

# Notes in ECEN 5448

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## First Day

23 topics, lecture notes typeset on d2l.  
structure, background, and hopefully jumping in to material.

goal is to actually design real controllers.  
goal is to get course structure, slide with nyquist, root locus and bode plot.  
digital controllers, difference equation from differential equation.  
discount code for pdf version of book \$ 35.

OH after class monday wednesday, friday 11 to 12.

Franklin, Powell, and Workman, Digital control of dynamic systems. 3rd edit. (1997 or 1998).  
Discount code is FPW3, on atlasbooks.  
ARe some other references, largely online at libraries.colorado.edu

review ecen 5458

digital controllers are used because they are much cheaper than analog controllers.  
ZOH hold?

a digital signal is discrete in time and quantized (discrete in amplitude).

$\frac{1}{T}$  is greater than 30 times the closed loop system bandwidth and quantization is less than  $2^{-15}$ .

forward and backward difference approximations for differential equations.  
How many points is optimal? (quadratic? cubic?)

lead lag compensator:

$$D(s) = \frac{U(s)}{E(s)} K_0 \frac{s+a}{s+b}, \quad a > 0, \quad b > 0$$

if a<b then lag, a>b then lead.

$$sU(s) + bU(s) = k_0(sE(s) + aE(s))$$

$$\dot{u} + bu = K_0(\dot{e} + ae)$$

$$\frac{u_{k+1} - u_k}{T} + bu_k = K_0 \left( \frac{e_{k+1} - e_k}{T} \right) + K_0 ae_k$$

then rewrite so that it is in the form  $u_{k+1} =$