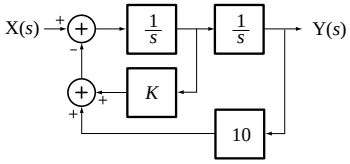
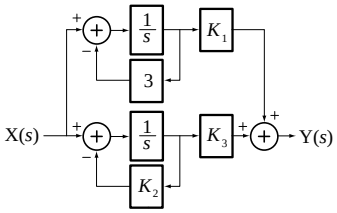
Solution of ECE 316 Test #7 S03 3/5/03

1. What numerical value of *K* in this system will make it marginally stable?



The transfer function is $\mathrm{H}(s)=\dfrac{1}{s^2+Ks+10}$. The poles are at $s=\dfrac{-K\pm\sqrt{K^2-40}}{2}$. For a system to be marginally stable the poles must lie on the ω axis which means the real parts must be zero. That happens when $K=0$.

2. A system whose transfer function is $\mathrm{H}(s)=\dfrac{200s}{s^2+9s+18}$ is realized in the parallel configuration below. What are the numerical values of K_1, K_2 and K_3?



The transfer function can be expanded in partial fractions as $\mathrm{H}(s)=\dfrac{200s}{(s+3)(s+6)}=-\dfrac{200}{s+3}+\dfrac{400}{s+6}$.

Therefore $K_1=-200$, $K_2=6$ and $K_3=400$.

3. A normalized lowpass Butterworth filter has a pole at $s=e^{j\frac{3\pi}{5}}$. How many poles are there in the transfer function of this filter?

For a Butterworth lowpass filter the poles lie at angles which are integer multiples of $\dfrac{\pi}{n}$ where *n* is the number of poles. Since this pole lies at an angle of $\dfrac{3\pi}{5}$, *n* must be 5.