



# Mechanics and Machines, Lecture 5

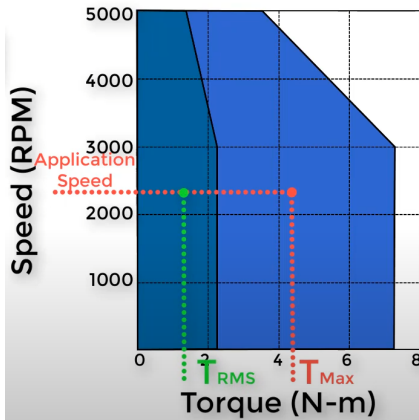
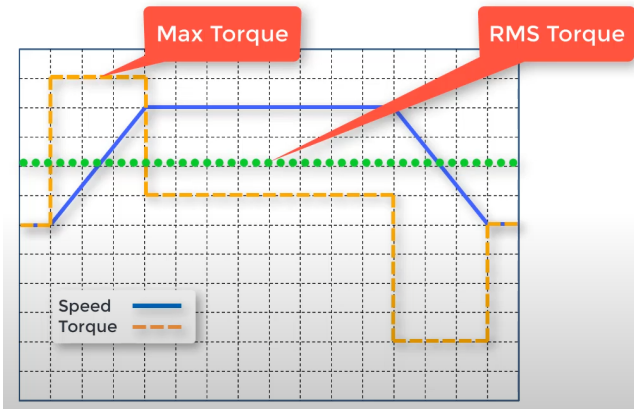
Motor sizing (selection)

# Four Key Sizing Factors



1. Inertia Ratio: Load Inertia / Motor Inertia (A measurement of how difficult to change the rotating velocity of an object). Nice ratio: (5-10):1
2. Speed
3. Max Torque for particular Speed
4. RMS Torque for particular Speed

# Profiles





## Motor Selection guideline (Using Simulation)

1. Determine, what do you want to receive in the end (for instance, a particular R.O. linear velocity and etc).
2. Create a CAD and Motion Analysis model. Find a load inertia related to a motor axis of rotation.
3. Define your motion (for example, using table function).
4. Solve the simulation.
5. Create plots:  $\tau(t)$ ,  $\omega(t)$ , others if needed to check the correctness of simulation.
6. Calculate the power of motor in several position and take the average  $P = \omega\tau$  and multiply on some coefficient for reduce sim. error.
7. Based on the power and size, you can choose the motor.
8. Start to choose a gearbox (it linearly changes your profile).
9. If you can, calculate the motor (rotor + gearbox) inertia and find inertia ratio.

# Friction in simulation



- Friction coefficients
- Documentation about 3D contact in NX
- Guidelines for contact materials

# Motors



- Pololu motors (which are provided)
- Application for motor sizing from Maxon
- Dynamixel MX-28

## Reference material



1. Servo Motor Sizing Basics Part 1 - Core Concepts (video)
2. Servo Motor Sizing for Robotic Applications (video)

# Deserve "A" grade!

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📍 @Lupasic

🏢 Room 105 (Underground robotics lab)