LAB 3: Joint-space impedance control

1) Implement joint-space PD impedance controllers for all the joints with just stiffness, just damping, and stiffness with damping. Use the values $K = 500\ Nm/rad$ and $\mathrm{B} = 10\ \mathrm{Nms/rad}$. After *1 s* of simulation, apply an external sinusoidal torque disturbance of amplitude $\tau_{ext} = 20\mathrm{Nm}$ and frequency *1 Hz* at all joints and plot the disturbance torques vs. the joint position, speed and acceleration for each of the previously designed controllers. Does the dynamic coupling affect the rendered impedance? Present evidences of your answer.

2) Add gravity and Coriolis compensation to the previously designed joint-space impedance controller. Does the impedance emulation improve?

3) Improve the previously designed controller so that it compensates for the inertial dynamic coupling across the robot links.

4) With the dynamics of the system decoupled, set now a diagonal desired joint-space inertia of $\mathrm{M} = \mathrm{eye}(6) * 0{,}1$.

5) Explain the impedance profiles obtained in each experiment.