PROCEED DEMONSTRATION/EXPERIMENT IDEAS FOR ME 324

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Resources:

- Access to PC MATLAB Environment with simulation software.
- Small tabletop planar robot such as Adept Cobra 600 set-up in ETC lab.
- TA support.

Topic	**Descriptions**	**Outcomes**
Kinematics of Particles	*Robotics – Simulation*: Begin with simulation of kinematics, include graphical animations. Students plan robot paths for single simple symmetrical object in robot end-effector. Students run existing simulations to determine feasibility based on constraints of robot kinematics. Use of various coordinate systems. Students submit plots from simulations. *Robotics – Physical System Experiments*: Run corresponding trajectory and payload on physical robot after satisfactory simulations. Students submit lab worksheets.	*Simulations*: Intuition for kinematic parameters of simulation programs. Familiarity with application of numerical integration software. Understanding of motion in different coordinate systems. *Experiments*: Intuition for magnitude of velocities and accelerations. Intuition for motion in different coordinate systems.
Dynamics of Particles	*Robotics – Simulation*: Proceed to simulation of dynamics of single simple symmetrical object in end-effector using existing simulation programs. Students vary payloads, parameters of simulation. Determine dynamic loading due to mass at end effector. Determine linear and angular momentum, kinetic energy of payload. Adjust payload/motion as necessary for constraints of robot through simulation. Students submit plots from simulations. R*obotics – Physical System Experiments*: Run corresponding trajectory and payload on physical robot after satisfactory simulations. Students submit lab worksheets.	*Simulations*: Intuition for parameters that affect dynamics using simulation programs. Understanding of motion and force/torque in different coordinate systems. Understanding of momentum and energy. *Experiments*: Intuition for physical magnitude of force/torque. Intuition for motion in different coordinate systems. Intuition for momentum and energy.
Plane Kinematics of Rigid Bodies	*Robotics – Simulation*: Extend particle kinematics to include kinematics of various locations of interest on robot such as origins of moving coordinate systems	*Simulations*: Understanding of motion in rotating coordinate systems. *Experiments*:

	in robot joints, mass centroid locations, etc. Consider using more complex objects in end-effector and determine associated kinematics. Determine motion in moving coordinate systems. Students submit plots from simulations. R*obotics – Physical System Experiments*: Run corresponding trajectory and payload on physical robot after satisfactory simulations. Students submit lab worksheets.	Intuition for motion in rotating coordinate systems.
Plane Dynamics of Rigid Bodies	*Robotics – Simulation*: Extend to include mass and moment of inertia parameters for links of robot, mass properties of more complex objects being manipulated. Determine dynamic loading due to system mass properties. Determine linear and angular momentum, kinetic energy. Adjust payload/motion as necessary for constraints of robot through simulation. Students submit plots from simulations. R*obotics – Physical System Experiments*: Run corresponding trajectory and payload on physical robot after satisfactory simulations. Students submit lab worksheets. Free body diagrams of robot links and joints.	*Simulations*: Intuition for parameters that affect dynamics using simulation programs. Understanding of motion and force/torque in different coordinate systems. Understanding of momentum and energy within a mechanical system. *Experiments*: Intuition for physical magnitude of force/torque. Intuition for motion in different coordinate systems. Intuition for distribution of momentum and energy. Understanding of free body diagrams for components in a mechanical system.