**Folder: Functions**

This folder contains functions to be used in other scripts.

**Files and Descriptions:**

**costFunction** – This function serves as the primary cost function or objective function that the optimization code will be attempting to minimize throughout iterations. The first component of the cost output is the summed and normalized difference between the human torque and PAM replacement torque. The second component of the cost output is the weighted angle between the human torque directional vector and the PAM replacement torque directional vector.

Inputs: This function takes the human muscle torque and the PAM replacement torque as inputs.

Outputs: The output of this function is a C or cost value. The value is unitless and can be scaled to any arbitrary amount through the use of the gains Gt and Ga.

**RowVecTrans.m** – This function orients a vector in one reference frame into a second reference frame. Useful for bringing muscle location points in the first reference frame into a second reference frame.

Inputs:

* T – The transformation matrix that describes the orientation of the second reference frame with respect to the first reference frame.
* p – A row vector in the first reference frame

Outputs:

* v – The row vector, p, in the second reference frame

**RpToTrans** – This function comes from a robotics text book. It creates a transformation matrix from a rotation matrix and a distance column vector.

Inputs:

* R – The rotation matrix that describes the rotation of the second reference frame with respect to the first reference frame
* p – the column vector that describes the distance of the second reference frame origin from the first reference frame origin

Output:

* T – Transformation matrix which is the combination of R and p

**festo** – This function comes from Dr. Hunt’s work on characterizing the 10 mm I.D. Festo BPA. It calculates force based on current muscle length and resting length.

Inputs:

* Lmt – Total Musculo-tendon length
* rest – resting BPA length
* dia – BPA diameter
* long – longest musculotendon length

Output:

* F – Force at maximum pressure