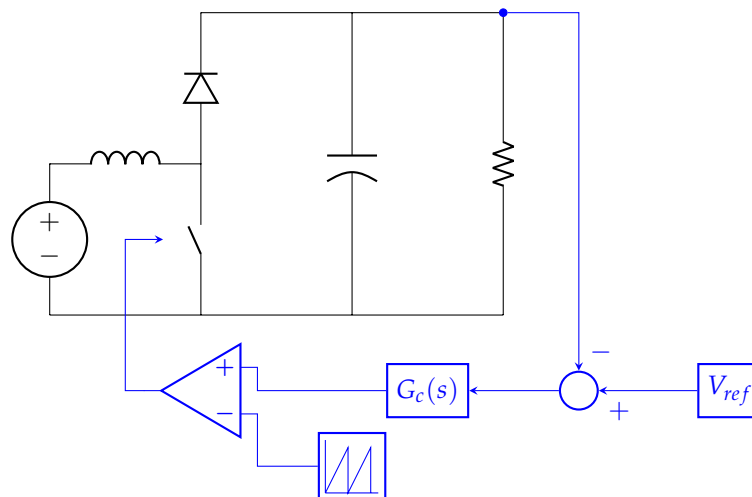


DIGITAL CONTROL OF POWER ELECTRONICS

Voltage Mode Control of Boost Converter



```
1 clear
2 Vin = 5
3 Vo = 10
4 d = 0.5
5 L = 100e-6
6 C = 247e-6
7 r = 0.01
8 Po = 10
9 fsw = 200e3
10 R = Vo^2/Po
11
12 Le = L / (1-d)^2
13
14 % plant transfer function
15
16 s=tf('s');
17 opts = bodeoptions('cstprefs');
18 opts.FreqUnits = 'Hz';
19
20 Gp = Vin/(1-d)^2 * (1-s*Le/R) * (1+s*r*C) / (Le*C * (s^2 + s*(1/(R*C) + r/
    Le) + 1/(Le*C)))
21 bode(Gp,opts)
22 grid on
23 poles = pole(Gp)
24 zeros = zero(Gp)
25
26 % design controller
27
28 fc = 1e3
29 pm = 60
30 kfb = 1
31 Gpwm = 1
```

```

32
33 [gain phase] = bode(Gp,2*pi*fc)
34 phase = -phase;
35 phiboost = -90 + pm - phase
36 kboost = tand(45 + phiboost/4)
37 gaincontroller = 1 / (kfb * Gpwm * gain)
38 fz = fc/kboost
39 fp = fc*kboost
40 kc = gaincontroller * 2*pi*fz/kboost
41 wz = 2*pi*fz
42 wp = 2*pi*fp
43
44 Gc = kc/s * (1+s/(2*pi*fz))^2 / ((1+s/(2*pi*fp))^2);

```

$$G_p(s) = -\frac{1.0 (0.00000001976s^2 + 0.007506s - 200.0)}{0.000000988s^2 + 0.0004247s + 10.0} \quad (1)$$

$$G_c(s) = \frac{k \left(1 + \frac{s}{\omega_z}\right)^2}{s \left(1 + \frac{s}{\omega_p}\right)^2} \quad (2)$$

$$\omega_p = 37584.9319, \omega_z = 1050.3789, k = 24.7986 \quad (3)$$

$$p_1 = -55241.028, p_2 = -13201.0018, p_3 = -3122.8686 + 5036.1582i, p_4 = -3122.8686 - 5036.1582i, p_5 = -276.9265 \quad (4)$$

