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EE152 Basic Electrical Science Lab

Session – 7

Clamping & Voltage Doubler Circuit with Diodes

7. A. Introduction:

This session makes students to understand various applications of Diode (such as clamping circuit and voltage doubler circuit), and to verify their characteristics through a Simulation platform, MATLAB/Simulink.

7. B. Objectives:

a. Acquire a good knowledge on application of Diode in clamping and voltage doubler circuits.

b. Verification of the theoretical knowledge on these circuits through simulation in MATLAB/Simulink Platform.

7. C. Theory: Refer to the notes or necessary materials mentioned in EE151 course.

7. D. Statement of Experiments:

Fig. 7.1 represents clamping circuits with diode, where an ac sinusoidal voltage source ($v(t) = 230\sqrt{}\ 2\sin(100\pi t)$) gets clamped to a certain value decided by the doide's on-state voltage (**with 0.7 V as forward-bias voltage drop of the diode**). In Fig. 7.1(a), positive voltage gets clamped to diode on-sate voltage, while the negative voltage is clamped in the circuit shown in Fig. 7.1(b). Therefore, the former circuit is known as Positive Clamping circuit while the later one is a negative clamping circuit. The following task has to be done theoretically and those have to be verified by simulation in Matlab.

1. Derive the expression of $v_o(t)$ and $i_{in}(t)$.
2. Draw the waveforms of $v_o(t)$ and $i_{in}(t)$ for 5 cycles.

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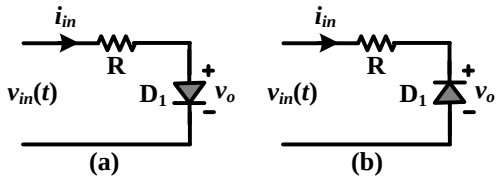

Fig. 7.1

7. E. Procedure:

Determine all the parameters asked in section- 7.D theoretically and draw corresponding experimental circuit (necessary measuring instruments are to be incorporated in the circuit) of the circuit shown in Fig. 7.1. Construct the Experimental circuits in Simulink domain, simulate it, and observe the output waveforms.

7. F. Assignments:

Part-1: Replace sinusoidal voltage source by a ramp voltage source (with slope 10) in Fig. 7.1, and do the simulation again.

Part-2: with the theoretical analysis, design a circuit with sinusoidal voltage source ($v(t) = 230\sqrt{}2\sin(100\pi t)$) and Ramp voltage source (with slope 10) to get both halves (positive and negative) clamping at 2.1 V of the output. With simulation, validate your design.

Part-3: Consider Fig.7.2 with $v(t) = 230\sqrt{}2\sin(100\pi t)$, C = 1 mF, do the same as mentioned in Section - 7.D.

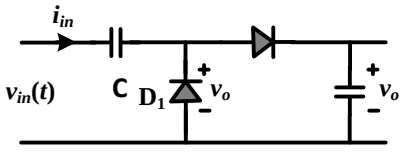

Fig. 7.2