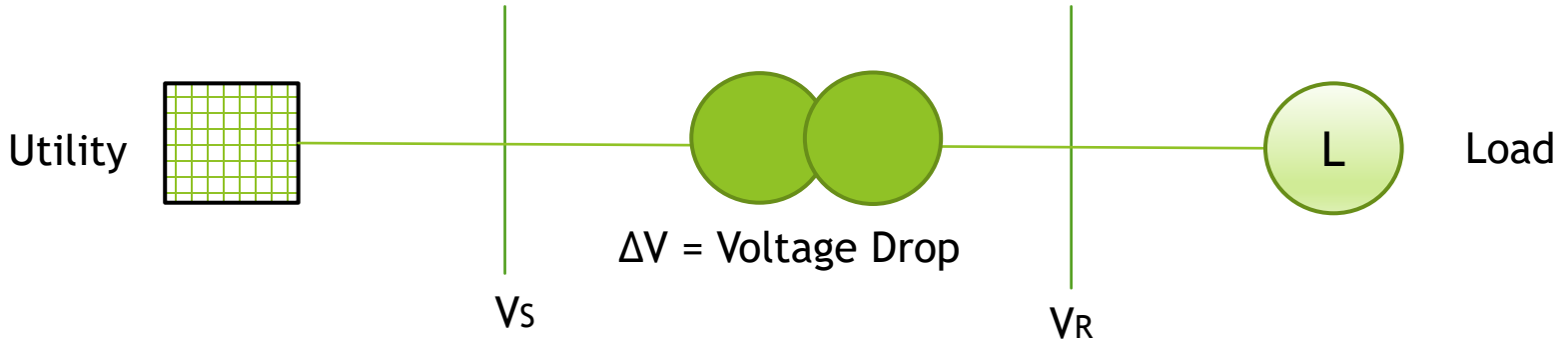
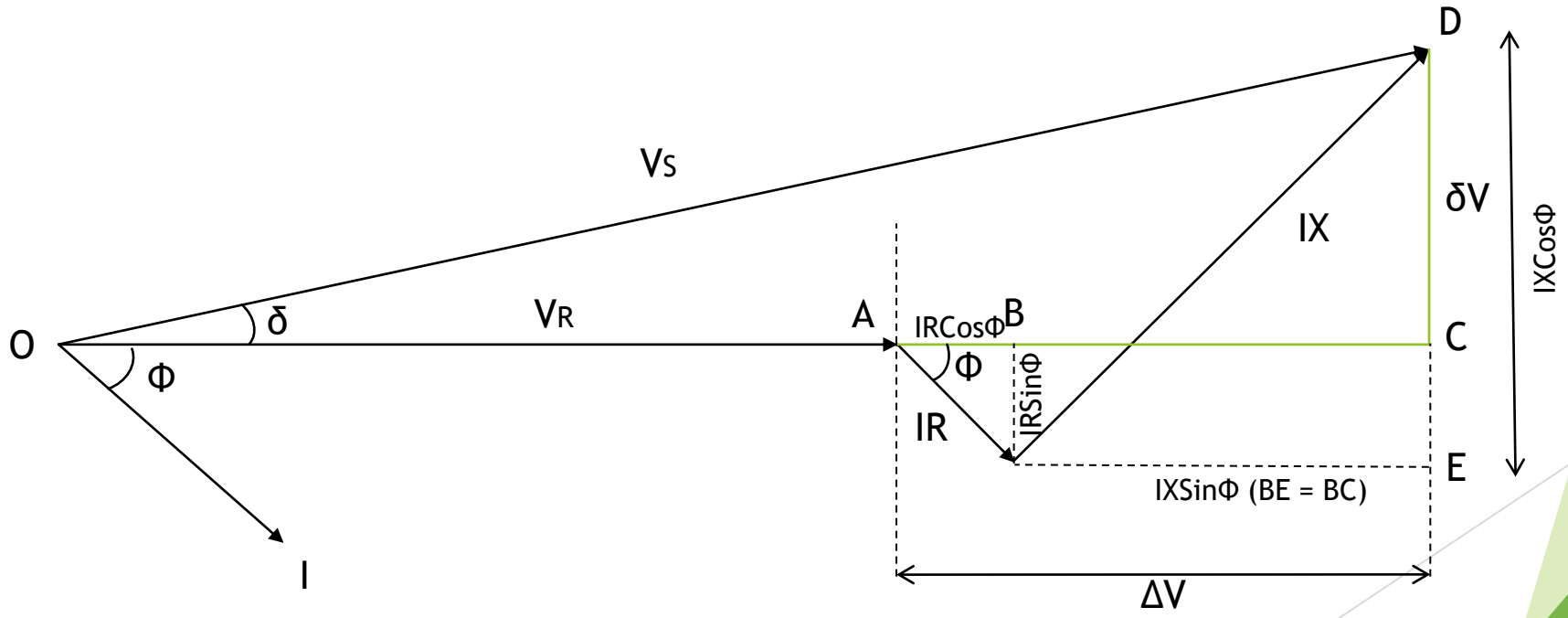
Load Flow Analysis Calculation

(Comparing Hand Calculations with ETAP Results)

How Load Flow Calculation Works?





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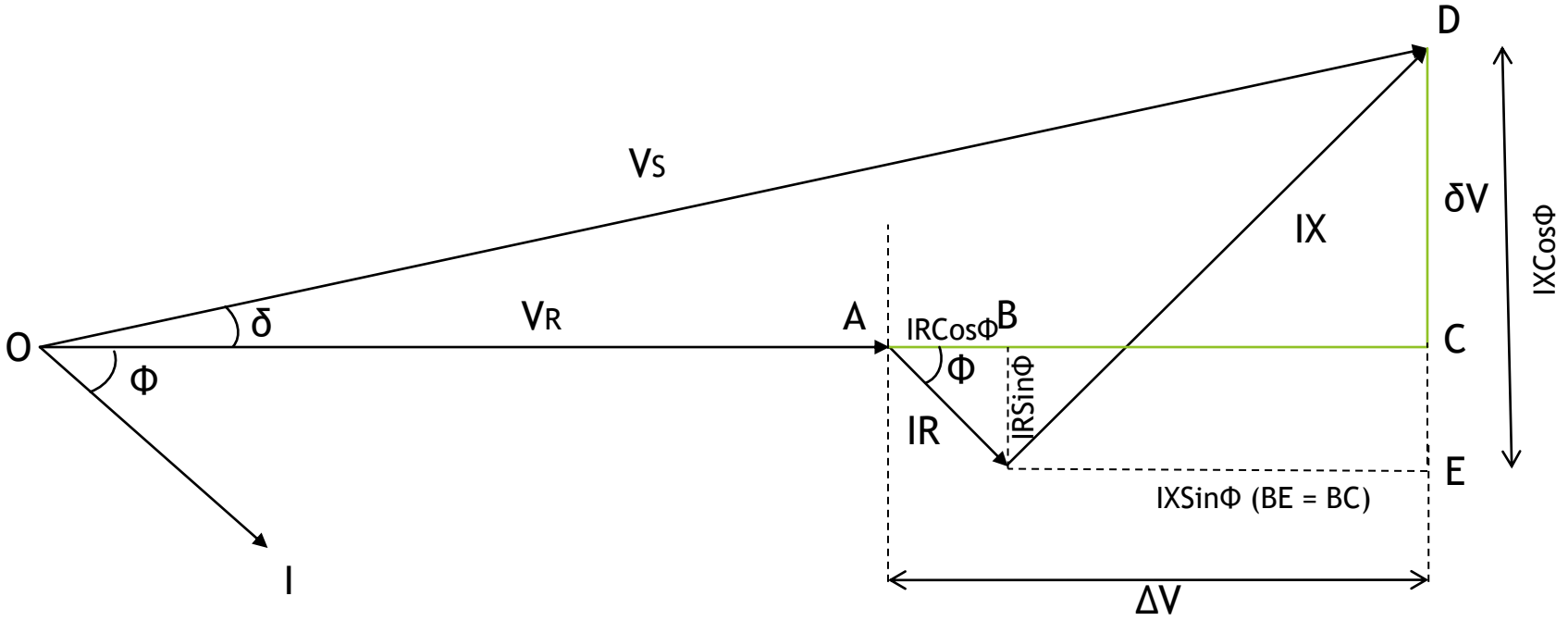

$OD = V_S$, $OA = V_R$

$OD^2 = OC^2 + CD^2$

$OD^2 = (OA+AB+BC)^2 + (DE-CE)^2$

$AB = IR\ COS\Phi$, $BC = IX\ SIN\Phi$

$DE = IX\ COS\Phi$, $CE = IR\ SIN\Phi$

$$VS^2 = (V_R + IR\ COS\Phi + IXSIN\Phi)^2 + (IX\ COS\Phi - IR\ SIN\Phi)^2$$

$$= (V_R + (R*P + X*Q)/V_R)^2 + (X*P - R*Q)/V_R)^2$$

$$VS = \sqrt{\{(V_R + (R*P + X*Q)/V_R)^2 + (X*P - R*Q)/V_R)^2\}}$$

$$TAN\delta = CD / OC = (DE - CE) / (OA + AB + BC)$$

$$= (IX\ COS\Phi - IR\ SIN\Phi) / (V_R + IR\ COS\Phi + IX\ SIN\Phi)$$

$$= ((X*P - R*Q)/V_R) / (V_R + (R*P + X*Q)/V_R)$$

$$\delta = ATAN\ [((X*P - R*Q)/V_R) / (V_R + (R*P + X*Q)/V_R)]\ Radian$$

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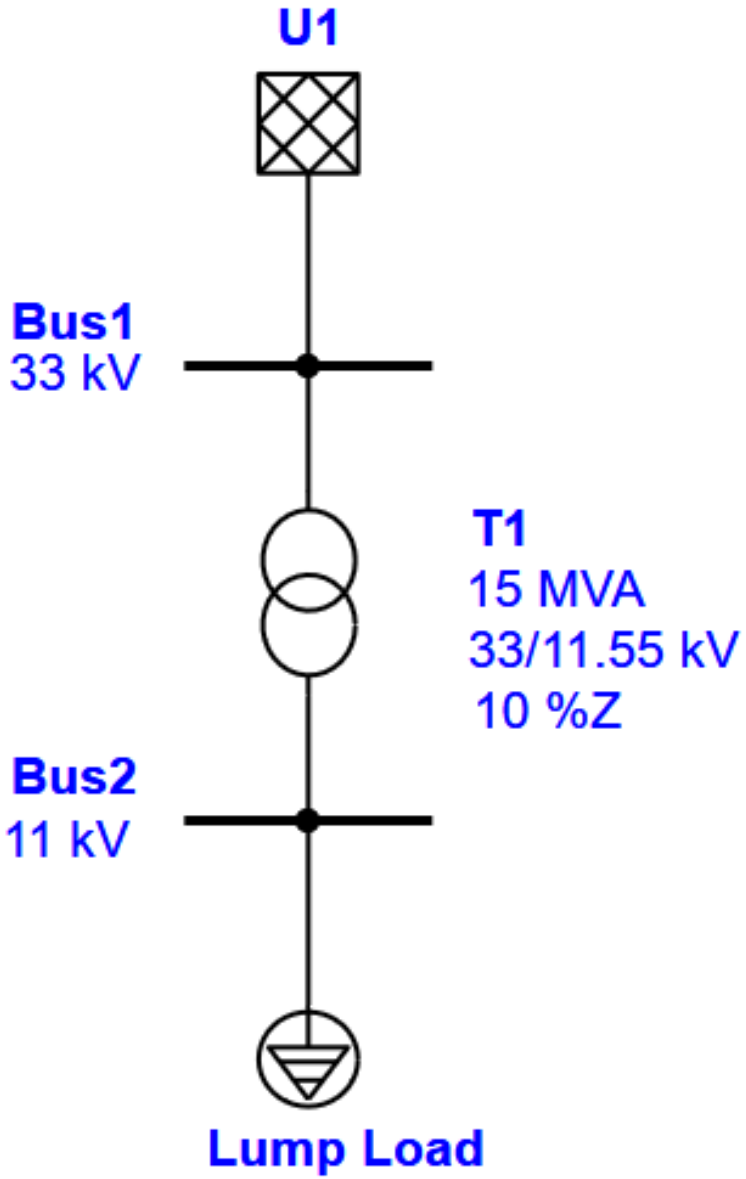

Grid Data

Grid Voltage = 33kV

Bus Data

Bus Voltage = 33kV

Transformer Data

Voltage Rating - 33/11.55 kV

MVA Rating - 15 MVA

% Impedance - 10%

X/R Ratio - 18.6

Load Data

Voltage Rating - 11 kV, MVA Rating - 12 MVA

Motor Load - 80%, Static Load - 20%

Power Factor - 80%