HyQ2max Description of SimMechanics files

HyQ2Max Leg SimMechanics Model.pdf
Short document describing the SimMechanics model

HyQ2Max_KLev_PolFit_SFcn.m
S-Function with Lever arm Polynomial Fit

HyQ2Max_KLev_SFcn.m
S-Function with Lever arm theoretical expression

HyQ2Max_CAD_For_SimMechanics_LF_RF.m
M-File with the mass and inertia parameters for HyQ2Max (run this file before running the SimMechanics simulation)

HyQ2Max_Leg_2Dof_ForAc1.mdl
SimMechanics file with Torque and Force inputs for hip and knee joints.
The Force inputs are provided in the Body Force interface for Lower leg block. Hard stops are included in the model to keep the motion within the real range of motion of the robot leg.

HyQ2Max_Leg_2Dof_ForAc1CylMot.mdl
SimMechanics file with Ideal pressure sources as inputs for hip and knee joints.
For the hip joint the ideal custom hydraulic motor block includes a hard stop and a rotational damper (details can be viewed by "looking under the mask" for this block). Variable oil volumes are not included in this ideal model.
For the knee joint the ideal custom cylinder block includes hard stops. A rotational damper is included directly on the knee joint. Variable oil volumes are not included in the ideal cylinder block. This file illustrates how the hydraulic elements can be connected to the mechanical model of the leg.

In the "Body Force interface for Lower leg" block, both SimMechanics files include piston, rod and oil mass in the mass and inertia for Bodies A and B. The masses (and inertias) can be set to very small values (e.g. 1e-3 or 1e-4) if they are included in the hydraulic part of the system. The masses and inertias for the bodies AR and BR are set to 0.01 kg and 1e-3 kgm^2. In the knee lever mechanism three spherical joints are used, Spherical A, Spherical B and Spherical AR. If there are problems running the simulations, for example the simulation becomes too slow or strange transients occur at the beginning of the simulation, then these 3 joints can be replaced by revolute joints about the z axis (in this case matlab may give a warning about some constraints being redundant but this does not cause a problem running the simulation). The piston position for the lever mechanism is measured using a joint sensor. The range is determined by the piston stroke 0.06834 m and the initial piston position -1.4570e-4m (which is obtained for 0 degrees for the knee joint as this is the home configuration in SimMechanics).This will make the piston range vary between -1.4570e-4m and -(0.06834+1.4570e-4) m in the simulation. To change the piston range a constant is added to the position sensor reading, for example adding (0.06834/2+1.4570e-4) will give piston positions between -0.035 and +0.035 m, while adding (0.06834+1.4570e-4) will give position readings between 0 and 0.06834 m (note that the actual values in the simulation may be a little outside the theoretical range because the hard stops are modelled as contacts with high stiffness and damping and this can cause penetration beyond the hard stop limits). In the SimMechanics files the piston range is set to be between 0 and 0.06834 m and the added constant is (0.06834+1.4570e-4) m.