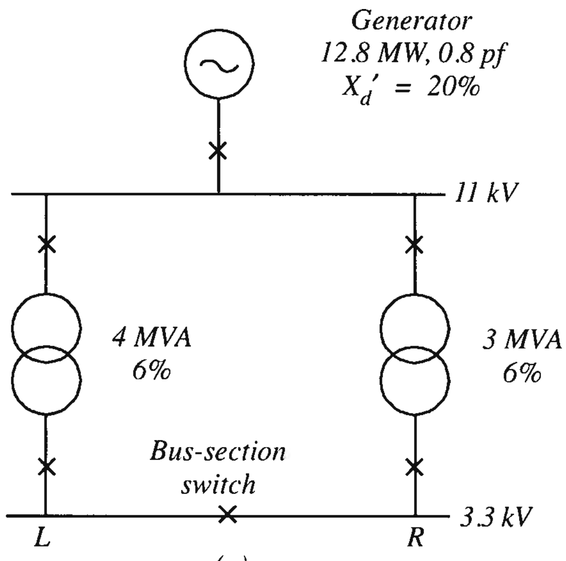
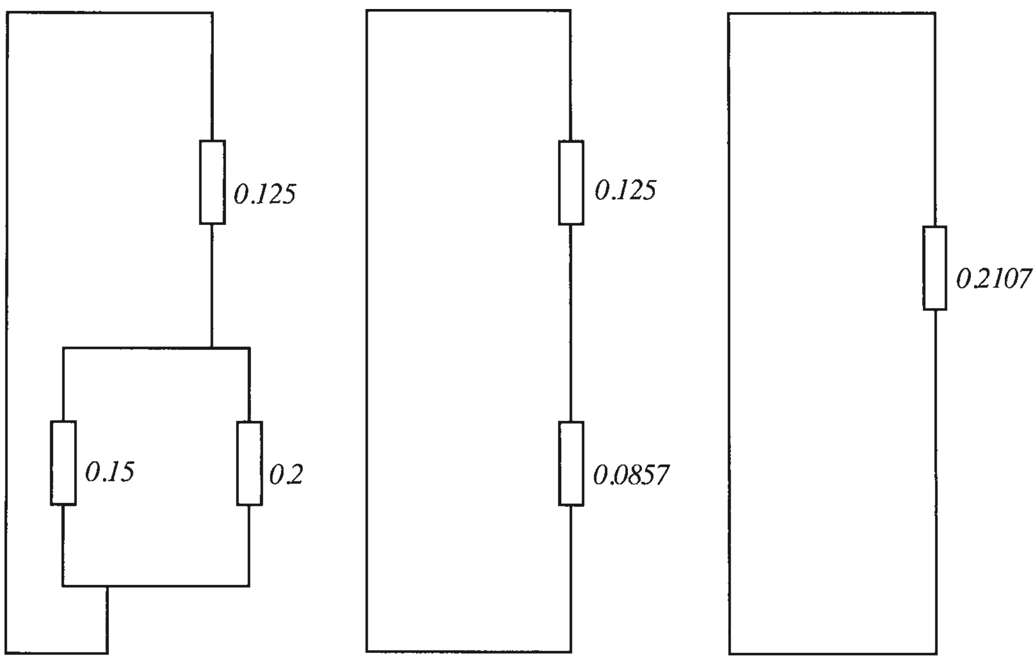


(a)
System diagram



(b) Impedance diagram fault on 3.3 kV busbar (c) (d) Circuit reduction

FIG. 3 Power System with Dissimilar Transformers

A fault on the 3.3 kV busbar with the bus-section switches closed would result in the 0.2 pu and the 0.15 pu impedances being connected in parallel.

$$\frac{1}{X\,\text{pu}} = \frac{1}{0.2} + \frac{1}{0.15} = 11.666 \therefore X\,\text{pu} = 0.0857$$

The impedance of the transformers in parallel is therefore 0.0857 pu. Add to this the generator impedance, 0.125 pu,

$$0.0857 + 0.125 = 0.2107\ \text{pu}$$

and the fault level at the 3.3 kV busbar is:

$$\frac{10}{0.2107} = 47.5\,\text{MVA}$$

FIGURE 4 shows the fault MVA distributed across the equivalent and the various component impedances.

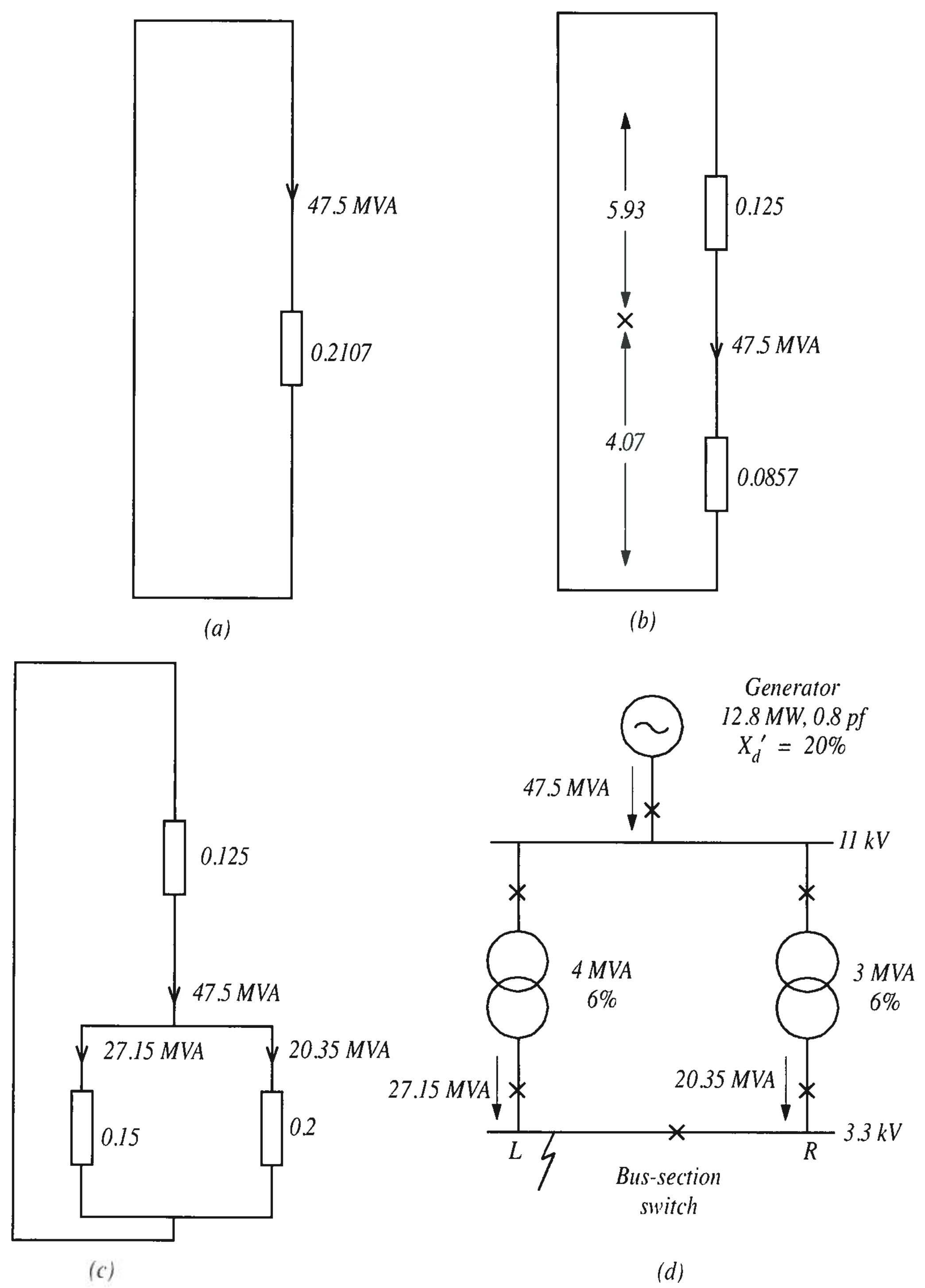


FIG. 4 Distribution of Fault MVA

The "voltage" (MVA base) across the two impedances in series of FIGURE 4(b) is, of course, 10 MVA. So the proportion of 10 MVA across the generator impedance is:

$$47.5 \text{ MVA} \times 0.125 \text{ pu} = 5.93 \text{ MVA}$$

and across the transformer impedances in parallel as shown in FIGURE 3(b) is:

$$47.5 \text{ MVA} \times 0.0857 \text{ pu} = 4.07 \text{ MVA}$$

or

$$10 - 5.93 = 4.07 \text{ MVA}$$

From this, the fault MVA in each transformer can be calculated.

Transformer 1 $$\frac{4.07 \text{ MVA}}{0.15} = 27.15 \text{ MVA}$$

Transformer 2 $$\frac{4.07 \text{ MVA}}{0.2} = 20.35 \text{ MVA}$$

which totals 47.5 MVA (to 1 decimal place).

From the fault MVA the current in each transformer can be calculated.

Note that the transformers share the fault MVA in direct proportion to their ratings. This is because their impedances are the same.

To summarise, the calculation proceeds as follows:

Draw the system diagram
Draw the impedance diagram
Calculate the per unit impedances to a common base

$$X \text{ pu} = \frac{\text{Base MVA}}{\text{Rated MVA}} \times \frac{X\%}{100}$$