EE4010
Electrical and Electronic Power Supply Systems

Problems on Symmetrical Components

Problem 1: The following currents flow in the input lines to a three-phase, star connected load with a solidly grounded neutral: $I_a = 200 \angle 25°$ A, $I_b = 200 \angle -95°$ A and $I_c = 200 \angle 145°$ A. Calculate the corresponding set of symmetrical components. What current flows in the neutral?

Answer 1: Zero sequence current = 0 A
Positive sequence current = 200 A at a phase angle of 25 degrees
Negative sequence current = 0
Neutral current = 0 A.

Problem 2: A three-phase set of currents is given by $I_a = 100 \angle 0°$ A, $I_b = 100 \angle 90°$ A and $I_c = 0$ A. Calculate the symmetrical components of these currents.

Answer 2: Zero sequence current = 47.1405 A at a phase angle of 45 degrees
Positive sequence current = 17.2546 A at a phase angle of -75 degrees
Negative sequence current = 64.3951 A at a phase angle of -15 degrees.

Problem 3: The symmetrical components of the phase to ground voltages at a point in an electrical power supply network following a fault are defined by $V_0 = 20 \angle 80°$ V, $V_1 = 100 \angle 0°$ V and $V_2 = 30 \angle 180°$ V. Evaluate the magnitudes and the phase angles of the actual phase to ground voltages would be monitored using an oscilloscope.

Answer 3: Phase a voltage = 76.0672 V at a phase angle of 15.0066 degrees
Phase b voltage = 98.0917 V at a phase angle of -108.748 degrees
Phase c voltage = 135.985 V at a phase angle of 103.406 degrees.

Problem 4: One line of a three-phase star-connected generator is open circuited while the other two are shorted to ground. The line currents are $I_a = 0$ A, $I_b = 1500 \angle 90°$ A and $I_c = 1500 \angle -30°$ A. Calculate the symmetrical components of the currents and the actual current into the ground.

Answer 4: Zero sequence current = 500 A at a phase angle of 30 degrees
Positive sequence current = 1000 A at a phase angle of -150 degrees
Negative sequence current = 500 A at a phase angle of 30 degrees

Ground current calculated via zero sequence current = 1500 A at a phase angle of 30 degrees
Ground current calculated via actual phase currents = 1500 A at a phase angle of 30 degrees