

ECE 321: Handout #11

Analog Computers

Design an op-amp circuit to implement a 3rd-order Elliptic filter

$$Y = \left(\frac{s \pm j9.919}{(s+0.942)(s+0.391 \pm j1.242)} \right) U$$

$$Y = \left(\frac{s^2 + 98.39}{s^3 + 1.724s^2 + 2.432s + 1.597} \right) U$$

Solution:

Rewrite as

$$Y = \left(\frac{s^2 + 98.39}{s^3 + 1.724s^2 + 2.432s + 1.597} \right) U$$

$$X = \left(\frac{1}{s^3 + 1.724s^2 + 2.432s + 1.597} \right) U$$

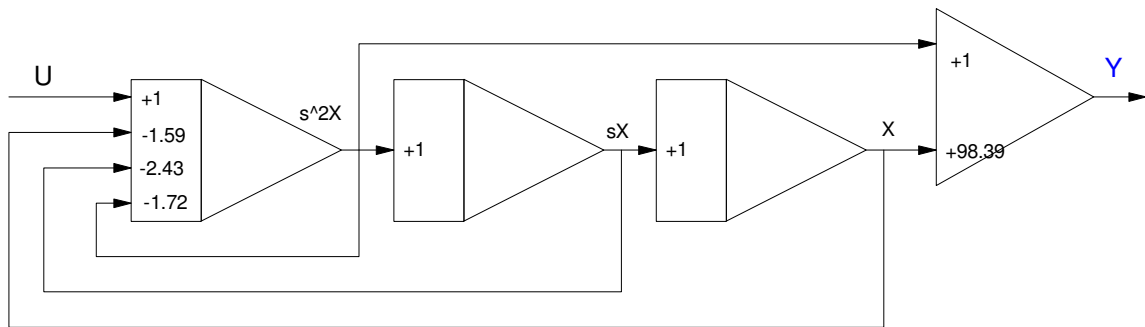
$$Y = (s^2 + 98.39)X$$

Rewrite X as

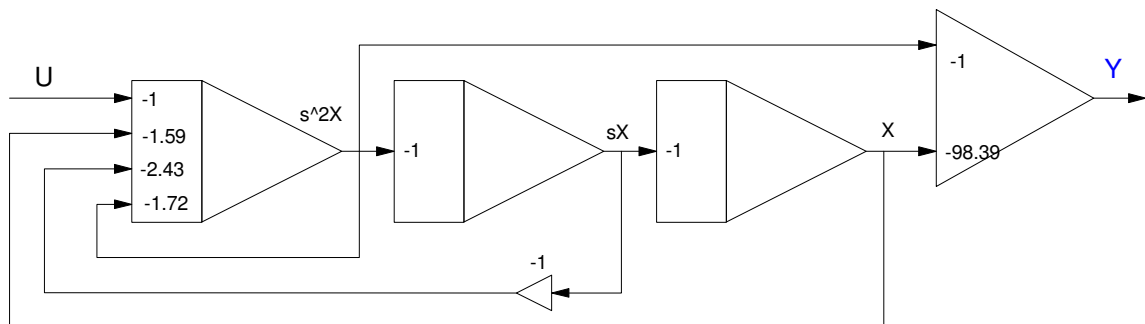
$$(s^3 + 1.724s^2 + 2.432s + 1.59)X = U$$

$$s^3X = -1.724s^2X - 2.432sX - 1.59X + U$$

Express this using analog computer notation



Adjust the gains so that they are all negative (may require adding an inverter)



Now build using op-amps

