**Assignment 7: Due March 11, 2010.**

**Problem 1**. Implement MATLAB functions that provide all the computational kinematics quantities that are associated with the basic GCons $\Phi^{DP2}$ and $\Phi^{D}$. Specifically, the MATLAB functions should be able to return any or all of the following quantities: the value of the expression of the constraint, the right-hand side of the velocity equation $\nu$, the right-hand side of the acceleration equation $\gamma$, the expressions of $\overline{\overline{\Pi}}$ and $\Pi$, the expression of the partial derivatives $\Phi_{r}$ and $\Phi_{p}$. Since you don't need all these quantities all the time, you should devise a mechanism (using maybe flags) to instruct the subroutine what quantities are actually needed.

Note that you will need an input file that contains information that a user would provide to specify the attributes of your GCons. Since the user specifies the *value* of the attributes, but not the format and order in which these attributes are to be provided in an input file, you will also have to think about the format in which you will have the user provide the required attributes. In conclusion, think about how you want the model attributes to be provided to you, and then generate a file "me751HW7.mdl" (extension doesn't have anything to do with the Simulink input file, which incidentally has the same extension), that specifies the attributes for your GCons.

Augment your MATLAB driver file called "simEngine3D.m", which when executed by the TA is expected to generate all the Kinematics quantities listed above by reading the attributes and data specified in the "me751HW7.mdl" file that you specified.



Simple 3D Pendulum
(connected to ground at point Q)
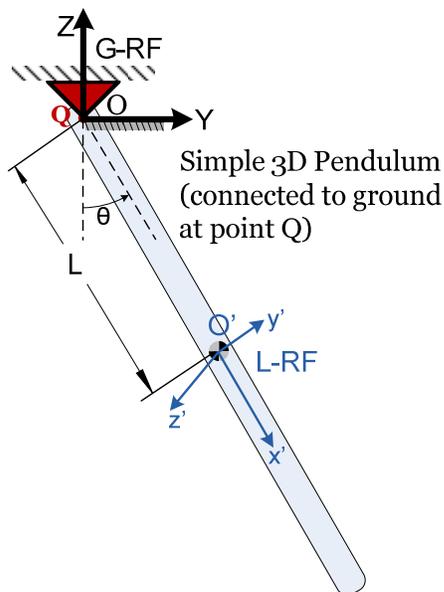
**Problem 2**. In an input file "revJoint.mdl", define your first mechanism model that will have one body hanging as shown in the figure. The pendulum has $L = 2$, it is symmetric as shown in the figure, and it is attached to ground at its tip (point $Q$). The revolute joint on the ground is at point $O$ of location $(0, 0, 0)$; that is, the origin of the G-RF. Note that the pendulum moves in the global OYZ plane; also note that the $O'x'y'$ plane of the L-RF is parallel to the OYZ plane of the G-RF. The body is subjected to a motion specified as

$$\theta(t) = \frac{\pi}{4}\sin(2t).$$ One way to implement this motion is through a DP1 basic geometric constraint.

For this homework, at $t = 0$, provide the following information: value of $\Phi^{F}(\mathbf{q}, t)$, $\Phi_{\mathbf{q}}^{F}$, $\nu$, $\gamma$, $\overline{\overline{\Pi}}(\Phi)$. All units used are SI. Modify your "simEngine3D.m" driver to prompt you to provide a integer of the homework number (7, in this case), and problem number (2, in this case) that it is supposed to solve. By providing the input 7 and 1, it should solve problem 1 above.

**Problem 3**. Provide a description of your Final Project that is no longer than one page. See last page of this document for the format in which I will ask you to provide the proposal. I will provide comments and tell you if this sounds like a good plan or not. A well defined final project will allow me to understand what you plan to do and give me an early chance to redirect you if not heading in a good direction.

NOTE: A forum topic has been started in case you want to post any questions/comments related to Assignment 7.

ME751 Final Project Proposal

**YOUR PROJECT TITLE HERE**

Your Name Here

**Project Proposed**: I propose to put together a tool that will parse an adm file and generate model related that I can subsequently feed into my SimEngine3D program to carry out dynamics analysis of more complex mechanisms. Blah, blah, blah (THIS SHOULD BE A SUMMARY OF THE PROPOSAL, NO LONGER THAN ONE PARAGRAPH)

**Deliverables**: At the end of the project I will have a software environment that can parse a pair of adm and acf files to read the model in from the first file, and understand the type of analysis to conduct from the second one. Since ADAMS is a general purpose simulation package, its model definition has evolved to the point where it can support a large family of modeling elements. However, the scope of my Final Project will be limited to being able to process adm files associated with models that are made up of the following elements:

a) Spherical Joints
b) Revolute Joints
c) Translational Joints
d) Distance Drivers
e) Translational-Spring-Damper-Actuator elements
f) Etc
g) Etc
h) Blah

**Work Plan**: I intend to use for the parsing process Python (or Perl, or MATLAB, or yak, or whatever you want). SAY A SENTENCE OR TWO ABOUT HOW BELIEVE THAT YOU CAN ACCOMPLISH THIS TASK. IT WILL HELP ME UNDERSTAND IF THIS PROJECT STANDS A CHANCE OR IT'S OUT THERE IN THE LEFT FIELD.

**Demonstration of Contribution and Validation**: For demonstration purposes, I will generate a model in ADAMS/View using exclusively the modeling elements in the list provided above. Then I will run that model in ADAMS and produce plots with the reaction force in a joint present in the model. I will then take the input file generated by my tool using the adm file and run a simulation in simEngine3D. I will show that the reaction force produced in ADAMS matches the reaction force produce by the MATLAB simulation engine.

**Intellectual Rights**: I do not want the outcome of this work to be available for use by other people (Alternatively, indicate that you are ok with posting your project on the class website and have it used by anyone who might be interested in doing so, with no strings attached).