سیستم زیر را به کمک محیط سیمولینک شبیه‌سازی و با فرض ورودی پله شبیه‌سازی کنید.

توجه: سیگنال بار TL در ثانیه ۱۰ از مقدار ۵۵ به مقدار ۱۱۰ تغییر می‌کند.

2. MOTOR DYNAMICS

Consider a series DC motor shown in Figure 1 below.

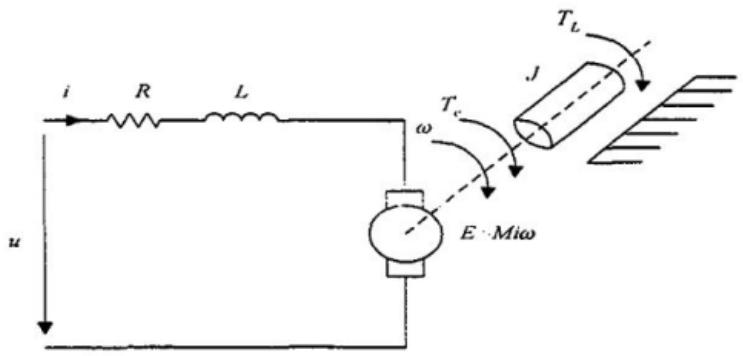

Fig. 1. Series DC motor

If we neglect magnetic saturation in field circuit, the motor can be modeled as (refer to Liu et al. (1999) for details).

$$\begin{aligned} L\frac{di}{dt} &= u - Ri - Mi\omega, \\ J\frac{d\omega}{dt} &= Mi^2 - T_L, \end{aligned} \tag{1}$$

where the physical meaning of the quantities are as follows.

i: armature current (or filed current)

u: terminal control voltage

ω: rotational speed of the motor

L: total armature and field current inductance

R: total armature and field circuit resistance

J: moment of inertia associated with both motor and the load

M: motor constant

T_L: load torque

$T_e = Mi^2$ and $E = Mi\omega$.

For notational convenience, we set

$$x_1 = \omega, x_2 = i.$$

Then, the system (1) becomes

$$\begin{aligned} \frac{dx_1}{dt} &= \frac{M}{J}x_2^2 - \frac{T_L}{J}, \\ \frac{dx_2}{dt} &= -\frac{1}{L}(Rx_2 + Mx_1x_2) + \frac{1}{L}u. \end{aligned} \tag{2}$$

The control goal is to design a feedback controller u such that the speed of the motor x_1 tracks a constant desired speed ω_r.

$$\begin{aligned} &R = 1\Omega, \quad && J = 0.5kgm^2, \\ &L = 0.05H, && M = 0.027H, \\ &T_L^1 = 55Nm, && T_L^2 = 110Nm \\ &\omega_r = 151.7. \end{aligned}$$