FL. 2018 ESE 447.02 Robotics Lab

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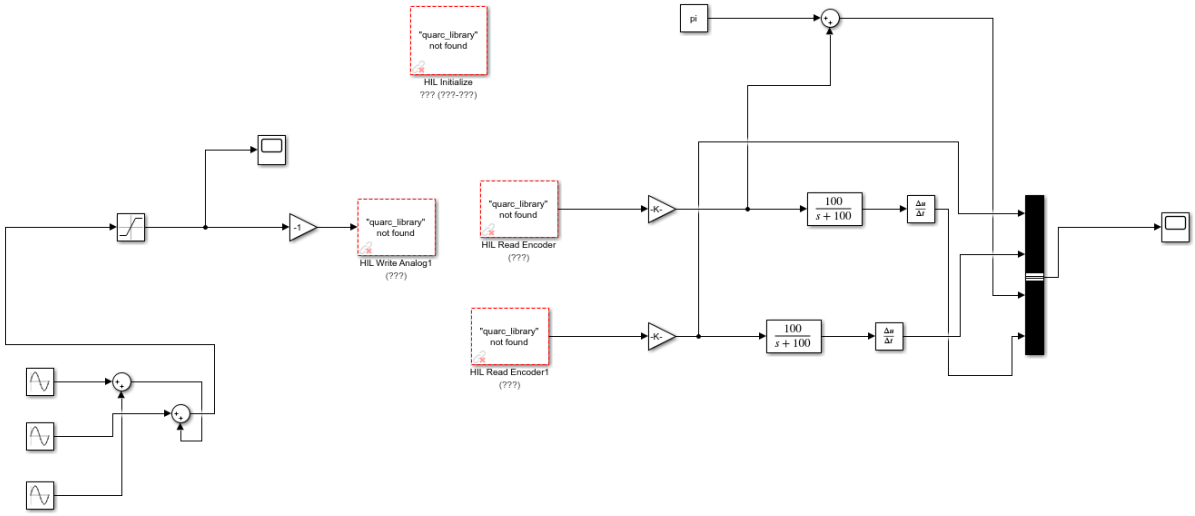
1. Applying Hamiltonian to the physical system.
   The model for collecting data from the physical system was constructed as shown below.



We used the same input signal to generate random movements for the robot links. The angles for the two links of the robot were collected by the READ Encoder and converted to radiance unit. A bias of pi was added to q2 since the zero position is shifted by pi compared to the physical system. Transfer function blocks and derivative blocks were used to get the q_dot data. The transfer function worked as a low pass filter to eliminate noises. The data was recorded by the scopes and saved as arrays.
Then we used the Hamiltonian function in the same way we used for the simulated system and calculated the theta values. When collecting data for the real system, the running setting was changed by going to Code→external control→signal&trig→durtation and set duration to 50000. This would ensure we got enough data pints (more than 5000).
We also worked on different work stations to use different systems so that we could get theta values for different physical robot systems. We compared the results with other groups.

System	10		8		12	
	ours	others	ours	others	ours	others
theta 1	0.0785	0.0902	0.0682	0.0672	0.0734	0.0758
theta 2	0.0272	0.0309	0.0238	0.0231	0.0245	0.0264
theta 3	0.0238	0.0303	0.0222	0.0207	0.0249	0.0254
theta 4	0.1145	0.1461	0.1085	0.1088	0.1118	0.1325
theta 5	0.5436	0.5758	0.5372	0.5031	0.5407	0.5432
theta 6	0.0107	0.0095	0.0055	0.0148	0.0099	0.0123

By comparing the theta values from different groups for the same robot system, we concluded that the results were very close but not exactly the same. This can be caused by different working conditions for the systems. The 6 theta parameters reflect different physical properties of the robot system including inertia, mass and frictions in joints. These parameters can change due to unexpected factors. For example, the wire that connects the encoder ports can affect the parameters depending on how much force the wire apply on the system.

As mentioned in the simulation part, the randomicity of the movement of the links can also affect the results. As we concluded above, the more random the movement of the robot was, the more accurate the theta values calculated were. This is because the random movement can create different working conditions and this will help getting more distinct data points. So the more random the movement is, the better the quality of the data would be.