Problem 4

A schematic diagram of a rotor mounted in bearings is shown in Fig. 4. The moment of inertia of the rotor about the axis of rotation is $J = 0.31\ kgm^2$. Let us assume that at $t = 0$ the rotor is rotating at the angular velocity $\omega(0) = \omega_0 = 121\ \frac{rad}{sec}$. We also assume that the friction in bearings is viscous friction, where the coefficient of friction is $b = 0.02\ \frac{Nm}{\frac{rad}{sec}}$.

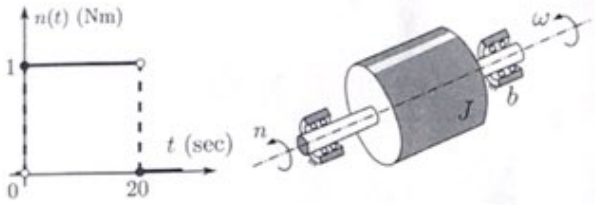

Figure 4: *Input signal nad rotor mounted in bearings*

Assume that the input to the system is the external applied torque $n(t)\ (Nm)$ in the form of a pulse signal shown in Fig. 4, while the output is the angular velocity $\omega(t)\ (\frac{rad}{s})$. *Find and plot free* y_{free}, *forced* y_{forced}, *and total response* y_{total} of the system. Calculate the total response y_{total} for time $t = 20\ s$.

Answer: $y_{total}(t = 20) =$ 69.5379 $\left[\frac{rad}{s}\right]$

Problem 5

For the system shown in Fig. 5, find the output, $y(t)$, if the input $r(t)$ is a unit step, where $G(s) = \frac{13}{s(s+2)}$. *Plot the response and provide* $y(t)$ for $t = 0.9069\ s$.

Answer: $y(t = 0.9069) =$ 1.4038

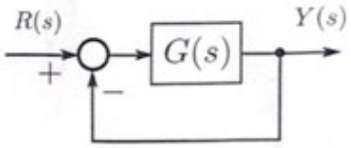

Figure 5: *Feedback control system*

Problem	No. 1	No. 2	No. 3	No. 4	No. 5	Total
Points						

[0]The problem set has been generated November 3, 2020 r., g. 13:52:28