Sheet

Mechanical System Modeling, Mechanisms and Actuators

1. The specifications of a machine that utilizes a lead screw mechanism are:
    a) Ball screw: Diameter: 14 mm, length: 500 mm, pitch: 0.5 rev/mm, efficiency: 45%
    b) Mechanical data: Friction coefficient (μ): 0.1, load: 6 kg, orientation: inclined by 10° relative to horizontal. Taking into consideration that inertia ratio between the machine and the motor is 4:1
    c) Move profile: Type: 1/6- 2/3- 1/6 Trapezoid, distance: 8 mm, move time: 0.2 s, dwell time: 0.1 s.

Determine the peak and root mean square torques of a suitable motor to drive this machine.

2. A rotary motion axis driven by an electric servo motor directly. The rotary load is a solid cylindrical shape made of steel material, d= 50 mm, l= 60 mm, ρ= 7800 kg/m^3.The desired motion of the load is a periodic motion. The total distance to be traveled is 1/4 of a revolution. The period of motion is tcyc= 250 ms. and dwell portion of it is tdw= 100ms. And the remaining part of the cycle time is equally divided between acceleration with an exponential form; according to the following equation: k (e^{10t} −1), constant speed and deceleration with a linear form. Determine the peak and root mean square torques of a suitable motor for this application.

3. A conveyor; shown in Fig. 4; is used to transfer bags 15 kg in a production line. The conveyor main roller is connected to main servomotor through a gear box with the following specifications: Roller diameter=300mm, Roller length=1000mm, gear box reduction ratio=50:1, orientation=20° to the horizontal plane, conveyor belt weight=10 kg, working temperature=35°C, maximum number of bags on conveyor at the same time=10 bags. The motion profile: Type: 1/10 - 4/5 - 1/10 –Trapezoid, distance =500mm, move time=30s, dwell time=3s. Determine the peak and root mean square torque of the servo motor.

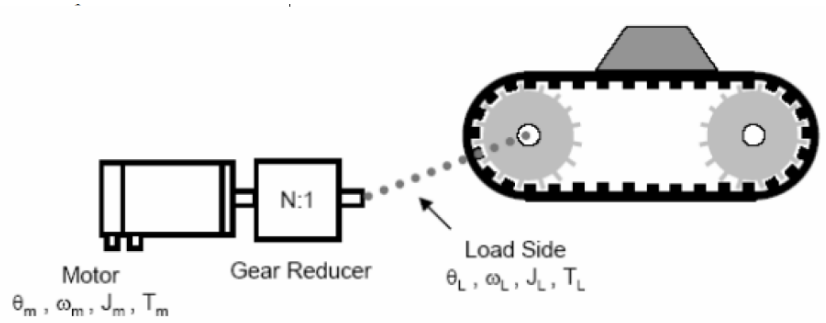

Fig. 4