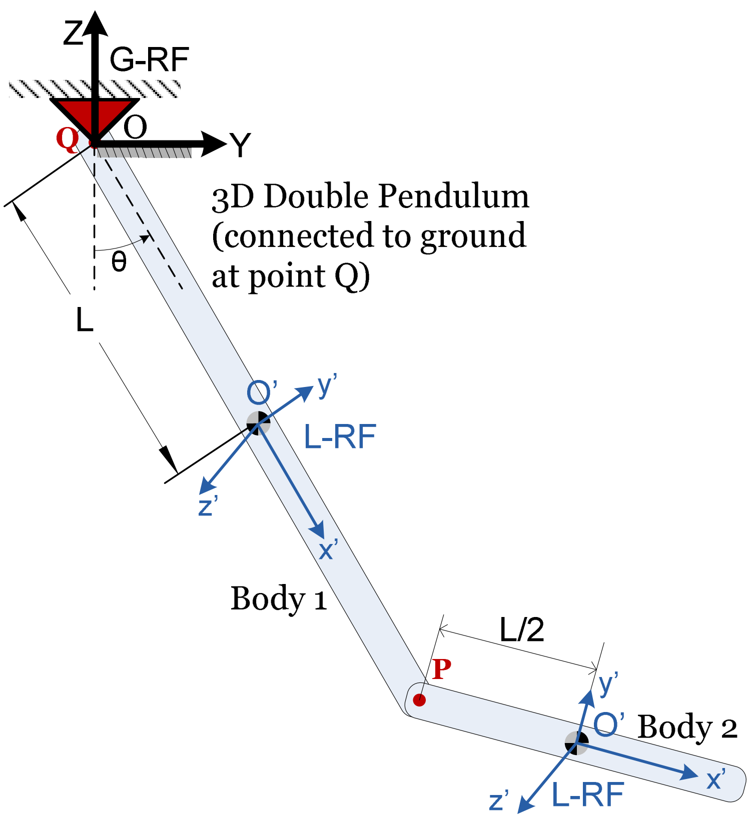
Assignment 12: Due April 29, 2010.

Problem 1. Based on the course notes of April 13, derive $[(\Phi^{\alpha}_{\mathbf{r}_i,\mathbf{r}_j,\mathbf{p}_i,\mathbf{p}_j})^T \lambda]_{\mathbf{r}_i,\mathbf{r}_j,\mathbf{p}_i,\mathbf{p}_j}$ for $\alpha \in \{DP1, DP2, D, CD\}$.

Problem 2. This problem builds on simple pendulum problem of previous assignments. The schematic of the mechanism is shown in the below.



You will have to carry out a Dynamics Analysis for the mechanism for 10 seconds of its evolution using a BDF method of order 1 in conjunction with a Quasi-Newton method for solving the resulting discretization nonlinear system of equations. For initial conditions consider the first pendulum (Body 1) to be horizontal; i.e., according to the figure, $\theta = \frac{\pi}{2}$, while the second pendulum (Body 2) is hanging down, making a $\frac{\pi}{2}$ angle with the first pendulum. Both bodies have zero velocity at time $t = 0$.

In the solution folder include a movie of the time evolution of this mechanism, along with seven plots. The first three will display the location of Body's 1 point O' in the G-RF as a function of time, the second one its velocity in the G-RF as a function of time, and the third one will display its acceleration in the G-RF. The next three plots will display the same information for Body's 2 point O'. The last plot will display the norm-2 of the violation of the velocity constraint equations for the revolution joint between Body 1 and Body 2 (you'll have five scalar velocity constraint equations, you need to compute the norm-2 of this vector; i.e., the violation of the velocity kinematic constraint equation).