6.334 Power Electronics
Spring 2007

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.334 Power Electronics   Issued: April 23, 2007
Problem Set 9   Due: April 30, 2007

Reading: KSV Chapter 11.1 – 11.3.4, 11.4, 12.1 – 12.4, and 13.1 – 13.2
Notes: 1. Due date for problem set 9 is on Monday
        2. Work on the design project!

Problem 9.1

Derive the averaged, linearized model for a buck converter in continuous conduction mode. Do this both by direct circuit averaging and state-space averaging. (You must show both the averaged circuit and the averaged state-space description of the system.) Show that the state-space averaged model and the averaged circuit model are equivalent descriptions of the system.

Linearize the state-space averaged model about an operating point (if it is not already linear) and derive the transfer function from perturbation in duty ratio to perturbation in output voltage.

Find the *audio susceptibility* for the buck converter. The audio susceptibility is defined as the transfer function from perturbation of the input voltage to perturbation of the output voltage with duty ratio held constant.

Problem 9.2

Following the approach of KSV example 11.5, derive the averaged model for a boost converter operating in *discontinuous* conduction mode.   Another reference for this approach is P.R.K. Chetty, "Current Injected Equivalent Circuit Approach to Modeling of DC-DC Converters in Discontinuous Inductor Conduction Mode," *IEEE Trans. Industrial Electronics* **29:230-234,** August, 1982.

Problem 9.3

KSV Problem 11.8 (part a only)