

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical and Computer Engineering

Course EE 2250  
Electric Circuit Analysis

Assigned: March 4, 1999  
Due: March 11, 1999

**Problem Set #9**

---

**Reminder:** The Final Exam will be held on Tuesday, Mar. 16, 1999. The exam will be comprehensive and *closed book, closed notes*. One sheet (8.5in by 11.0 in) of handwritten notes is permitted.

---

**Reading:** Read the following sections from Dorf and Svoboda:  
Chapter 16, Section 16.3–16.8

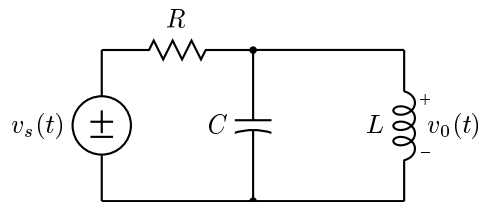
---

**Problem 9.1:** (Dorf and Svoboda problem 16.3-4) Highpass Butterworth filters have system functions of the form

$$H_{hp}(s) = \frac{\pm ks^n}{D_n(s)}$$

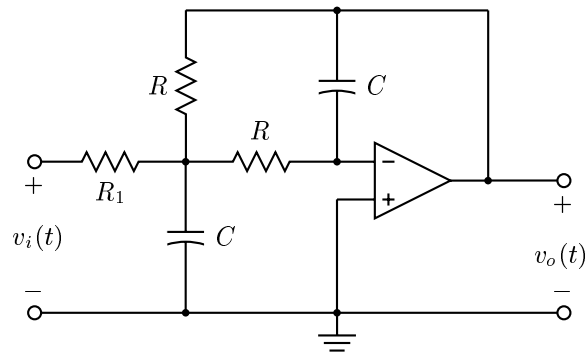
where  $n$  is the order of the filter,  $D_n(s)$  denotes the denominator polynomial of the corresponding lowpass filter, and  $k$  is the passband gain. Obtain the system function of a fourth-order Butterworth highpass filter having a cutoff frequency of 500 Hz. and a passband gain of 5.

**Problem 9.2:** (Dorf and Svoboda problem 16.4.1) The circuit shown below is a second-order band-pass filter. Design this filter to have  $k = 1$ ,  $\omega_0 = 1000$  rads/s and  $Q = 1$ .



**Problem 9.3:** (a) Compute the system function of the circuit below.

(b) Select convenient values of  $R$ ,  $R_1$ , and  $C$  to obtain a lowpass filter with a cutoff frequency of  $\omega_0 = 2000$  rad/s and  $Q = 8$ .



**Problem 9.4:** Work Problem 16.4-6 in the text by Dorf and Svoboda.

**Problem 9.5:** Work Problem 16.4-8 in the text by Dorf and Svoboda.

**Problem 9.6:** Work Problem 16.5-9 in the text by Dorf and Svoboda.