**List of Files and Functions**

The following is a list of the files included in this folder. In addition, there is a brief description of their function and role in running the phase-reduced neuro-mechanical model.

**datamusc.m** - This contains some of the cockroach data, such as leg lengths and hip

positions which are used in the analysis. This function is called in many of the other

functions.

**ep2fsmusc.m** - At the end of each stance, this function is used to get the set of state

variables for the Poincar\_e map from the final system state. The set is in turn used as initial conditions for the next stance.

**evathetamusc.m** - In order to find the initial condition for the body orientation, this function is used along with the matlab function fsolve in the main.m file.

**evtNconst.m** - This is the event function used along with the matlab integrator. This event function is used to define the condition based on which the integration stops, thereby marking the end of each stance.

**footdatamusc.m** - This function calls data from footModel.m (see below) to produce the TD foot position data in a suitable format for se in the model. It is in turn called by many of the other functions to define the TD.

**footModel.m** - This function was originally written by Shai Revzen, Polypedal lab, UCBerkeley based on his experimental data on running cockroaches. footdatamusc.m uses this function to get the appropriate foot TD data for the present model.

**footpP.m** - Given the TD joint angles, this function calculates the corresponding TD foot positions (in body frame) based on the geometry of the leg. To make the insect model run at higher speeds, the feet have to be place further forward and this is done in this file by modifying the TD joint angles.

**fs2spmusc.m** - At the beginning of each stance, this function transforms the initial conditions in Poincar\_e states into the initial state vector which is required as initial conditions for the integration of the body dynamics equations.

**GetDelta.m -** This function is used to obtain the forcing on the MN phase based on joint torques.

**getfootmusc.m** - At the beginning of each stance, this function is used to obtain the TD foot positions with respect to the inertial frame of reference.

**getvarmusc.m** - During the integration of the full system of equations, this function is used to calculate the foot forces and joint torques given the activation input to the muscles at any time instant. These forces and moments are in turn used to derive the center of mass dynamics of the insect.

**hiptorquevector.m** - This function is called inside getvarmusc.m to determine the hip joint torques of any one of the six legs, given the hip joint angle, angular rate and the activation input to the muscles at any time instant.

**kneetorquevector.m** - This function is called inside getvarmusc.m to determine the knee joint torques of any one of the six legs, given the knee joint angle, angular rate and the activation input to the muscles at any time instant.

**main.m** - The executable file to run the entire neuro-mechanical model. This file contains two functions: eqns, which contains all the governing differential equations

of the system and main, which is used to integrate those differential equations over

multiple stances.

**frontleft1.m, frontright4.m, midleft5.m, midright2.m,hindleft3.m, hindright6.m** - These files compute the forces and torques for each leg.

**neuraldata.m** - This file contains the parameters for the neuron models.

**PhaseDataAll.mat** - This file contains the parameters for the phase-reduced motoneurons and central pattern generator equations.

**Phaseneuraldata3.m** - This file contains the pre-computed slope and intercept information for the sensory feedback calculation.