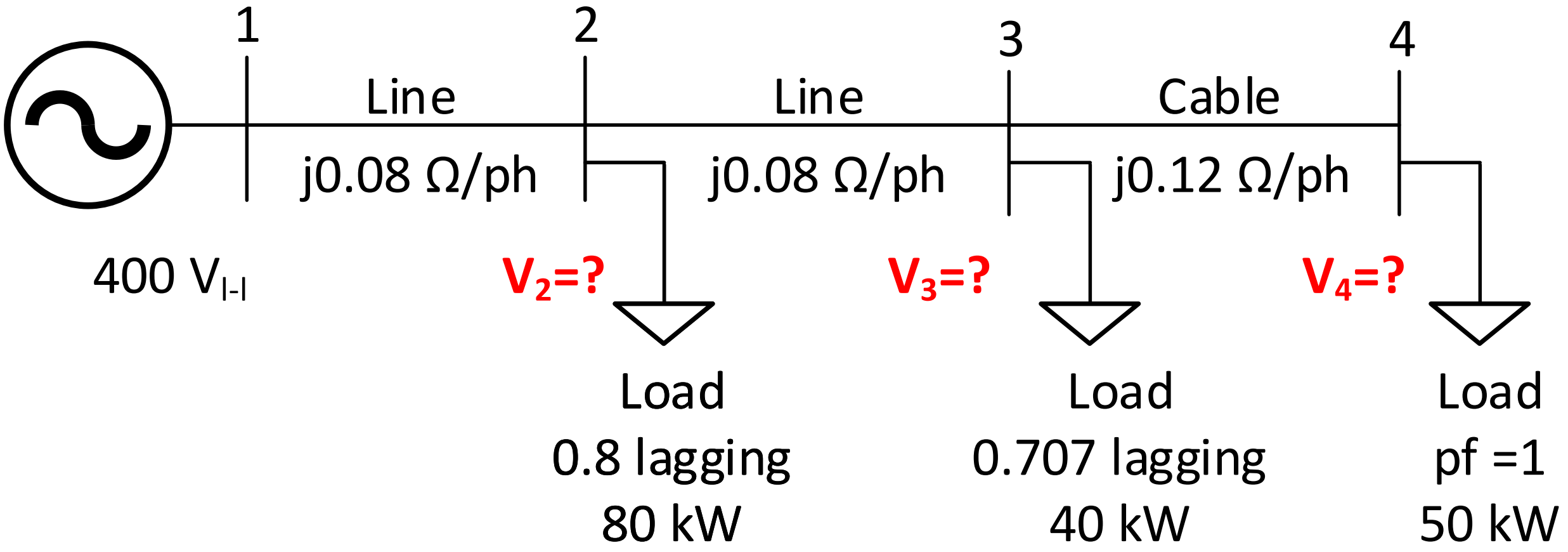


- Can you do all these computations by hand?
- How the computer programs do these calculations? (Topic of whole EE472 course)
- In this tutorial we will learn PSS Sincal, which is widely used in industry (especially for the Distribution System Studies)

PART 2: Let's analyze in PSS Sincal



PART 3: Let's try to analyze in PSS Sincal



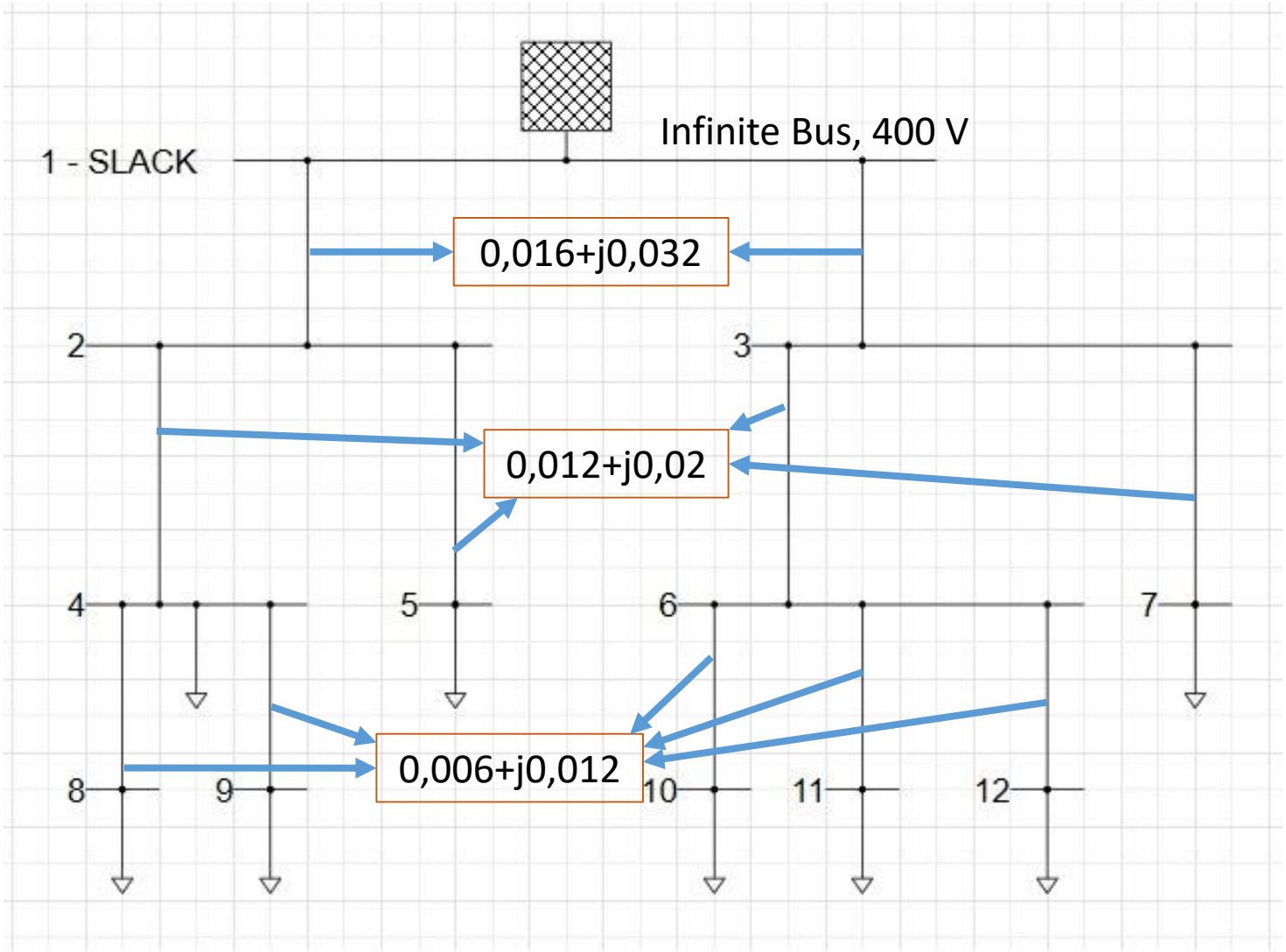
A Final Challenge

LOAD-4
30 kW
5 kVAr

LOAD-5
100 kW
40 kVAr

LOAD-8
60 kW
20 kVAr

LOAD-9
40 kW
pf = 1



LOAD-7
90 kW
15 kVAr

LOAD-10
20 kW
2 kVAr

LOAD-11
80 kW
30 kVAr

LOAD-12
40 kW
8 kVAr

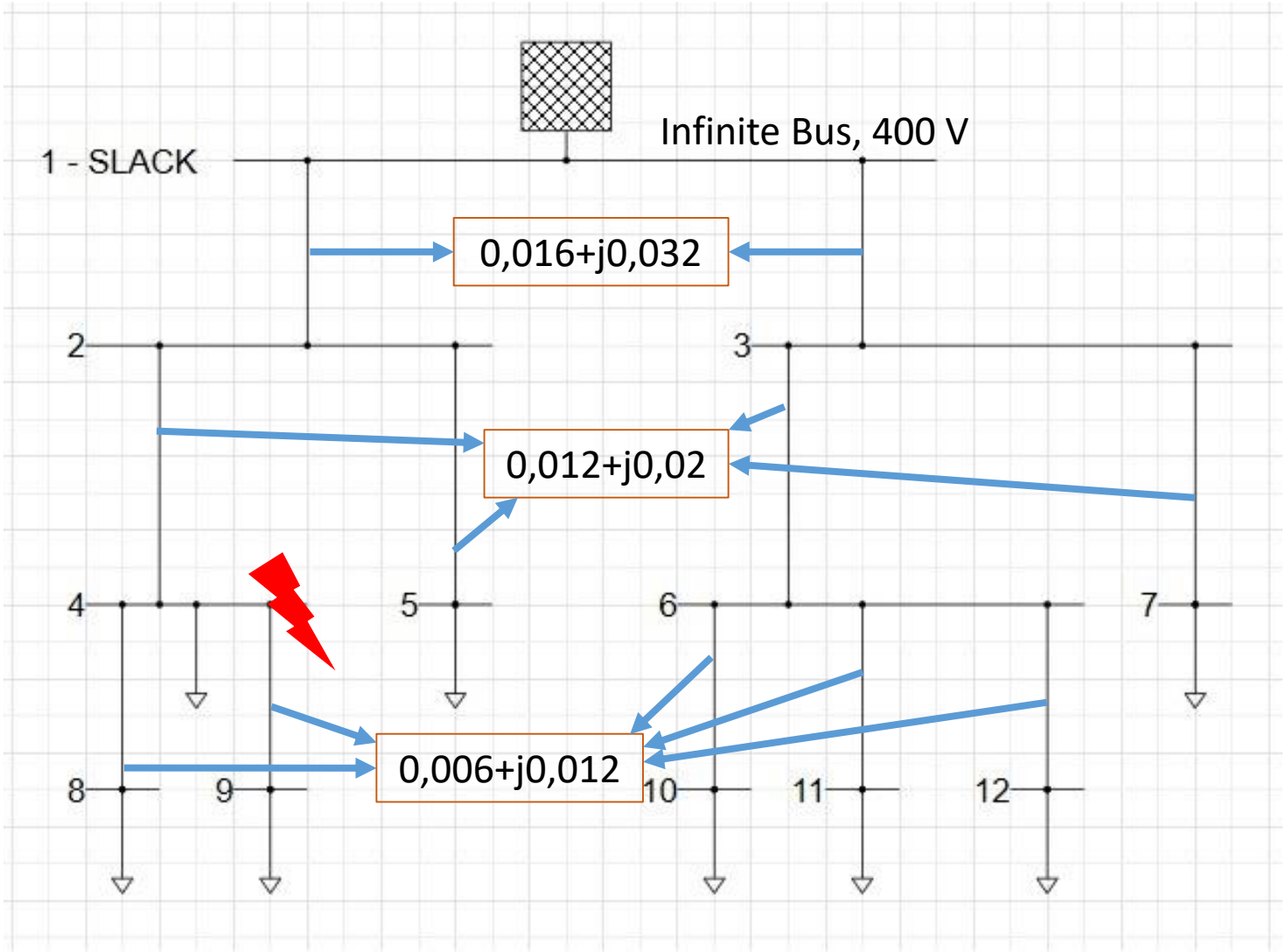
Short Circuit Analysis

LOAD-4
30 kW
5 kVAr

LOAD-5
100 kW
40 kVAr

LOAD-8
60 kW
20 kVAr

LOAD-9
40 kW
pf = 1



LOAD-7
90 kW
15 kVAr

LOAD-10
20 kW
2 kVAr

LOAD-11
80 kW
30 kVAr

LOAD-12
40 kW
8 kVAr