EE561: Power Electronics Laboratory

Experiment 5: Single-phase Rectifiers

Objective: The objective of this experiment is to study the operation of single-phase uncontrolled and controlled rectifiers using MATLAB/SIMULINK.

Parameters:

Parameter		**Value**
Input voltage		230 V, 50 Hz
Source Inductance		10 mH
Load Parameters	R Load Case (1)	20 Ω
	RL Load Case (2)	20 Ω in series with 20 mH Inductance
	RL Load Case (3)	20 Ω in series with 200 mH Inductance

Procedure

1. Simulate a Full-bridge uncontrolled rectifier (with four diodes) with no source inductance and the load parameters mentioned in all three cases. Take the snapshots for source voltage, source current, load voltage, and load current. Note down the peak-peak ripple in load current in each case.
2. Repeat step 2 with source inductance. Observe the change in load voltage and source current waveforms. For case (3), note down the commutation angle 'u' and match with the theoretical value.
3. Simulate a Full-bridge Full controlled rectifier (with four thyristors) with no source inductance and the load parameters mentioned Case (3). Consider two values of Firing angles: α = 30 deg and α = 90 deg. Take the snapshots for source voltage, source current, load voltage, and load current. Observe the change in load voltage and load current waveforms with change in α.
4. Repeat step 3 with source inductance and for α = 30 deg. Observe the change in load voltage and source current waveforms. For case (3), note down the commutation angle 'u' and match with the theoretical value.

Report

Prepare the report with the results obtained for each case and your observations. Report should also contain snapshot of the simulated circuit, Snapshot of the simulation configuration parameters

Note: (1) In Simulink, the circuit has to be simulated using a fixed time-step solver

(2) To find the commutation angle 'u', the following expression can be used:

$$\cos(\alpha + u) = \cos\alpha - \frac{2\omega L_s I_o}{230\sqrt{2}}$$

I_o is average load current; L_S is source inductance; ω is source voltage frequency;