Final Exam Project – Due 5pm Tuesday 11 Dec

Design a non-trivial manipulator with at least 4 degrees of freedom that is not solved ($i.e.$ inverse kinematics ...) in Craig or other books (to your knowledge) and sketch it; get the instructor's approval for your design (start early – do NOT wait until the end of the term!!). Model your robot using Peter Corke's MATLAB Robotics Toolbox or otherwise (VRML/X3D model?).

Steps/Chapters:

1. Illustrate & carefully label the modified-DH link frames of your robot model.
2. Create the Denavit-Hartenburg table (in Craig format: *i.e.* modified-DH).
3. Solve for the forward kinematics of your robot
   a. Solve for the individual ${}^{i-1}_{i}T$ matrices and ${}^{0}_{n}T$
   b. Use your robot model to check your forward kinematic model in two very different configurations.
4. Solve the inverse kinematics of your robot (be sure that you have all inverse solutions!!).
   a. Use your robot model to check your inverse kinematic model in two very different configurations.
5. Calculate the Jacobian Matrix wrt. frame {0}.
6. Finally, compute the dynamic model for at least the first 3 links.

Notes:

- The final project will be submitted (email) as a MS word file (+MATLAB or other code)
- This may be an iterative process; if you get stuck you may wish to alter your design.
- The robot choices will be secured on a first-come first-served basis (i.e. join sequence RRPR)
- It may prove to be a good idea to use symbolic math software (I use Mathematica)

Grading Scheme:

- Difficulty and Challenge Level of Robot: 10%
- Link Frame Assignments and D-H Parameters: 10%
- Forward Kinematics: 10%
- Inverse Kinematics: 30%
- Jacobian matrix: 10%
- Dynamic model: 30%

A BONUS of up to 10% will be awarded for neatness and layout/presentation.