

UNIVERSIDADE FEDERAL DE VIÇOSA
DEPARTAMENTO DE ENGENHARIA ELÉTRICA
CURSO DE ENGENHARIA ELÉTRICA

ELT 448 - Qualidade de Energia

Professor: Victor Dardengo

Nome: _____ Mat: _____ Data: _____

Aula Prática 4

O objetivo desta prática é analisar os impactos da entrada de um grande bloco de carga e de um banco de capacitores. Inicialmente, modele o circuito conforme os parâmetros abaixo. Todas as análises serão baseadas nas tensões de fase do lado de baixa do transformador.

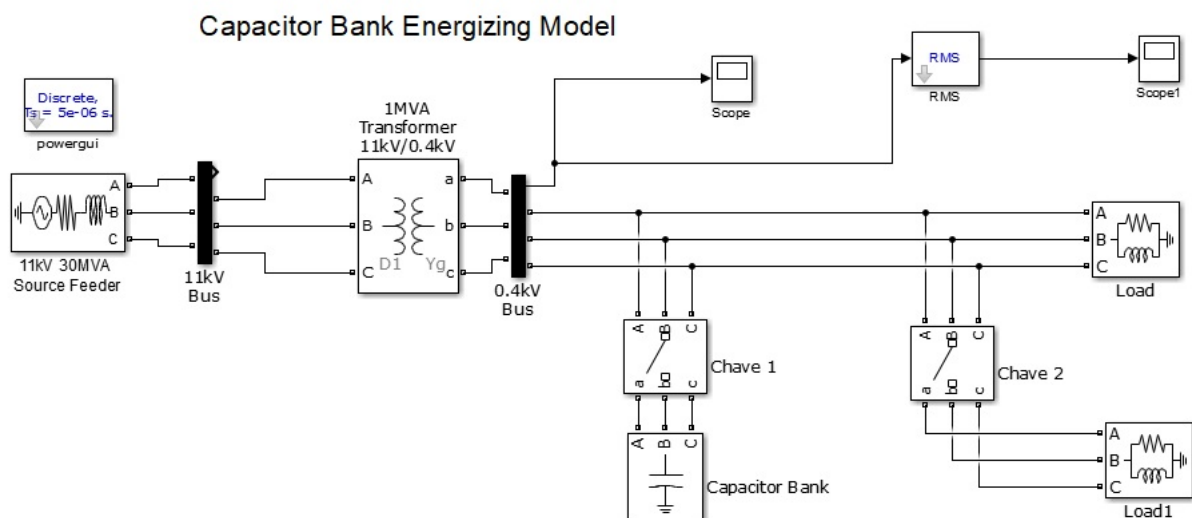


Fig. 1: Diagrama esquemático - Sistema de distribuição.

Experimento 1:

Adotando que as chaves 1 e 2 estejam inicialmente abertas, que o circuito esteja inicialmente alimentando somente a carga denominada “Load” e que os níveis adequados de tensão devem estar entre 0.9 e 1.1 pu, verifique esta condição de operação, isto é, o sistema está operando dentro dos limites normais de tensão?

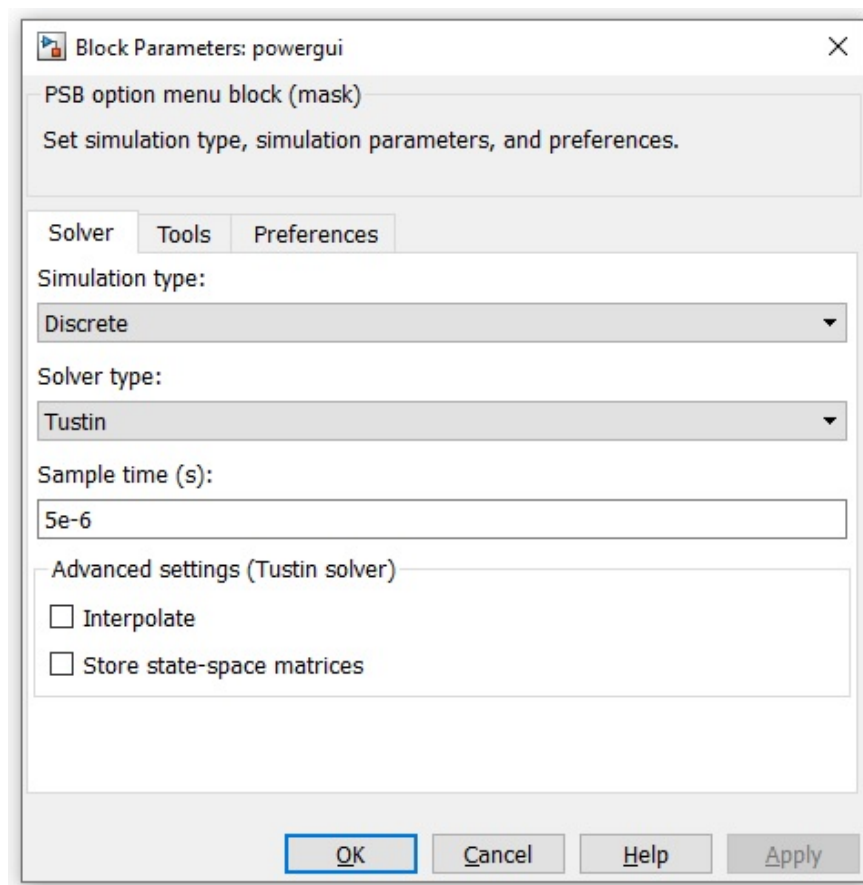


Fig. 2: Powergui.

Experimento 2:

Suponha agora que uma grande carga (Load 1) entre no instante 0.1s. O que acontece com as tensões do sistema? Os parâmetros da carga “Load 1”, são especificados conforme Fig. 7.

Experimento 3:

Depois da carga (Load 1) entrar no sistema em 0.1s, acione um banco de capacitores no instante 0.3s. O banco de capacitores é definido conforme Fig. 8. O que acontece com as tensões do sistema? Aumente o tempo de simulação para no mínimo 0.8s.

Experimento 4:

Repita o Experimento 3, entretanto, no instante 0.6s a carga Load 1 sai do sistema. Analise as tensões do sistema. Se os níveis de tensão estão fora do normal, o que pode ser realizado?

Block Parameters: 11kV 30MVA Source Feeder

Three-Phase Source (mask) (link)
Three-phase voltage source in series with RL branch.

Parameters Load Flow

Configuration: Yg

Source

☐ Specify internal voltages for each phase

Phase-to-phase voltage (Vrms):
11e3

Phase angle of phase A (degrees):
0

Frequency (Hz):
50

Impedance

☒ Internal ☒ Specify short-circuit level parameters

3-phase short-circuit level at base voltage(VA):
30e6

Base voltage (Vrms ph-ph):
11e3

X/R ratio:
7

OK Cancel Help Apply

Fig. 3: Fonte de tensão.

Block Parameters: 1MVA Transformer 11kV/0.4kV

Three-Phase Transformer (Two Windings) (mask) (link)

This block implements a three-phase transformer by using three single-phase transformers. Set the winding connection to 'Yn' when you want to access the neutral point of the Wye.

Click the Apply or the OK button after a change to the Units popup to confirm the conversion of parameters.

Configuration Parameters Advanced

Winding 1 connection (ABC terminals):

Delta (D1)

Winding 2 connection (abc terminals):

Yg

Core

Type: Three single-phase transformers


☐ Simulate saturation

Measurements

None

OK Cancel Help Apply

Fig. 4: Transformador - Configuration.


Block Parameters: 1MVA Transformer 11kV/0.4kV
✕

Three-Phase Transformer (Two Windings) (mask) (link)

This block implements a three-phase transformer by using three single-phase transformers. Set the winding connection to 'Yn' when you want to access the neutral point of the Wye.

Click the Apply or the OK button after a change to the Units popup to confirm the conversion of parameters.

Configuration
Parameters
Advanced

Units
pu

Nominal power and frequency [Pn(VA) , fn(Hz)]

[1e6 , 50]

Winding 1 parameters [V1 Ph-Ph(Vrms) , R1(pu) , L1(pu)]

[11e3 , 0.002 , 0.08]

Winding 2 parameters [V2 Ph-Ph(Vrms) , R2(pu) , L2(pu)]

[0.4e3 , 0.002 , 0.08]

Magnetization resistance Rm (pu)

500

Magnetization inductance Lm (pu)

500

Saturation characteristic [i1 , phi1 ; i2 , phi2 ; ...] (pu)

[0,0 ; 0.0024,1.2 ; 1.0,1.52]

Initial fluxes [phi0A , phi0B , phi0C] (pu):

[0.8 , -0.8 , 0.7]

OK

Cancel

Help

Apply

Fig. 5: Transformador - Parameters.

Block Parameters: Load

Three-Phase Parallel RLC Load (mask) (link)
Implements a three-phase parallel RLC load.

Parameters Load Flow

Configuration Y (grounded)

Nominal phase-to-phase voltage V_n (Vrms)
400

Nominal frequency f_n (Hz):
50

☐ Specify PQ powers for each phase

Active power P (W):
100e3

Inductive reactive Power Q_L (positive var):
100e3

Capacitive reactive power Q_C (negative var):
0

Measurements None

OK Cancel Help Apply

Fig. 6: Load.

Block Parameters: Load1

Three-Phase Parallel RLC Load (mask) (link)
Implements a three-phase parallel RLC load.

Parameters Load Flow

Configuration Y (grounded)

Nominal phase-to-phase voltage V_n (Vrms)
400

Nominal frequency f_n (Hz):
50

☐ Specify PQ powers for each phase

Active power P (W):
100

Inductive reactive Power Q_L (positive var):
1000e3

Capacitive reactive power Q_C (negative var):
0

Measurements None

OK Cancel Help Apply

Fig. 7: Load 1.

Block Parameters: Capacitor Bank

Three-Phase Parallel RLC Load (mask) (link)
Implements a three-phase parallel RLC load.

Parameters Load Flow

Configuration Y (grounded)

Nominal phase-to-phase voltage V_n (Vrms)
400

Nominal frequency f_n (Hz):
50

☐ Specify PQ powers for each phase

Active power P (W):
0

Inductive reactive Power Q_L (positive var):
0

Capacitive reactive power Q_c (negative var):
1000e3

Measurements None

OK Cancel Help Apply

Fig. 8: Banco de capacitores.