Assignment 12: Due April 29, 2010.

Problem 1. Based on the course notes of April 13, derive \[ \left( \Phi_{\alpha}^{r, r, \lambda, \lambda} \right)_{\alpha} \] 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).