SUMMARY

In this thesis the dynamic parameter estimation for the *KUKA iiwa 7 R800* robot arm is attempted to help provide more realistic and accurate simulations of the robot's joint positions, joint velocities and joint torques. Two different approaches are considered and attempted, one of which is successful in obtaining the dynamic parameters. These are then tested to study the quality of the results and compare them to already existing dynamic parameters for a similar robot in its family, the *iiwa 14*.

The first of the two approaches attempt to replicate an already proven method for a very similar robot [2], the *iiwa 14*. This method was the most similar approach that previously existed for the *iiwa* family of robots. Hence, this was considered to be a good approach to attempt for the *iiwa 7*. It involved generating a trajectory that is very optimised and would provide a very intelligently guided way to execute the experiment. Unfortunately, this attempt could not be completed due to time constraints. While the full details of the approach are provided in the [2], the text in this thesis serves as an important interpretation and explanation of the method used in that research paper. For anyone hoping to implement this type of method, reading both the research paper and Chapter 2 of the thesis would be useful, but this thesis on its own serves just to outline an explanation of the method done by [2] and the current state of this implementation done on the *iiwa 7*.

The second of the two approaches involve an existing *ROS* based library called *ROSdyn* which provides an automted and convenient procedure for conducting the experiment. This method utilizes existing software libraries for trajectory generation and for communicating joint commands to the robot and recording joint states. This approach is succesfully completed and a set of dynamic parameters is obtained. *ROSdyn* also provides some basic statistical calculations to compare different sets of estimated parameters so the best result can be used in the next stages for more thorough validation.

For validating the chosen set of estimated dynamic parameters, new test trajectories are generated and executed on the real robot and the joint states are recorded. A dynamic model for the *iiwa 7* is made using the newfound parameters and an existing dynamic model for the *iiwa 14* is also used for comparison. The same trajectories are simulated in *Gazebo* using the dynamic models for the *iiwa 7* and the *iiwa 14*. It is observed that the new dynamic model for the *iiwa 7* simulates the real *iiwa 7* robot's joint positions very accurately and precisely. This model for the *iiwa 7* also performs on par with the *iiwa 14*'s existing dynamic model for accurately simulating the joint

positions of the trajectory. The new dynamic model for the *iiwa 7*'s also provides more accurate simulations of the real robot's joint velocities, so there is improvement achieved compared to the existing dynamic model of the *iiwa 14*. Joint torques could not be compared very accurately, most likely due to simulation controllers that do not behave very accurately with the simulated dynamics. The existing dynamic model for the *iiwa 14* and the new dynamic model for the *iiwa 7*, both neglect contributions from the joint frictions. Future work could help by tuning the simulation controller to better simulate the robot's torque and also by including the joint frictions in the dynamic simulations.

The main objectives of the thesis are succesfully completed and an accurate dynamic model for the *KUKA iiwa 7 R800* is obtained. This dynamic model performs just as accurately as the existing dynamic model of the *iiwa 14* for simulating joint positions of the *iiwa 7* robot and performs more accurately for simulating joint velocities for the *iiwa 7* than the existing dynamic model of the *iiwa 14*. Though the simulation of the joint torques is not succesfully complete, it is due to the limitation of the current implementation of the motion controllers in the simulation software and this issue was outside of the scope of this thesis to solve.