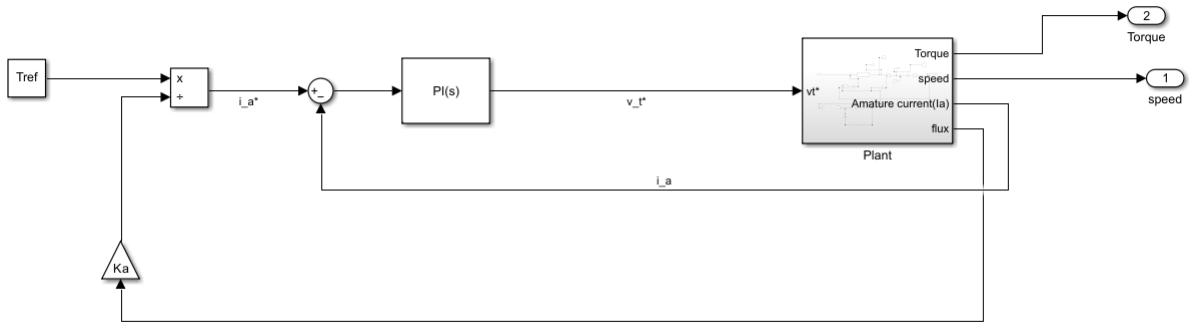
1.Torque control DC motor:

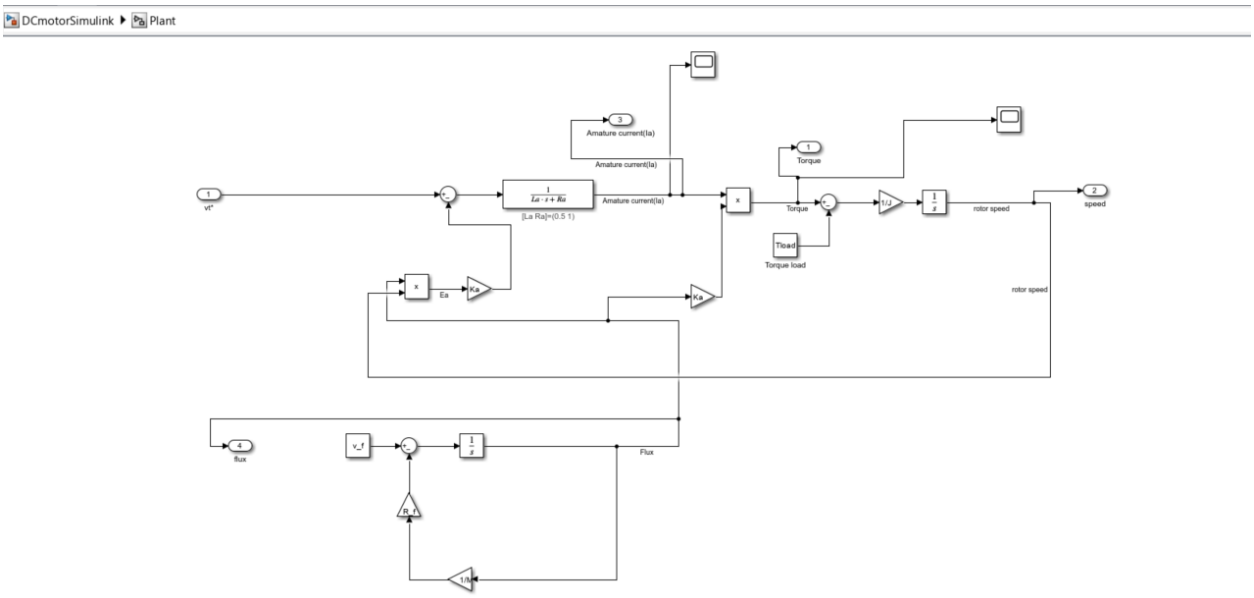
1.1 Constant parameters:

```
%Amature parameters
La = 2.3e-3;
Ra = 0.3;
vt = 50;

%motor parameters
Ka = 1;
J = 0.068;

%field
M = 1.304;
v_f = 240;
i_f = 0.65;
R_f = 356.7;
L_f = 1.44;

%at steady state
Tref = 10;
Tload = 10;
```

1.2 Model



1.3 Plant

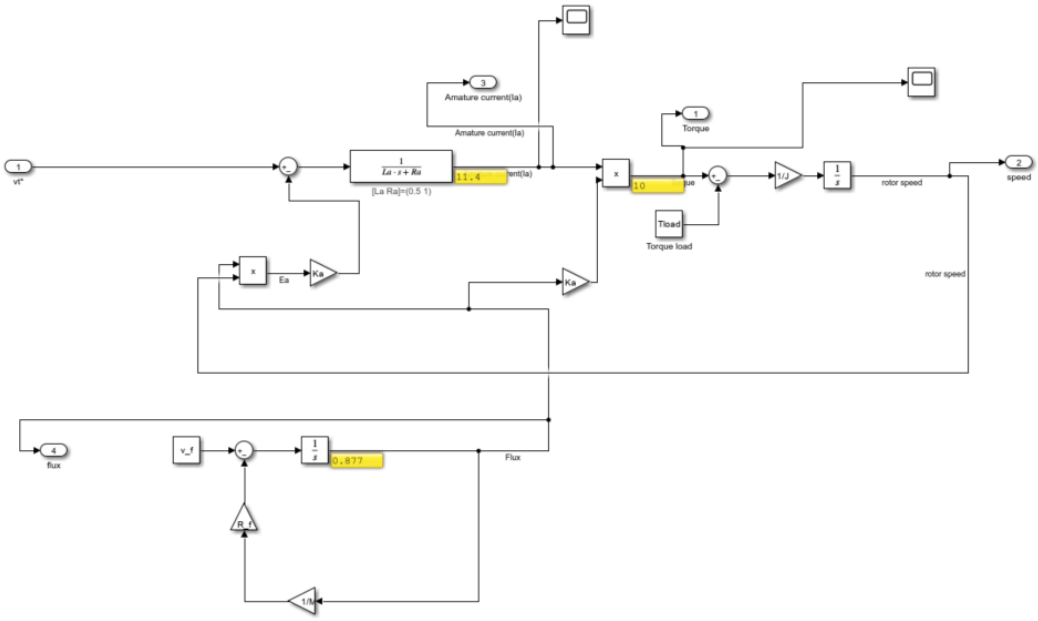


1.4 Cross checking

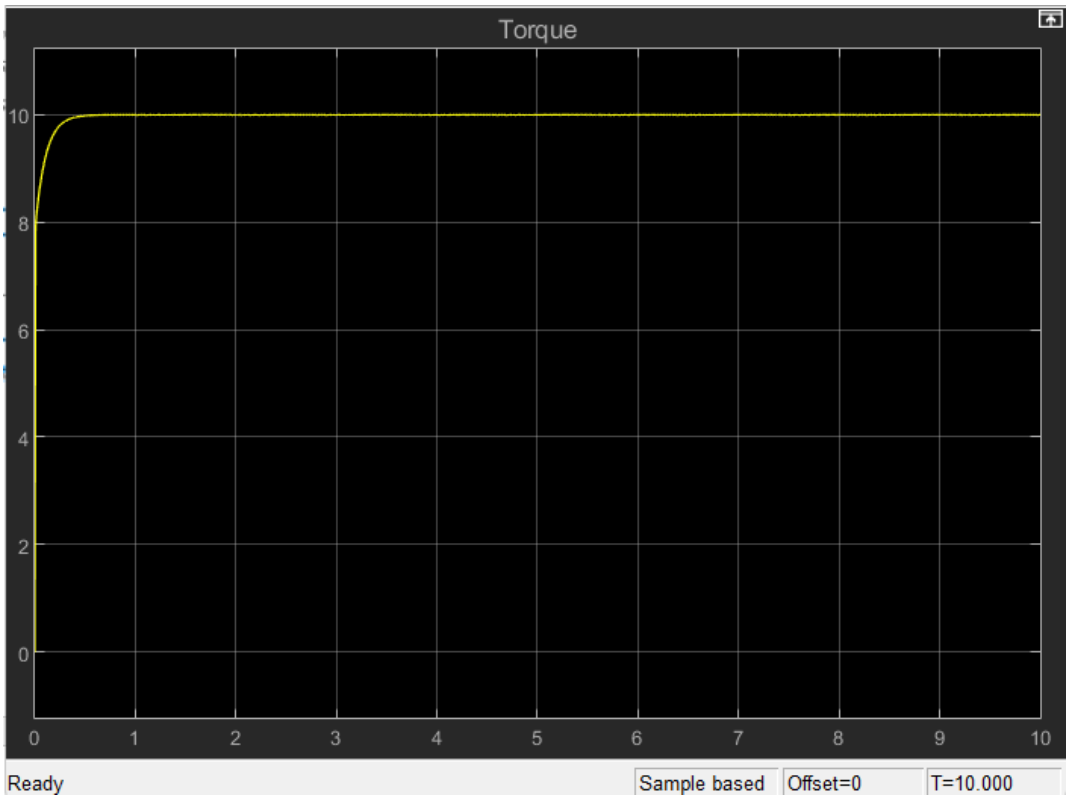
Let Tload = 10 N*m

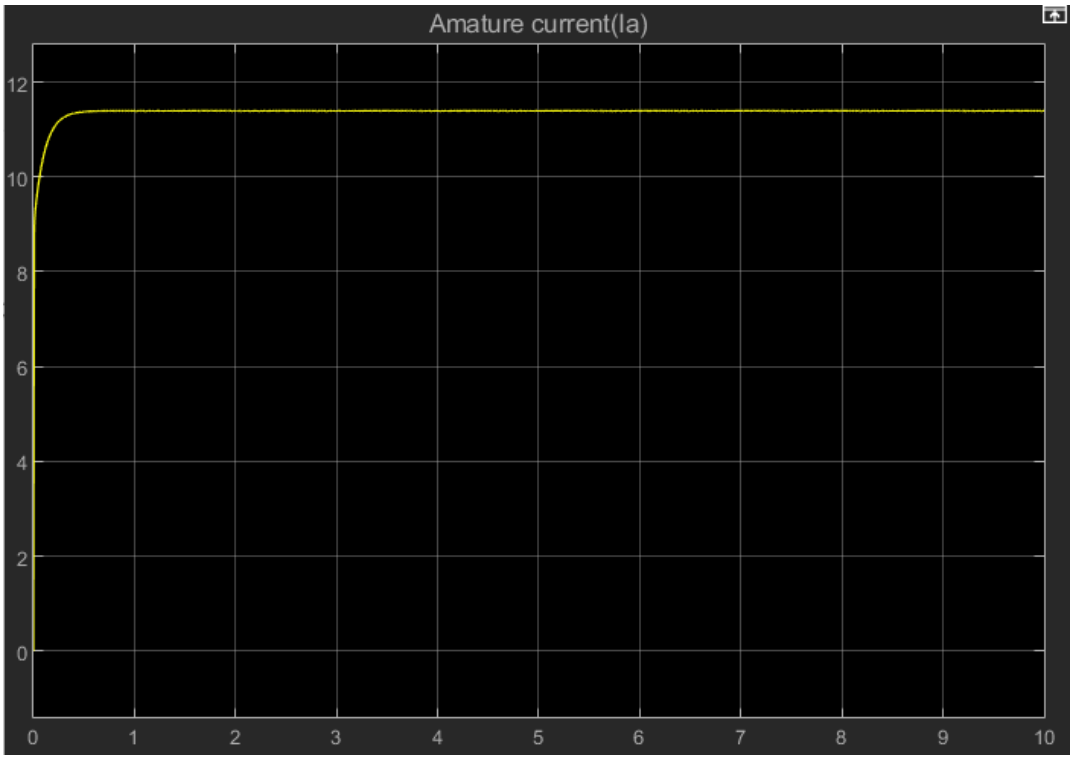
At steady state; T = Tload = 10 N*m

So that Tref = 10N*m, ia = 11.798 A, flux = 0.8476 Wb



PI controller 1 : (u = ia* - ia, y = vt*) : P=1, I=1



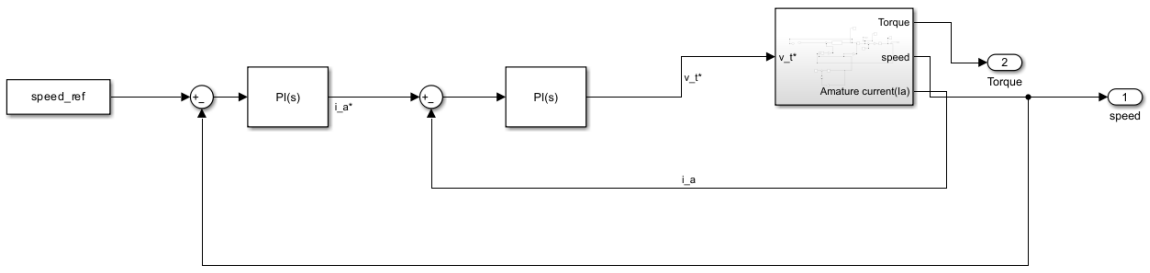


2. Speed control DC motor

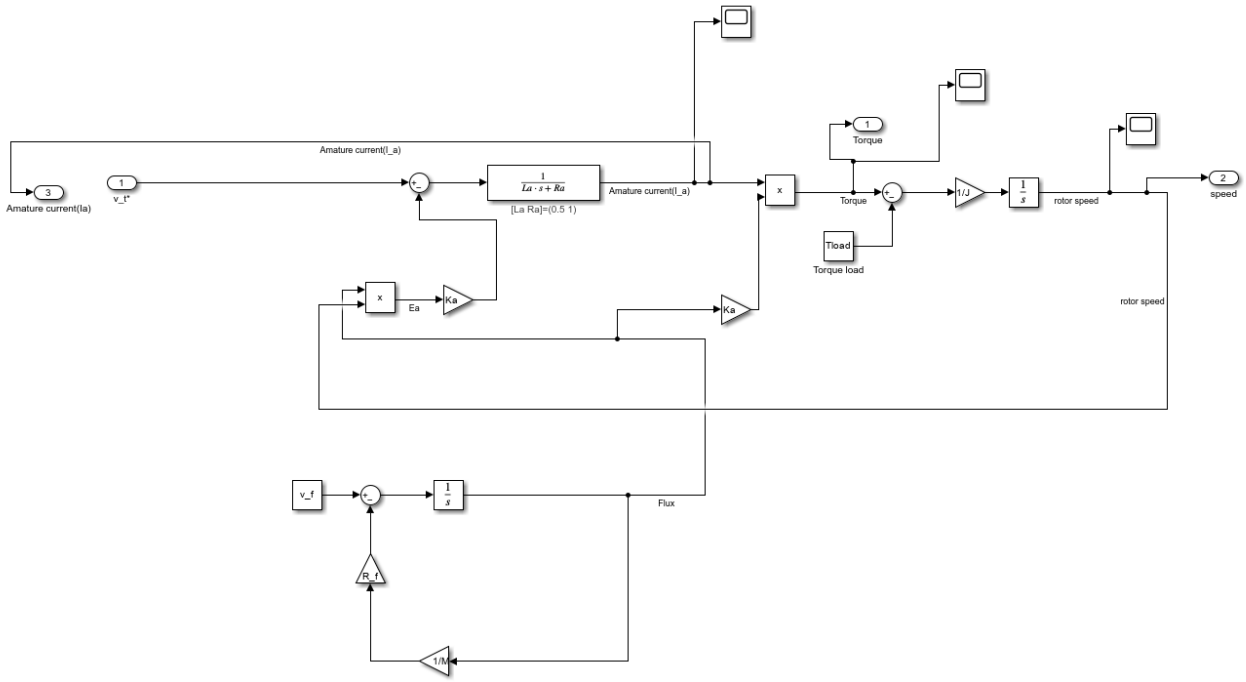
2.1 Constant parameters:

```
%Amature parameters
La = 2.3e-3;
Ra = 0.3;
vt = 50;

%motor parameters
Ka = 1;
J = 0.068;

%field
M = 1.304;
v_f = 240;
i_f = 0.65;
R_f = 356.7;
L_f = 1.44;

%speed control
Tload = 10;
speed_ref =20; %rpm
```

2.2 Model



1.3 Plant

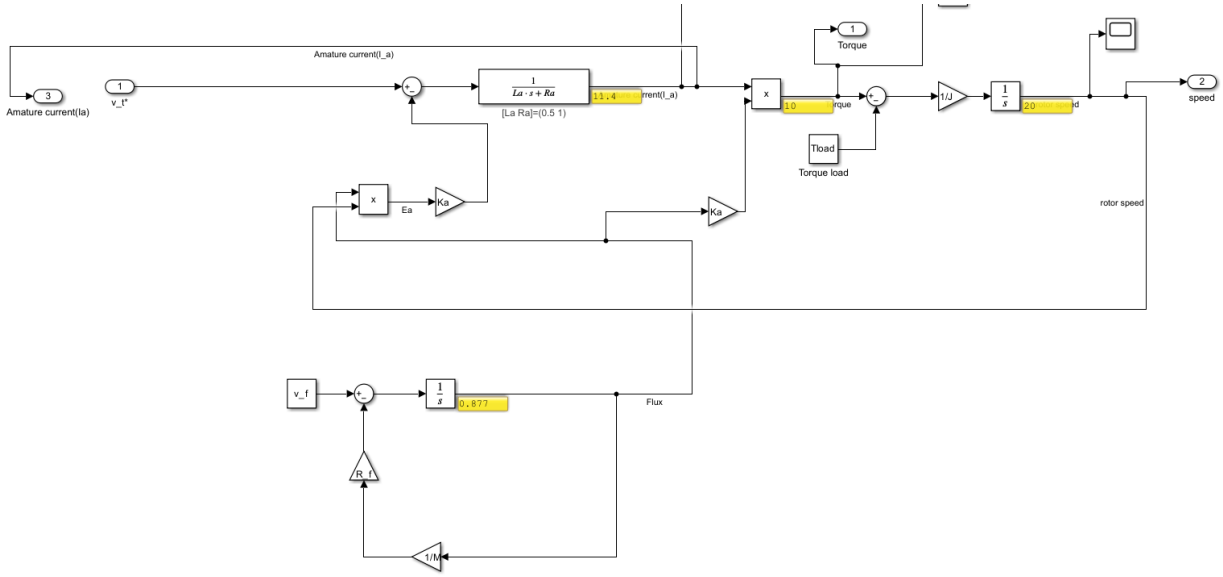


1.4 Cross checking

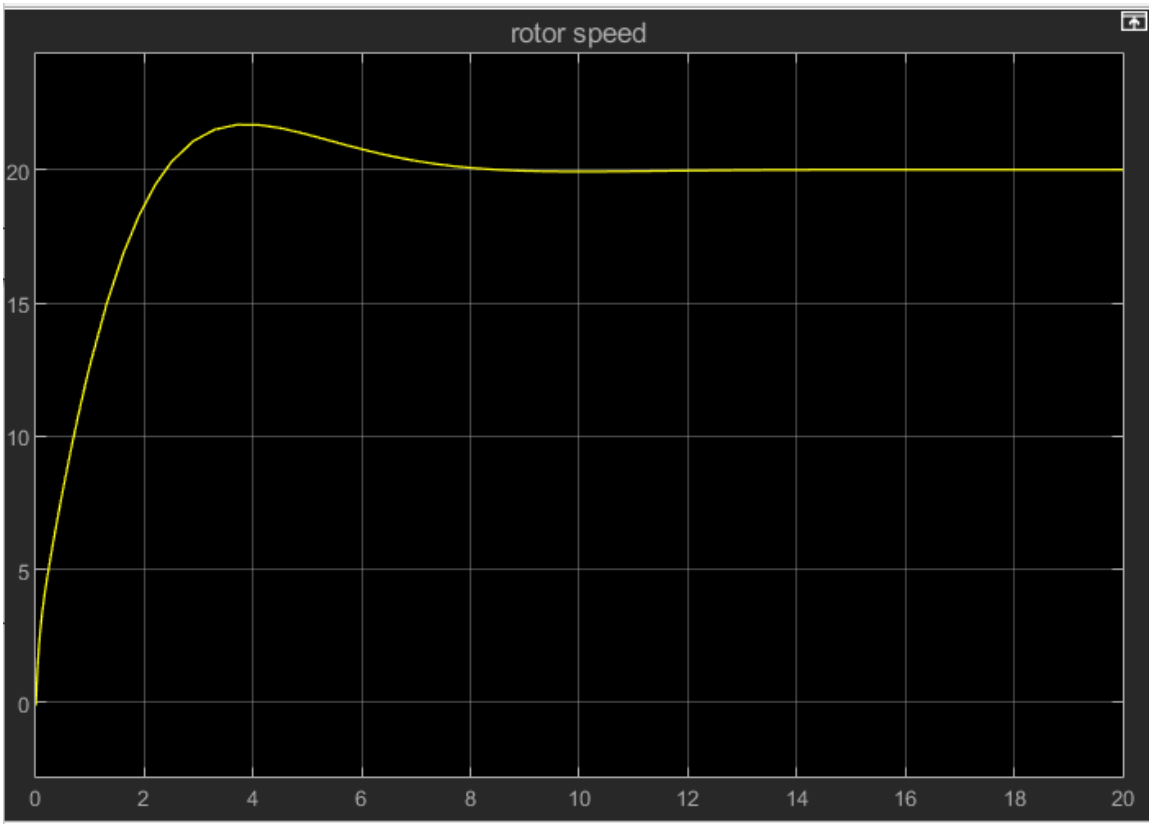
Let Tload = 10 N*m, speed_ref = 20 rpm

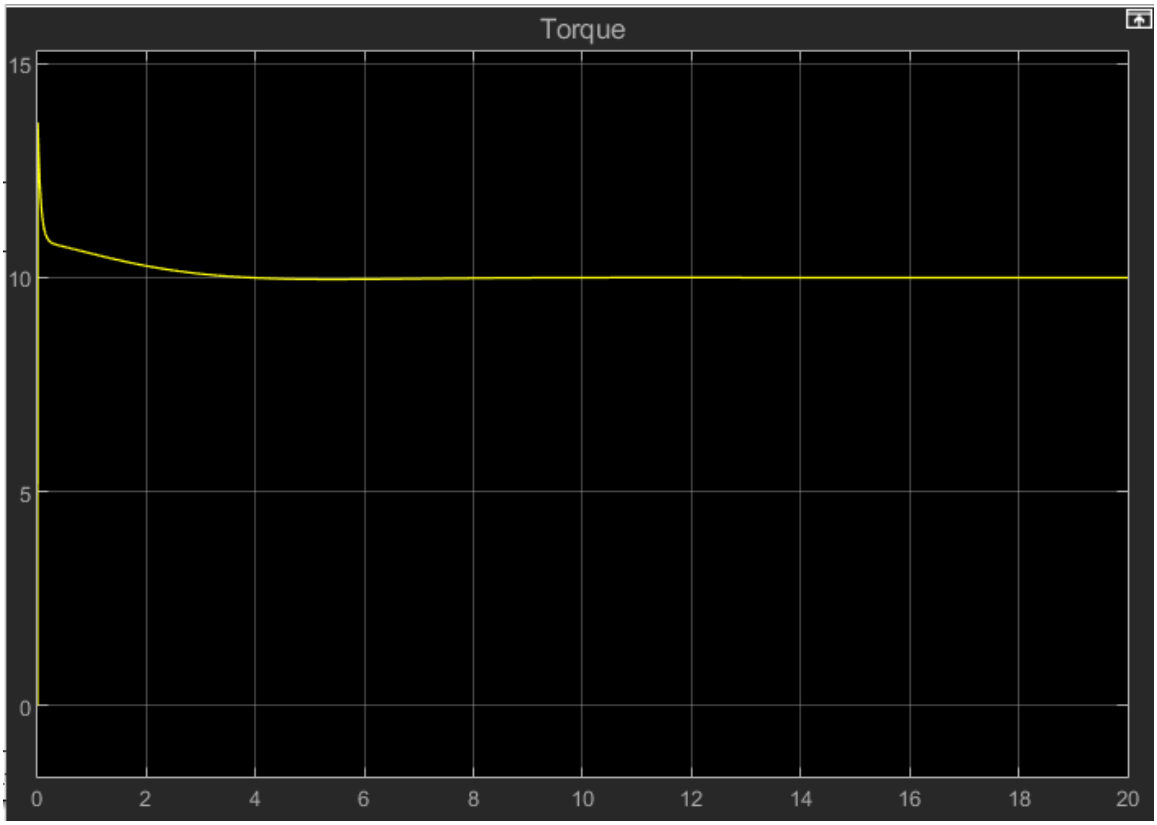
At steady state; T = Tload = 10 N*m

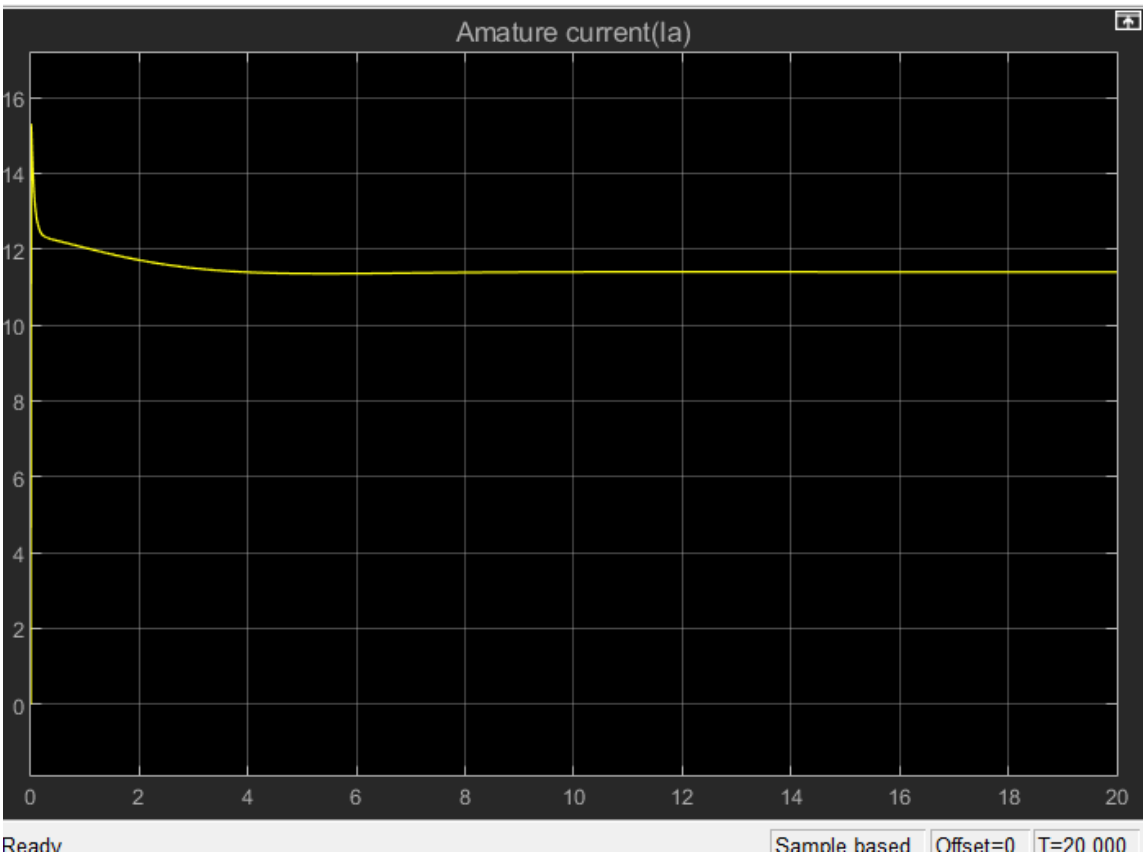
So we will get, flux = 0.8476 Wb, ia = 11.798



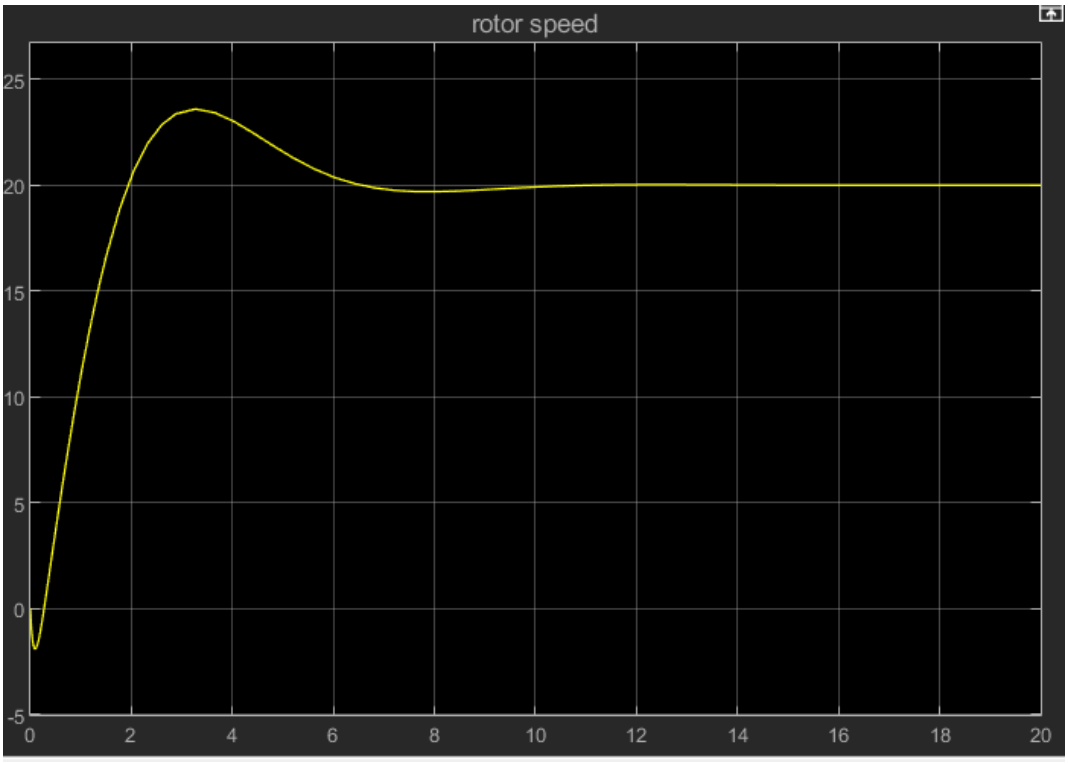
PI controller 2 : (u = speed_ref - speed, y = ia*) : P=1, I=1

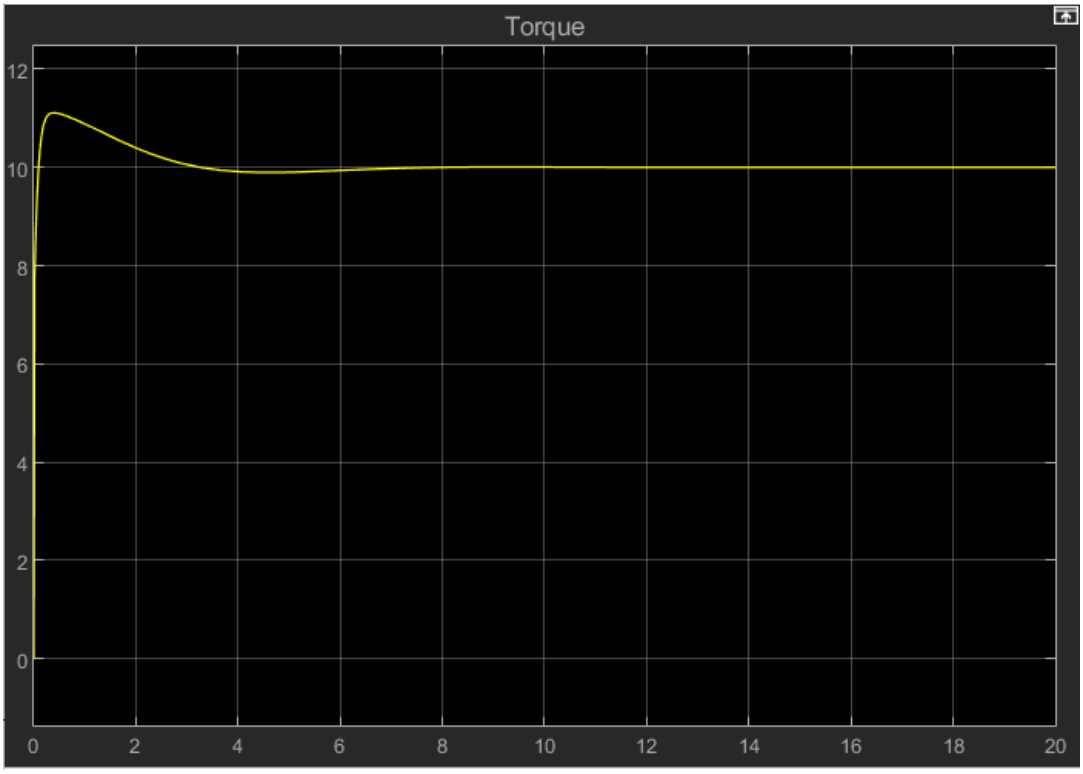


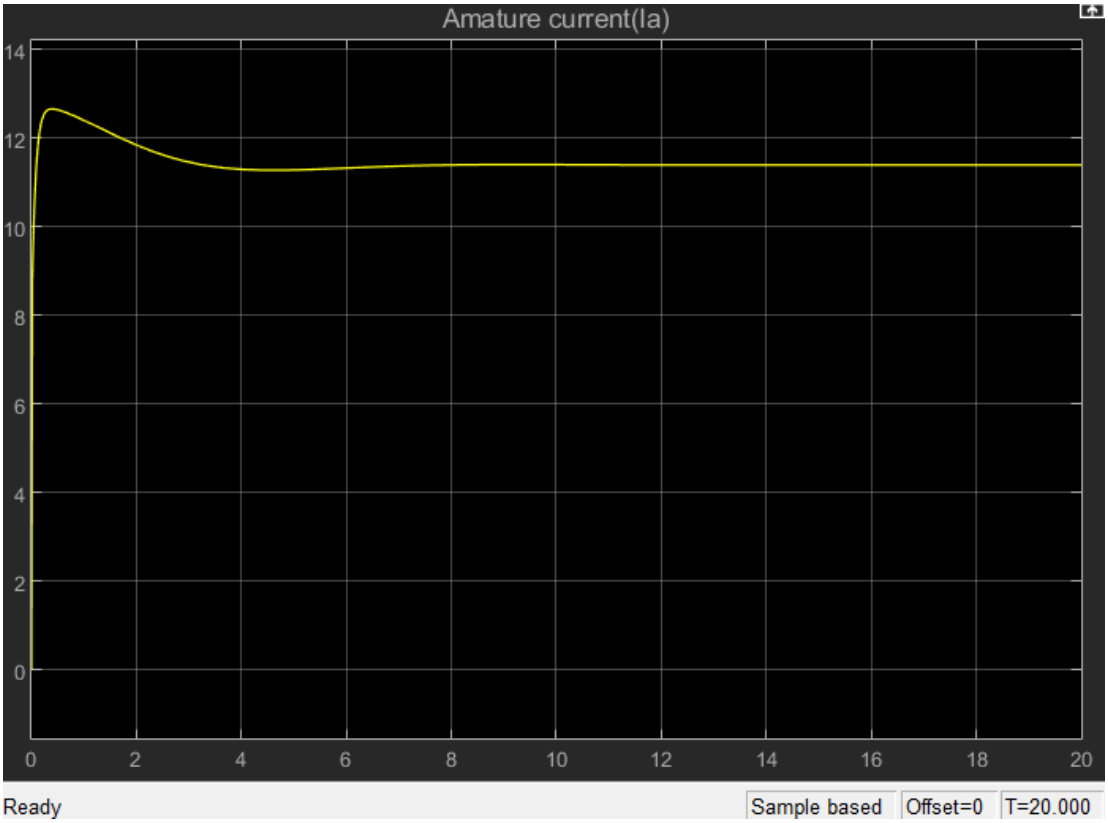

Torque
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20


Amature current(Ia)
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
14
16
18
20
Ready
Sample based
Offset=0
T=20.000

PI controller 2 : (u = speed_ref - speed, y = ia*) : P=0.5, I=1







From the inspection when P = 1 and I = 1, we can clearly see that there is a high overshoot with a short settling time in the response of Torque and Armature current, which is not good for a practical use in motor. After changing P to 0.5, the overshoots of the Torque and Armature current responses reduce significantly, which might yield a better result.