Quiz 5 L02

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MECHTRON 3DX4 Tutorial Quiz 5 L02: Block Diagram Reduction

1. **Block Diagram Reduction** (10 marks)

   Consider the system show below:

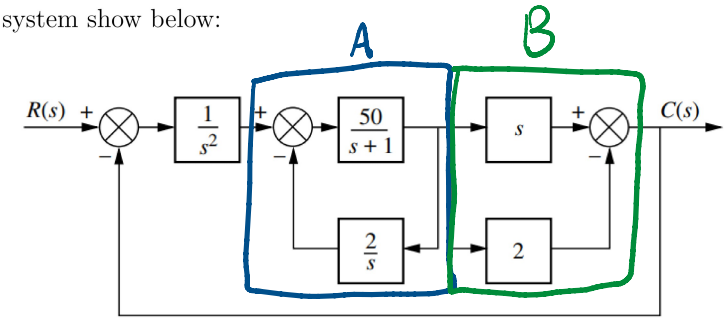
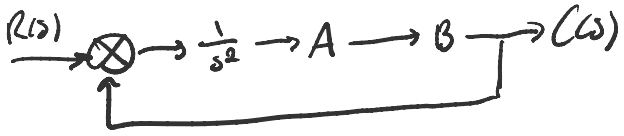


Figure 1: Block Diagram

a) (10 marks) Find the closed loop transfer function $T(s) = \frac{C(s)}{R(s)}$.

$$A = \frac{\frac{50}{s+1}}{1+\left(\frac{50}{s+1}\right)\left(\frac{2}{s}\right)} = \frac{\frac{50}{s+1}}{1+\frac{100}{s(s+1)}} \qquad B = s-2$$



$$\frac{C(s)}{R(s)} = \frac{\left(\frac{1}{s^2}\right)\left(\frac{50/s+1}{1+\frac{100}{s(s+1)}}\right)(s-2)}{1+\left(\frac{1}{s^2}\right)\left(\frac{50/s+1}{1+\frac{100}{s+1}}\right)(s-2)} = \frac{1}{\frac{s^2}{s-2}\left(\frac{1+\frac{100}{s(s+1)}}{50/(s+1)}\right)+1} = \frac{1}{\frac{s^2}{s-2}\left(\frac{s+1+\frac{100}{s}}{50}\right)+1}$$

$$= \frac{50(s-2)}{s^2(s+1+100/s)+50(s-2)} = \frac{50s-100}{s^3+s^2+100s+50s-100}$$

$$\boxed{T(s) = \frac{50s-100}{s^3+s^2+150s-100}}$$