ECE445 Projects

Aim: To determine the effectiveness of three different approaches to controller design of a buck regulator.

The three approaches are:

1) Single-loop voltage mode control.
2) Single loop droop control (passive droop control).
3) Two-loop droop control (active droop control).

Details:

The three different approaches are discussed in Chapter 6 of the instructor's book. The details of the buck converter power stage design and the PWM are given in Chapters 2 and 6. Use the same component values etc. For the comparison between controllers to be fair, be sure to design for the same unity gain crossover frequency, which should be around 6.31 kHz.

Report:

A separate report for each design should be written. It should describe in some detail in your own words how you designed your regulator. (Please do not copy material from the instructor's book).

Make sure to include the following in your report:

1) The transfer function of the controller, with the particular pole and zero values determined.
2) A Matlab Bode plot the loop gain. (Use the Matlab MARGIN command.)
3) A Matlab Bode plot of the open and closed loop audio-susceptibility (on the same plot).
4) A Matlab Bode plot of the open and closed loop output-impedance (on the same plot).
5) Implement the controller in an op-amp circuit.
6) Use your controller implementation and the PECS simulator to simulate step responses.
7) To determine the effectiveness of input voltage disturbance rejection, simulate the response to an input voltage step changes of 28V to 30V to 28V.
8) To determine the effectiveness of step load current disturbance rejection, simulate the response to an output load current step changes of 0.1A to 5A to 0.1A.
9) Include all Matlab code and PECS schematics