Benha University
Faculty of Engineering at Shoubra
Department of Electrical Engineering
Electrical Power and Machines (EP&M) Section

Power Electronics (1)
1st Semester, AY 2019-2020
3rd year, EP&M
Sheet Two

1. A three-phase, uncontrolled bridge rectifier is supplied from a 480 V (rms, line-to-line), 50 Hz 3-phase AC source, feeding a highly inductive load with R=50 Ω.

    (a) Plot the waveforms of the output voltage, diode currents, diode voltage and supply current.

    (b) Determine:

    i. the mean values of the load voltage and current,

    ii. the average and rms values of the diode currents,

    iii. PIV of the diodes,

    iv. the rms value of the supply current,

    v. the rectification ratio and converter efficiency.

2. A three-phase, uncontrolled bridge rectifier is connected to a 220 V (rms, line-to-line), 50 Hz 3-phse AC supply. The rectifier is supplying an inductive load of R=25Ω and L=100mH. Determine using **Fourier series**:

    (a) the average values of the rectifier output voltage and current,

    (b) the amplitude of the most dominant harmonic of the load voltage and current,

    (c) the rms value of the supply current,

    (d) the %THD of the supply current

    (e) The supply apparent power and power factor.

3. A three-phase, fully controlled bridge rectifier is connected to a 220 V (rms, line-to-line) 50 Hz 3-phase AC supply. The rectifier is supplying a pure resistive load of R=25Ω. Determine:

    (a) the required firing angle if the average output voltage is 50% of the maximum output voltage,

    (b) the average and rms values of the load current,

    (c) the average and rms values of the thyristor current,

    (d) the rectification ratio and converter efficiency,

    (e) the input power factor.

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4. A three-phase, fully controlled bridge rectifier is connected to a 660 V (rms, line-to-line) 3-phase AC supply. The rectifier is supplying a DC load current (R=25 Ω) and a thyristor voltage drop of 1.2 V.

   (a) Determine the mean values of the load voltage at firing delay angles (α) of: 0°, 30°, 45°, 60° and 90°.

   (b) Plot the waveforms of the load voltage and thyristor voltages at α=75°.

   (c) Calculate the average and rms values of the thyristor current (i_{T1}).

   (d) Calculate the average power loss in each thyristor.