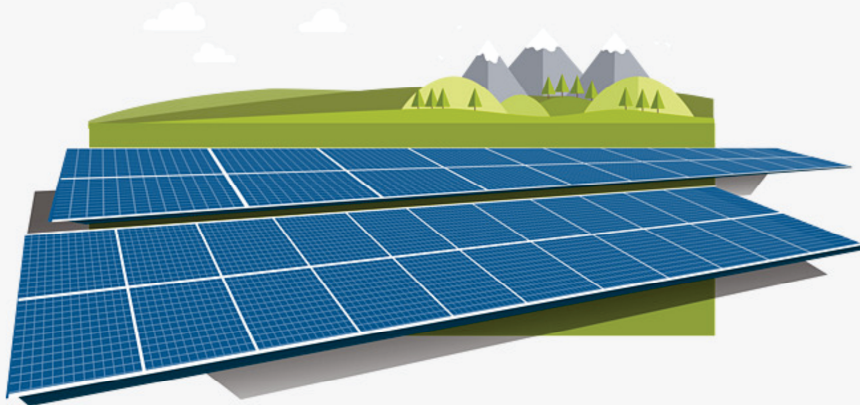




# Sistemas Elétricos de Potência

## Aula 02-P1 – Cálculo de Curto Circuito Trifásico

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heverton.pereira@ufv.br



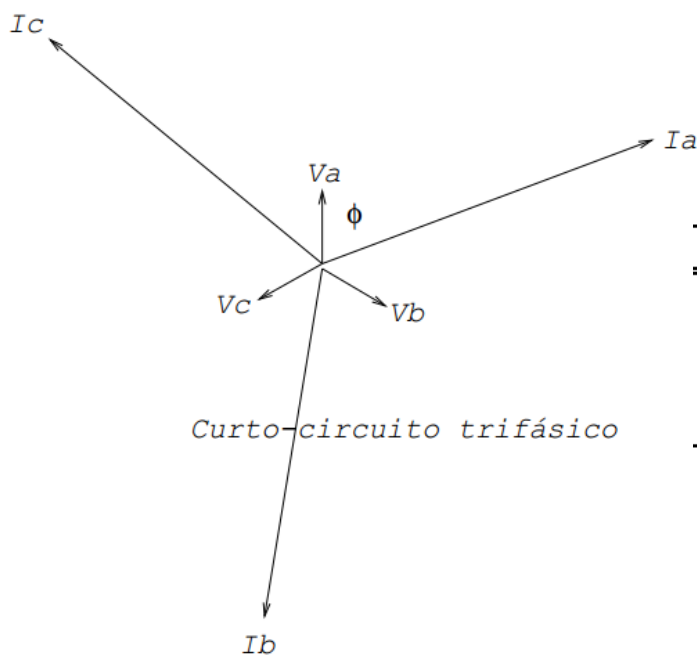
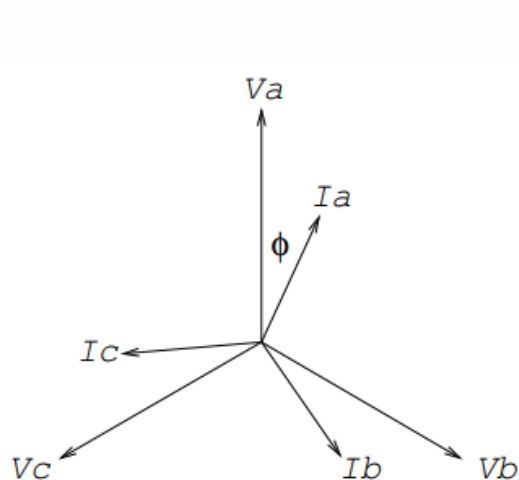
## Livro

- Capítulo 2 e 3
- Curto trifásico: é um curto simétrico
- Envolve somente as impedâncias de sequência positiva



# Características

- Curto trifásico: é um curto simétrico
- Envolve somente as impedâncias de sequência positiva

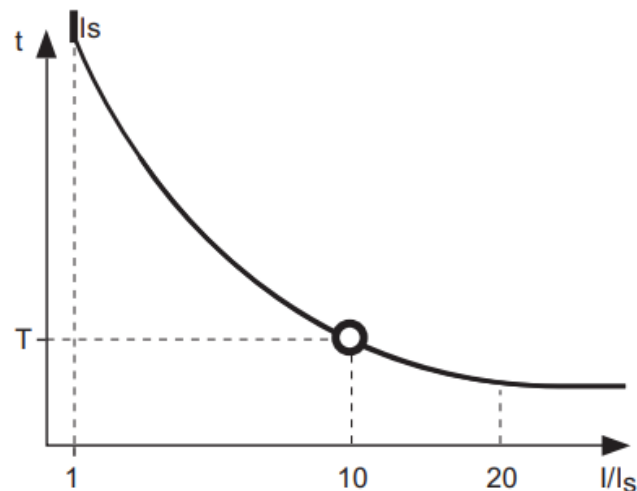
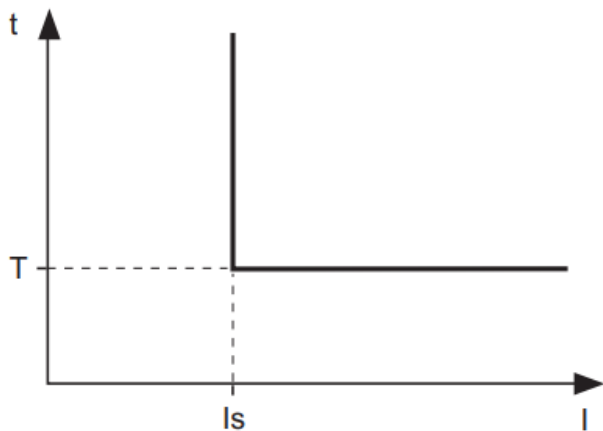


Curto-circuito	Frequência (%)
Trifásico	5,0
Bifásico	15,0
Bifásico-terra	10,0
Fase-terra	70,0



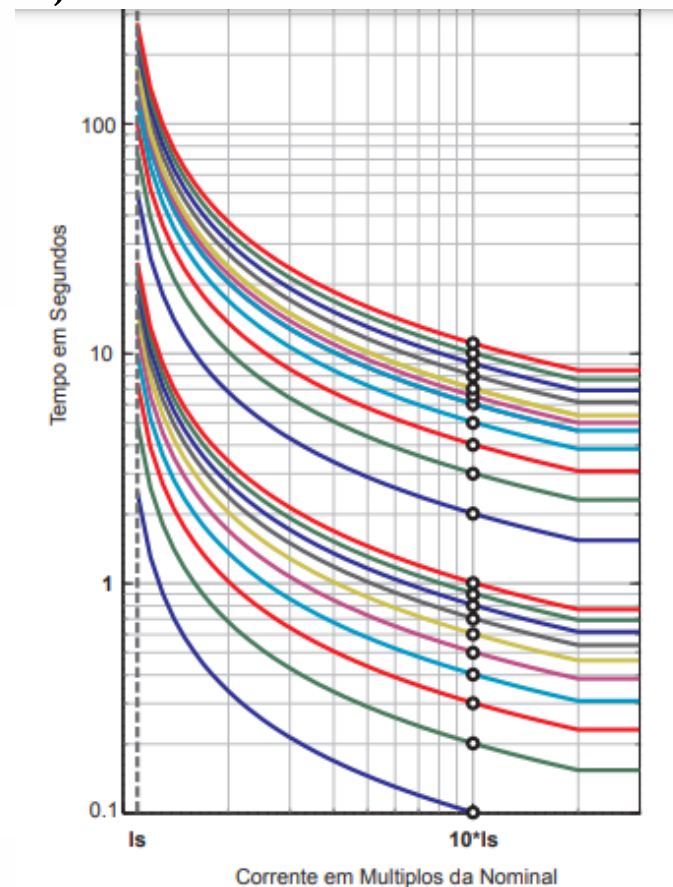
# Sistema de Proteção

- Cálculo da corrente de curto
- Parametrização do relé de proteção – Funções 50/51
- Utilização de TC para medição de corrente

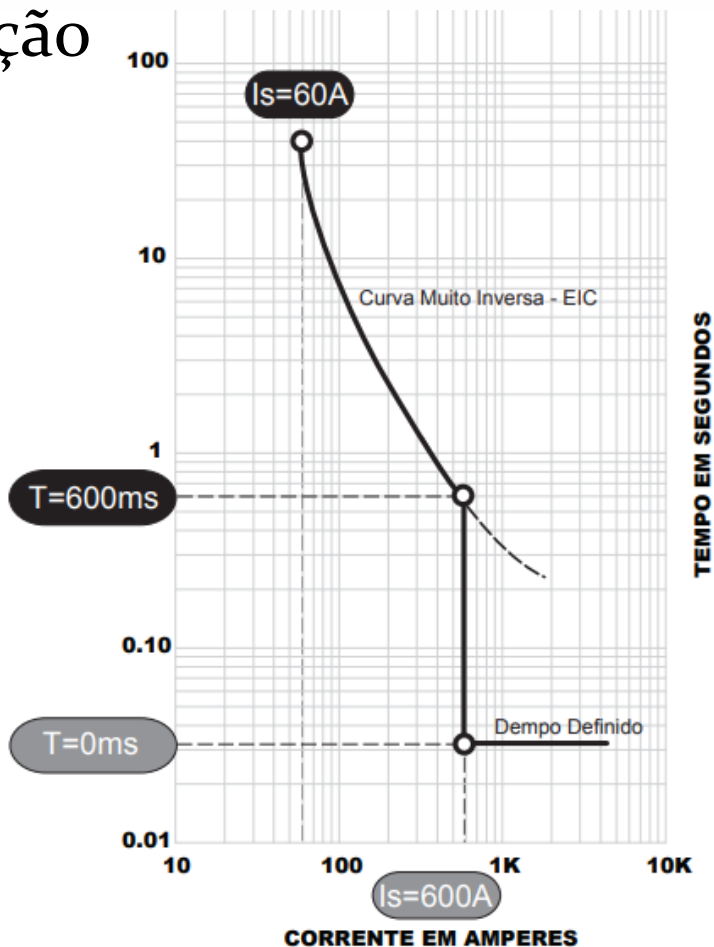
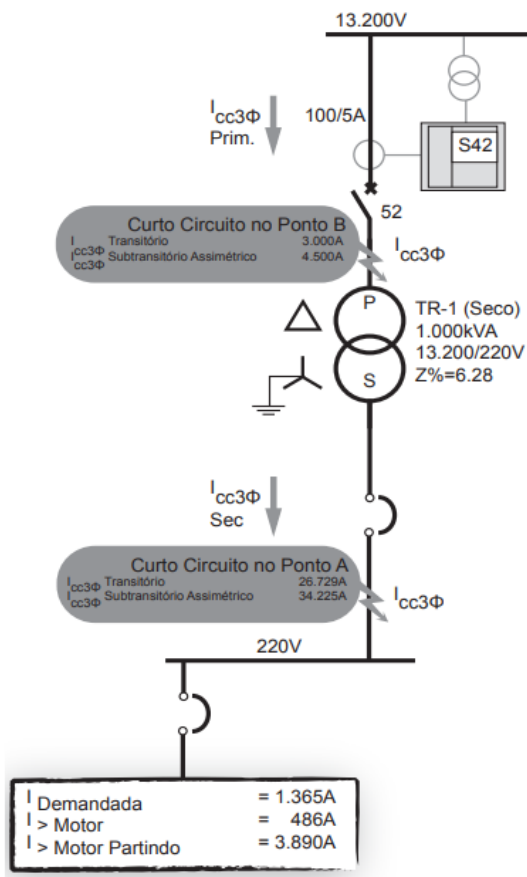


# Sistema de Proteção

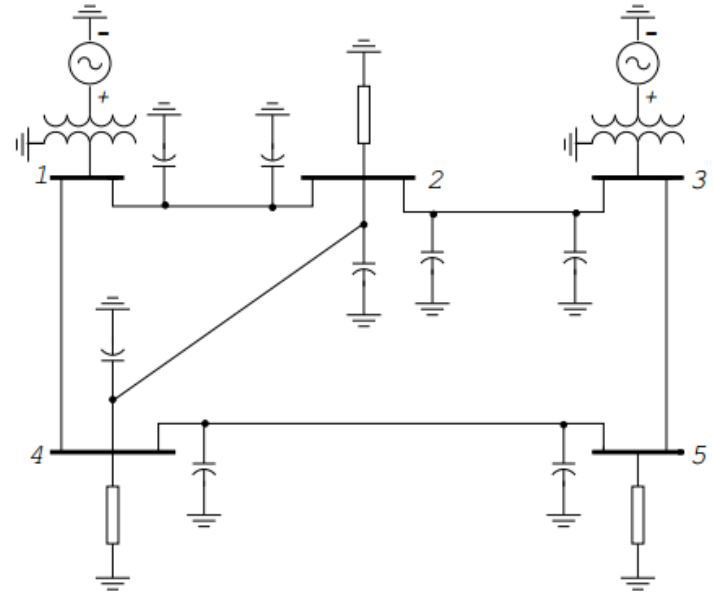
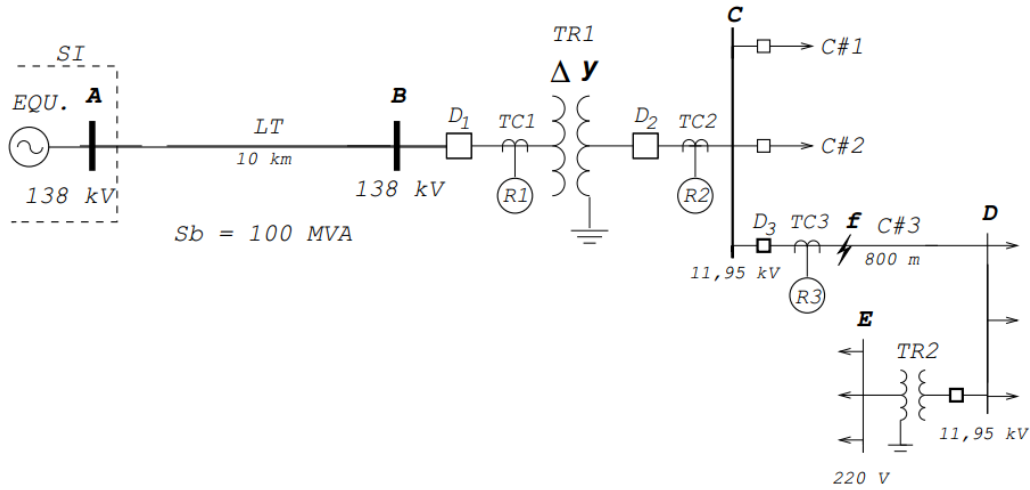
- Filtro Anti-aliasing para atenuar alta frequência
- Filtro digital para extrair a fundamental



# Sistema de Proteção

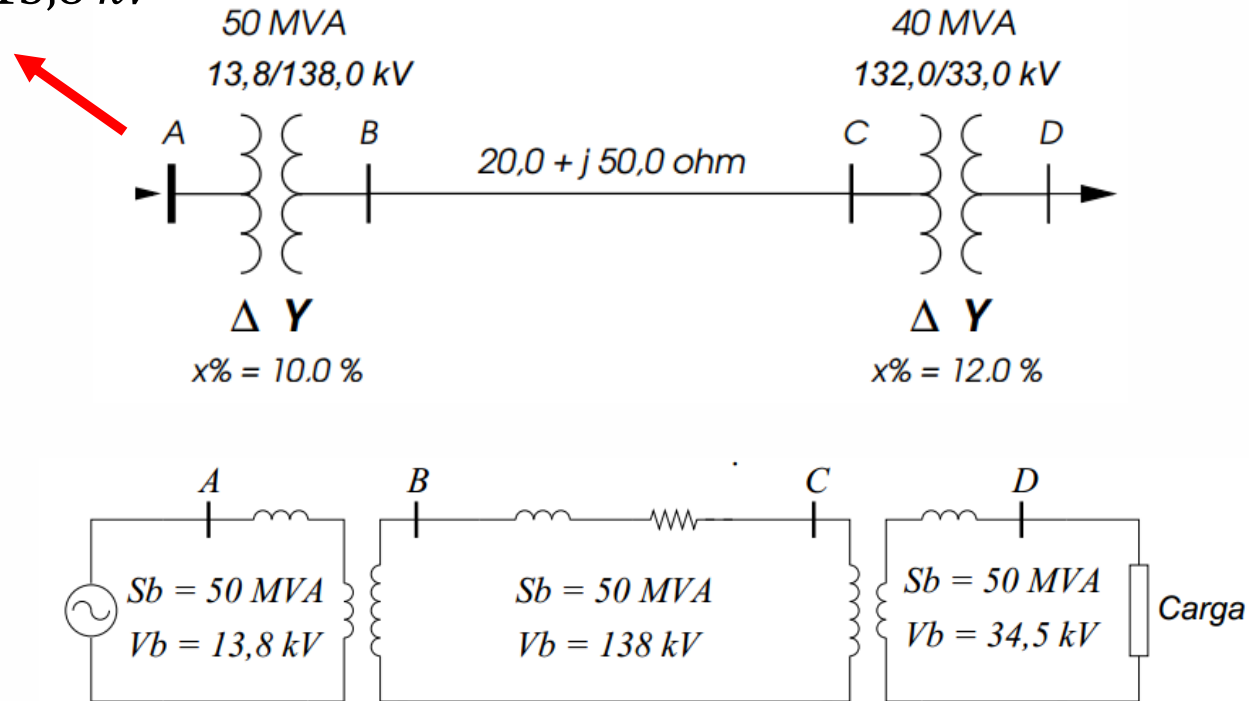


# Sistema Radial vs Anel



# Exemplo – Cálculo de curto-circuito Trifásico

Considere  $V_A = 13,8 \text{ kV}$

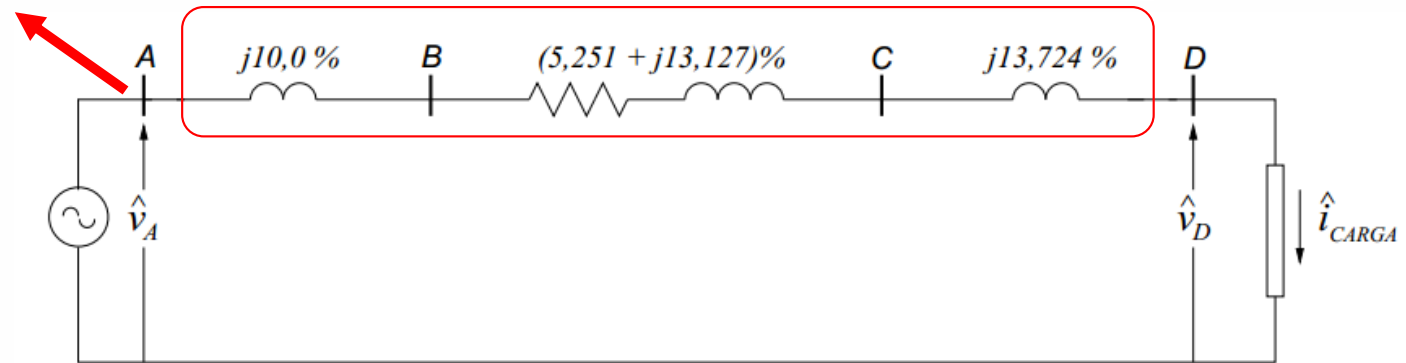




# Cálculo de curto-circuito Trifásico: Preparação dos dados

$$\widehat{v}_A = 100\%$$

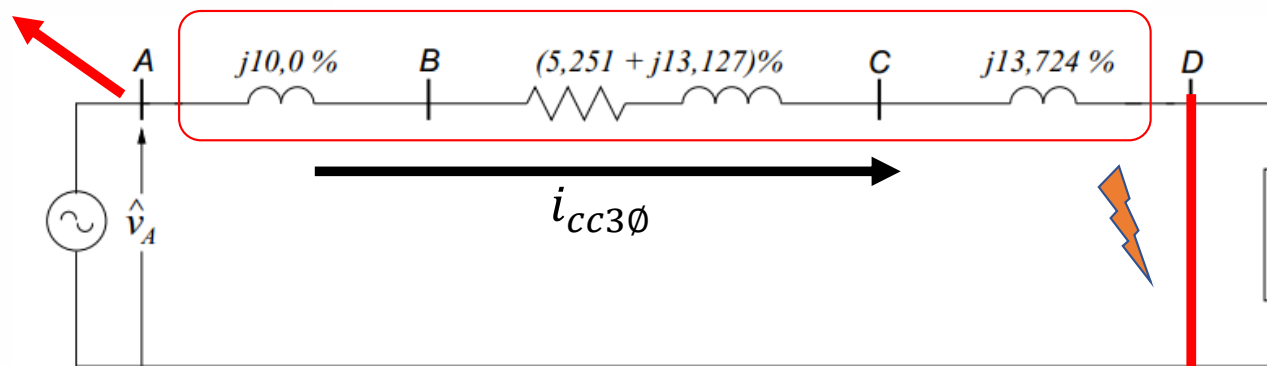
$$z_{eq}\% = 5,251 + j36,851 = 37,223 \angle 81,89^\circ$$



## Curto-circuito Trifásico na barra D

$$\widehat{v}_A = 100\%$$

$$z_{eq}\% = 5,251 + j36,851 = 37,223 \angle 81,89^\circ$$

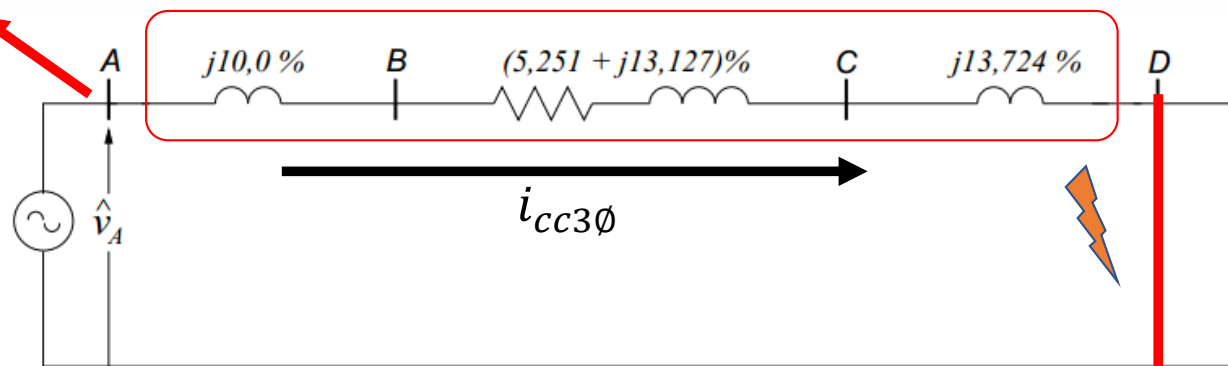


- Calcule a corrente de curto circuito na barra D.
- Calcule a tensão na barra C.

## Curto-circuito Trifásico na barra D

$$\widehat{v}_A = 100\%$$

$$z_{eq}\% = 5,251 + j36,851 = 37,223\angle 81,89^\circ$$



$$i_{cc3\phi}^D\% = \frac{100\angle 0^\circ}{37,223\angle 81,89^\circ} = 2,686\angle -81,89^\circ pu$$

$$I_{base}^D = \frac{50 \times 10^6}{\sqrt{3} \times 34,5 \times 10^3} = 836,74 A$$

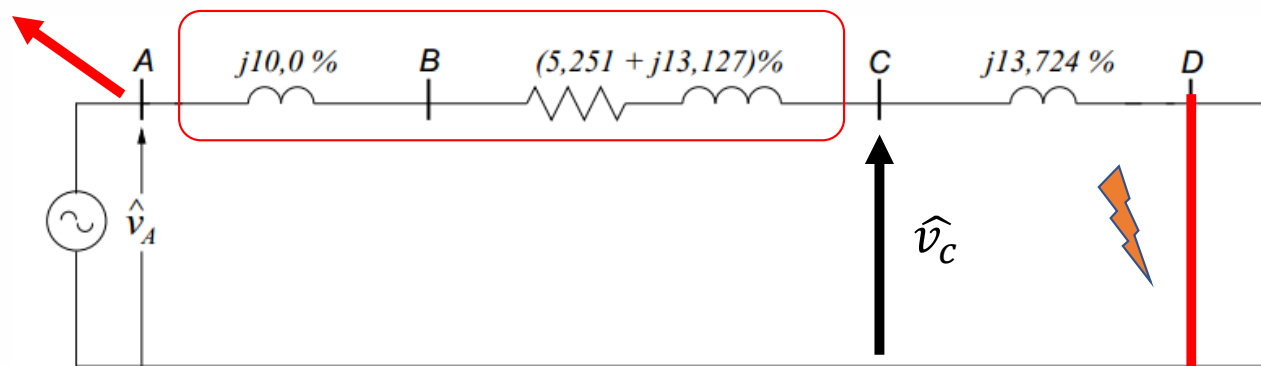
$$I_{cc3\phi}^D = 836,74 \times 2,686\angle -81,89^\circ$$

$$I_{cc3\phi}^D = 2.247,9\angle -81,89^\circ A$$

## Curto-circuito Trifásico na barra D

$$\widehat{v}_A = 100 \%$$

$$z_{eq} = 5,251 + j23,127 = 23,716 \angle 77,21^\circ$$



$$\widehat{v}_c = 100 \angle 0^\circ - 23,716 \angle 77,21^\circ \times 2,686 \angle -81,89^\circ$$

$$\widehat{v}_c = 36,87 \angle 8,11\% = 0,3687 \angle 8,11^\circ pu$$

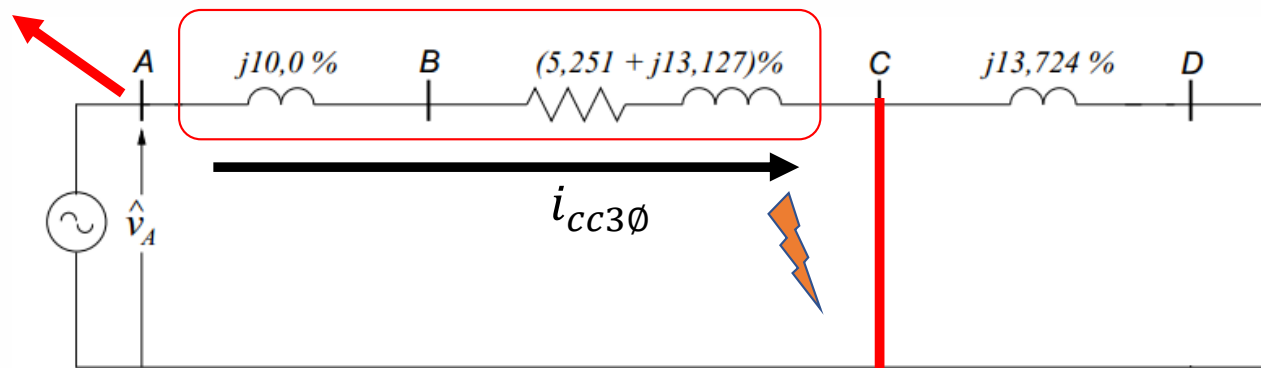
$$V_c = 138 \times 10^3 \times 0,3687 \angle 8,11$$

$$V_c = 50,88 \angle 8,11 kV$$

## Curto-circuito Trifásico na barra C

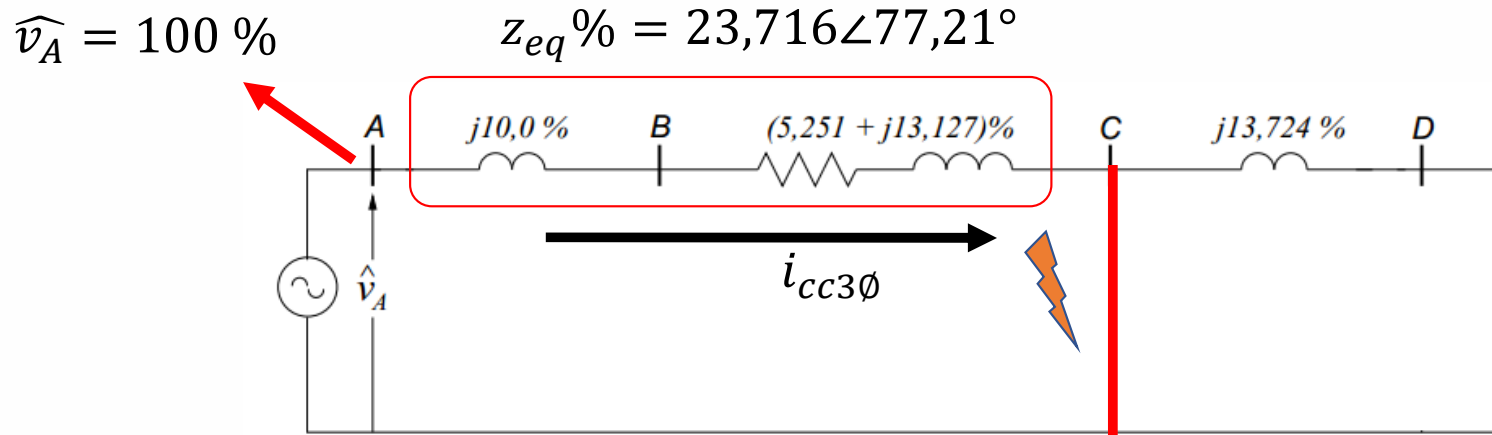
$$\widehat{v}_A = 100\%$$

$$z_{eq}\% = 23,716 \angle 77,21^\circ$$



- Calcule a corrente de curto circuito na barra C.
- Calcule a tensão na barra B.

## Curto-circuito Trifásico na barra C



$$i_{cc3\phi}^c \% = \frac{100 \angle 0^\circ}{23,716 \angle 77,21^\circ} = 4,22 \angle -77,21^\circ pu$$

$$I_{cc3\phi}^C = 209,18 \times 4,22 \angle -77,21^\circ$$

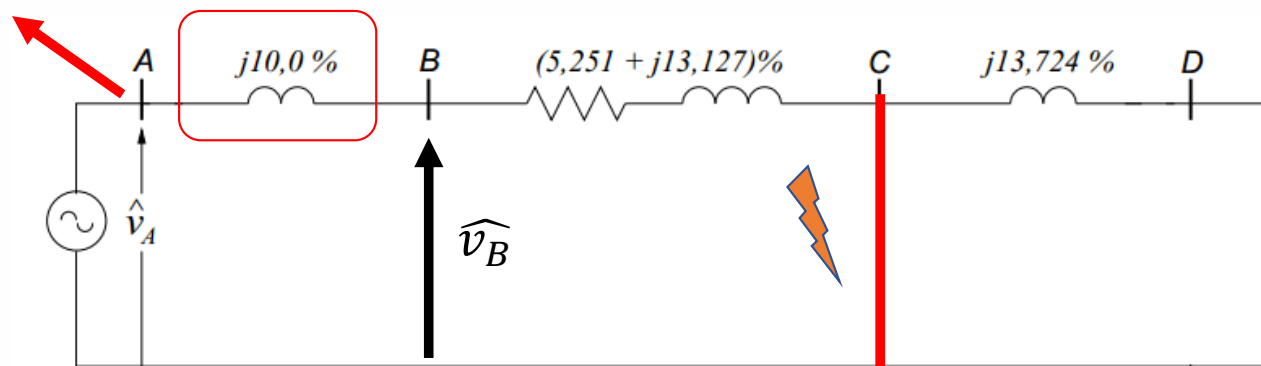
$$I_{base}^C = \frac{50 \times 10^6}{\sqrt{3} \times 138 \times 10^3} = 209,18 A$$

$$I_{cc3\phi}^C = 882,05 \angle -77,21^\circ A$$

## Curto-circuito Trifásico na barra C

$$\widehat{v}_A = 100 \%$$

$$z_{eq} \% = j10 = 10 \angle 90^\circ$$



$$\widehat{v}_B = 100 \angle 0^\circ - 10 \angle 90^\circ \times 4,22 \angle -77,21^\circ$$

$$\widehat{v}_B = 59,62 \angle -9,01^\circ = 0,5962 \angle -9,01^\circ pu$$

$$V_B = 138 \times 10^3 \times 0,5962 \angle -9,01^\circ$$

$$V_B = 82,27 \angle -9,01^\circ kV$$



[www.gesep.ufv.br](http://www.gesep.ufv.br)



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<https://play.google.com/store/apps/details?id=br.developer.gesep.estimate>





# Obrigado!

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## Sites

- ✓ [https://www.drb-m.org/protecaosep/te\\_131\\_-\\_capitulo\\_3.pdf](https://www.drb-m.org/protecaosep/te_131_-_capitulo_3.pdf)