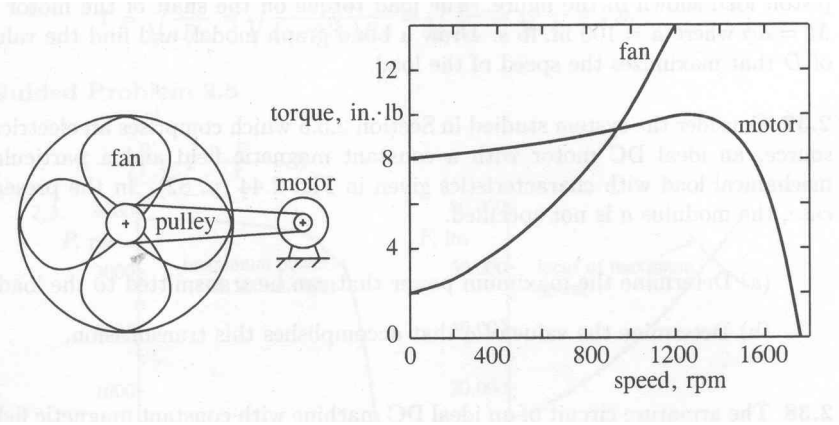
Exercise 2 TEP4240 SYSTEM SIMULATION 2023

A motor drives a fan through a belt. The characteristic for torque-angular velocity is plotted in the figure. The ratio for the belt is not given, but the motor must not be run with a torque larger than 4.0 in·lb over long times to avoid overheating.



Datapoints read from the figure:

```
motor=[0, 400, 800, 1200, 1600, 1763;
       8, 8.5, 9.0, 9.90, 7.15,    0];

fan  =[0, 400, 800, 1200;
       2, 3.8, 7.5,   14];
```

Use these tables to interpolate using *interp1*-funktion in MATLAB. Try the different interpolation methods (linear, spline, pchip).

Neglect initially all masses.

a) Find the speed for the motor that gives maximum *allowed* power. Find this power.

b) Find the corresponding speed and torque for the fan. Determine the ratio for the belt so that the motor runs in a stable operating point with maximum allowed power (4 in·lb).

c) Include rotational mass for the fan, $Iv = 1.2$ lb·in·s^2. Use Newton's second law for rotation: Net torque equals the rate of change of spin (angular momentum, here $Iv \cdot \omega$). Simulate the start-up from rest for the system and find the time it takes to reach the steady-state speed.

Upload your exercise on Bb as one single pdf-file. It should include your MATLAB codes, figures, derivations etc.