Introduction to Power Electronics Sample Problems
Phase-controlled Rectifier Circuits

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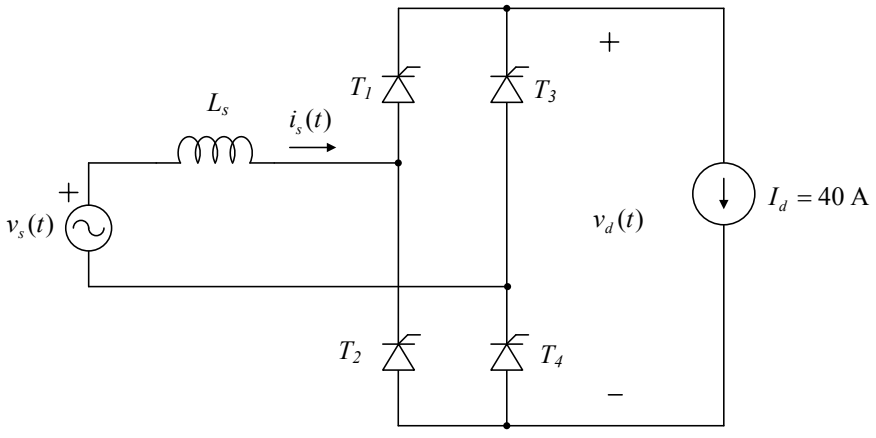
P1: Design a single-phase phase controlled rectifier to produce VDC= -120V across a constant current load drawing 50 A. Assume that the source input is 220V.

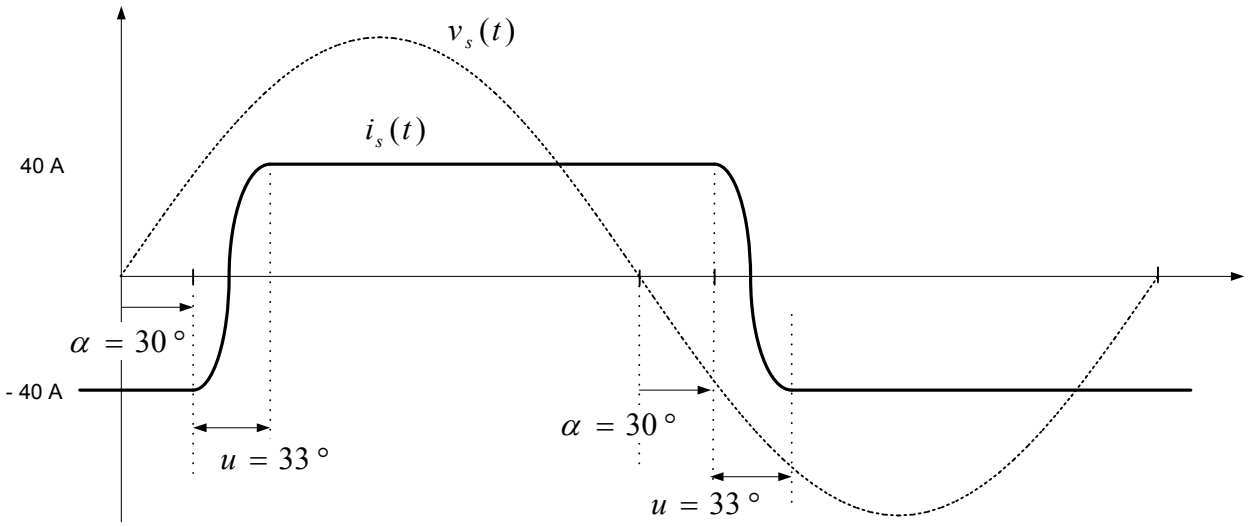
a) Find the triggering angle and show the control system
b) Sketch the output voltage and the source current.
c) Find Ps, Qs, Ss, kp, kd, and the THD of the current.

Answers:
Alpha= 127.29 Degree
Pd=Ps=6 kW, Ss=11 kVA, kp=0.60585, kd=0.9, THD=48.34%

P2: The circuit shown below is a single-phase full-bridge phase controlled rectifier supplying a highly inductive load. The load is represented by a constant DC current source. The rectifier input voltage is $v_s = \sqrt{2}\,220 \sin \omega t$ V and $I_d = 40$ A.

a) Plot the waveforms of v_d for the delay angle of $\propto = 30°$ and $\propto = 150°$, assuming Ls=0.
b) Calculate the average output voltage V_d for $\propto = 30°$ and $\propto = 150°$.
c) Find Ps, Ss, Qs, kp and kd for $\propto = 30°$.
d) Plot the waveforms of i_s for the delay angle of $\propto = 30°$ if Ls=2 mH.





P3: Design an AC controller to produce 150V from 220V.

a) Find the triggering angle and show the control system

b) Sketch the output voltage and the current assuming a purely resistive load

Answers:

Alpha = 93 degree.