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Key Solution

Quiz # 4 Sec. 1 Serial # Name: I.D.#

A generator rated 100 MVA, 20 kV has $X'' = X_2 = 20\%$ and $X_0 = 5\%$. Its neutral is grounded through a reactor of 0.32 Ohm. The generator is operating at rated voltage without load and is disconnected from the system when a single line-to-ground fault occurs at its terminals. Find the sub-transient current in the faulted phase.

Solution:

$$\begin{aligned} \text{Base } Z &= \frac{(20)^2}{100} = 4.0 \Omega \\ X_n &= \frac{0.32}{4} = 0.08 \text{ p.u.} \\ Z_0 &= j0.05 + 3j0.08 = j0.29 \\ I_{a1} &= \frac{1}{j0.2 + j0.2 + j0.29} = -j1.449 \\ I_a &= 3 I_{a1} = -j4.347 \text{ p.u.} \\ \text{Base } I &= \frac{100,000}{\sqrt{3} \times 20} = 2887 \text{ A} \\ |I''| &= 4.347 \times 2887 = 12,550 \text{ A} \end{aligned}$$