

Validation of converted neck6d model

The converted MJC model has been tested under the three categories below and with the accuracy of:

- Step 1: XML Conversion Validation

Check multi-body forward kinematics (using endpoints), approximation of custom/coupling joints & conditional/moving path points

Mean error: 1.4508 cm; std: 1.7521 cm

- Step 2: Muscle Kinematics Validation

Check muscle moment arms as indication how muscle wrap over joints

Mean error: 1.7171 cm; std: 0.6505 cm

- Step 3: Muscle Kinetic Validation

Check muscle force-length relationship as indication of how similar of them in generating forces

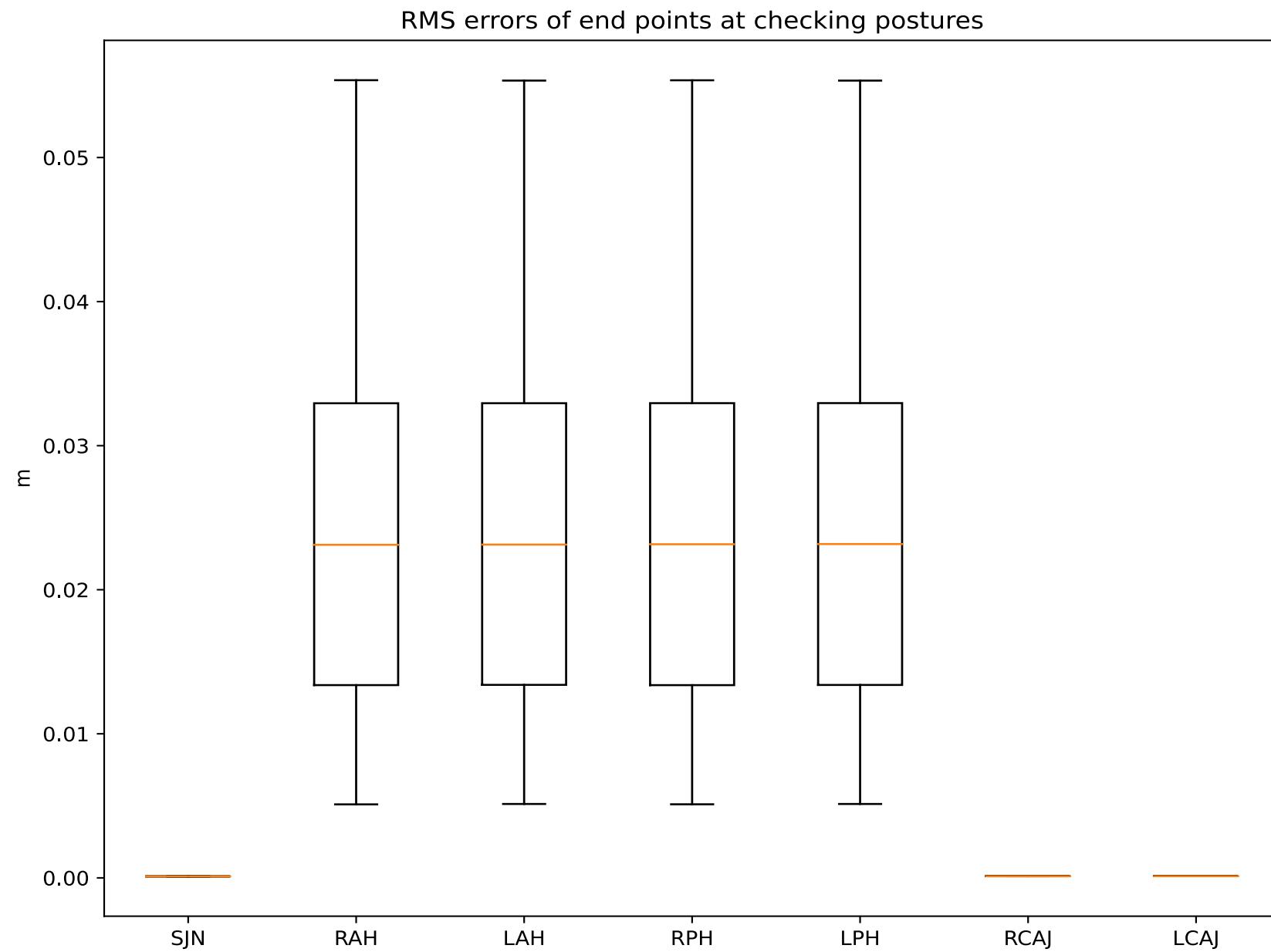
Mean error: 0.0903 Fmax; std: 0.0648 Fmax

Step 1: xml Conversion Validation

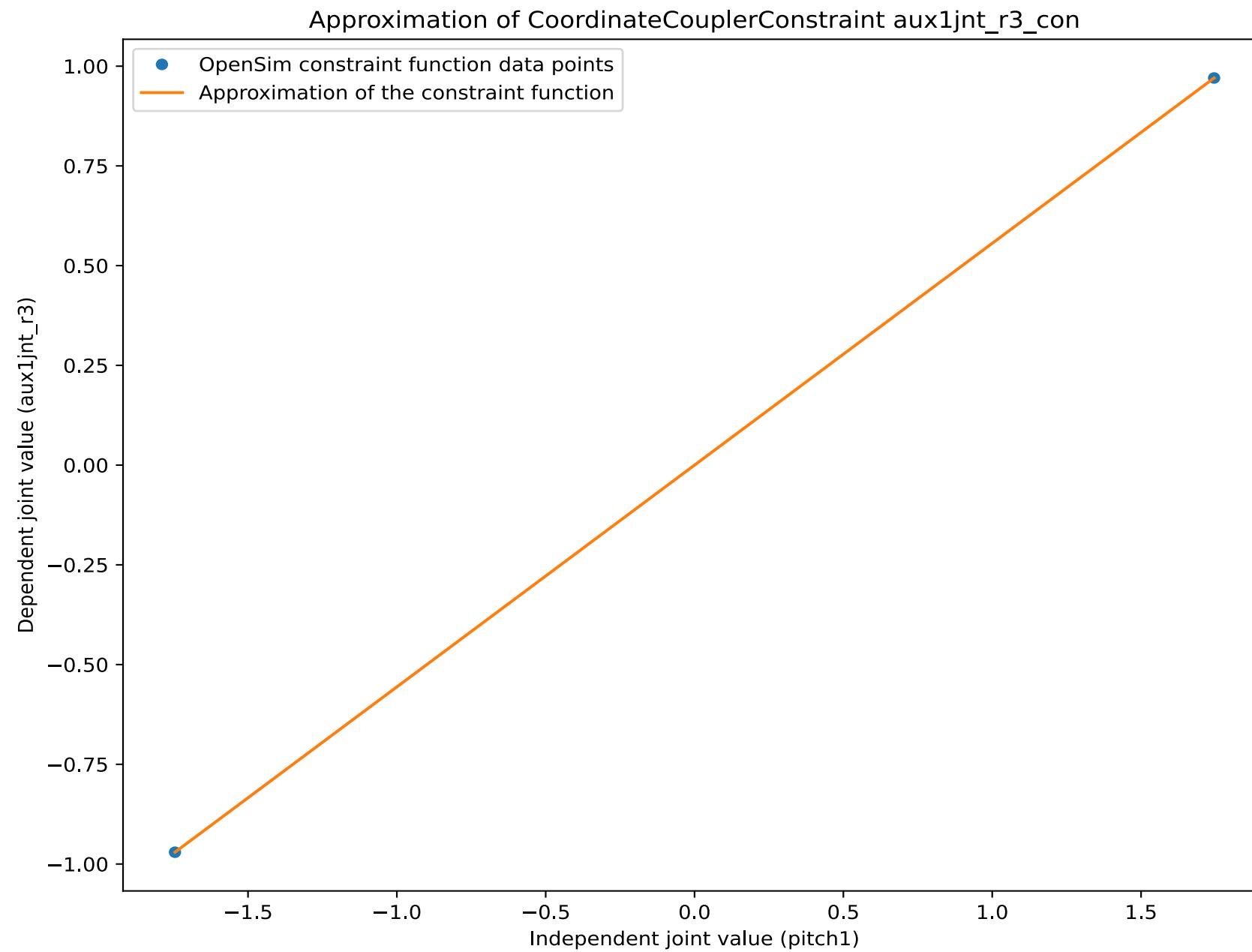
Randomly pose the model with 10 configurations within the joint limits. In each posture, the endpoints(markers) global locations of Osim and Mjc models are extracted and compared. Box plot of their mean-std errors are plotted together. Individual endpoint differences of these 10 postures are also plotted in the VLT folder, but not included inside this report.

Besides the endpoint check, the approximation of customer joints, coupling joints, conditional/moving path points are plotted and attached. In these plots, blue dots/lines represent their setup in the OpenSim model. Yellow dots/lines represent the approximations in the MuJoCo model.

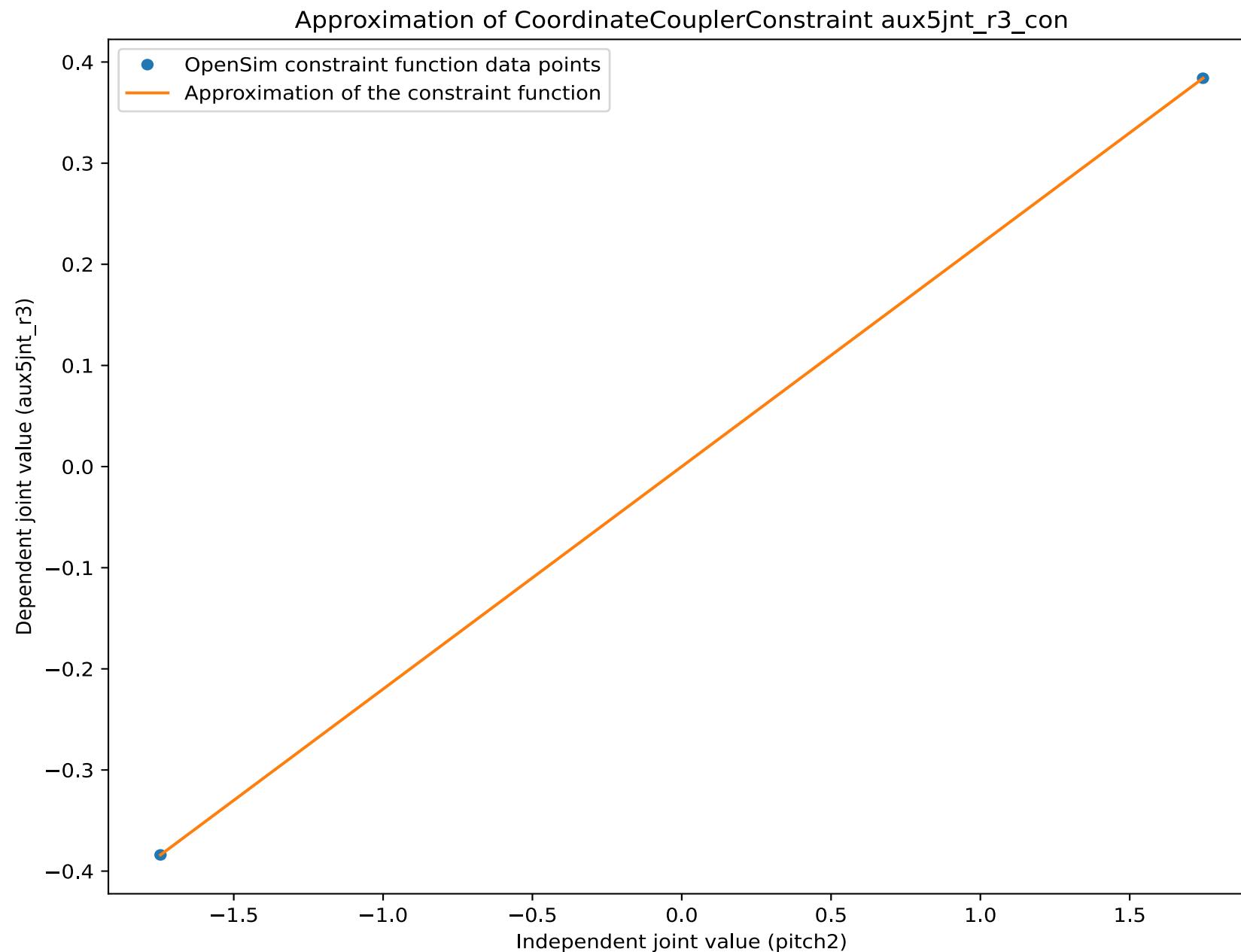
End points



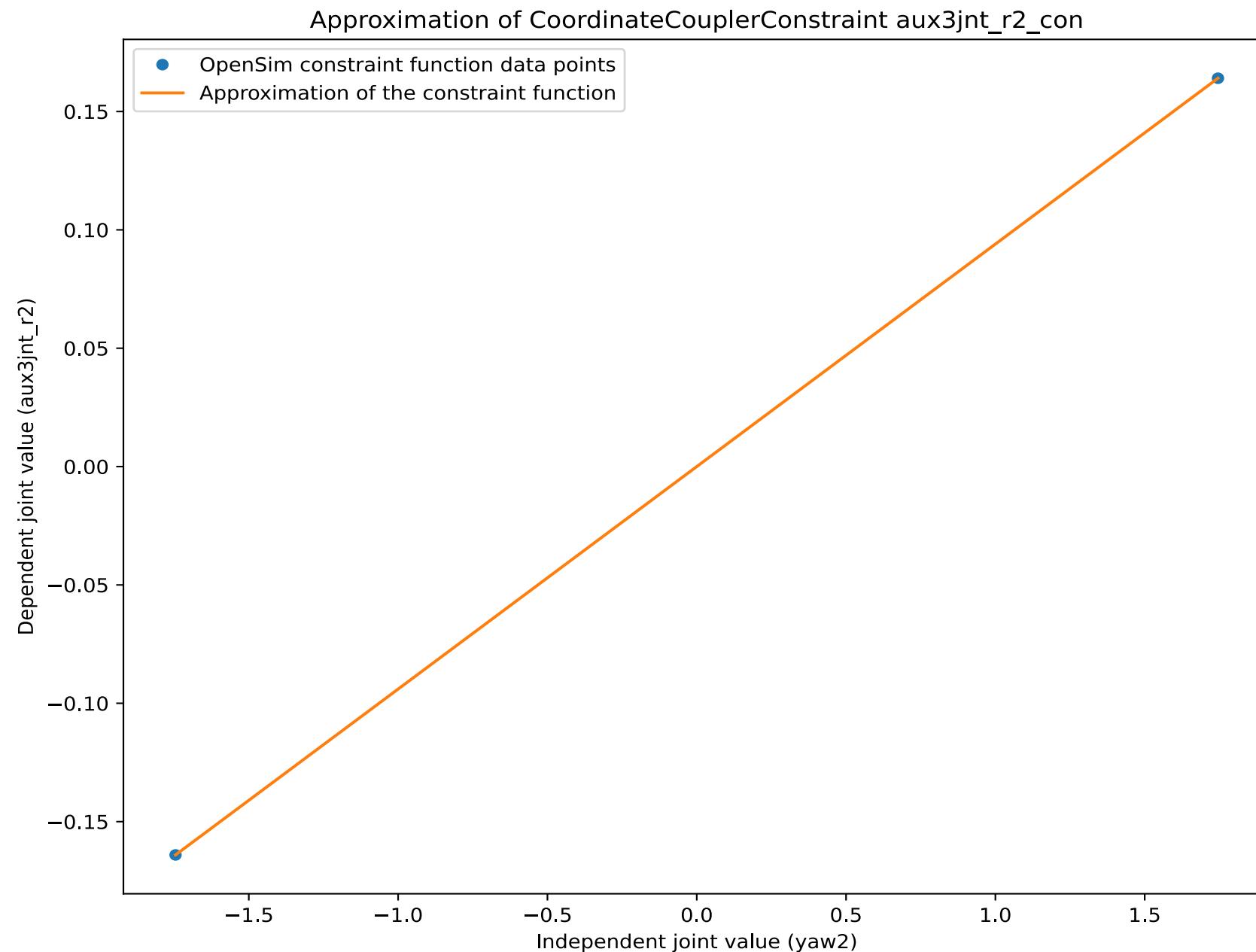
Approximation of coupling joints



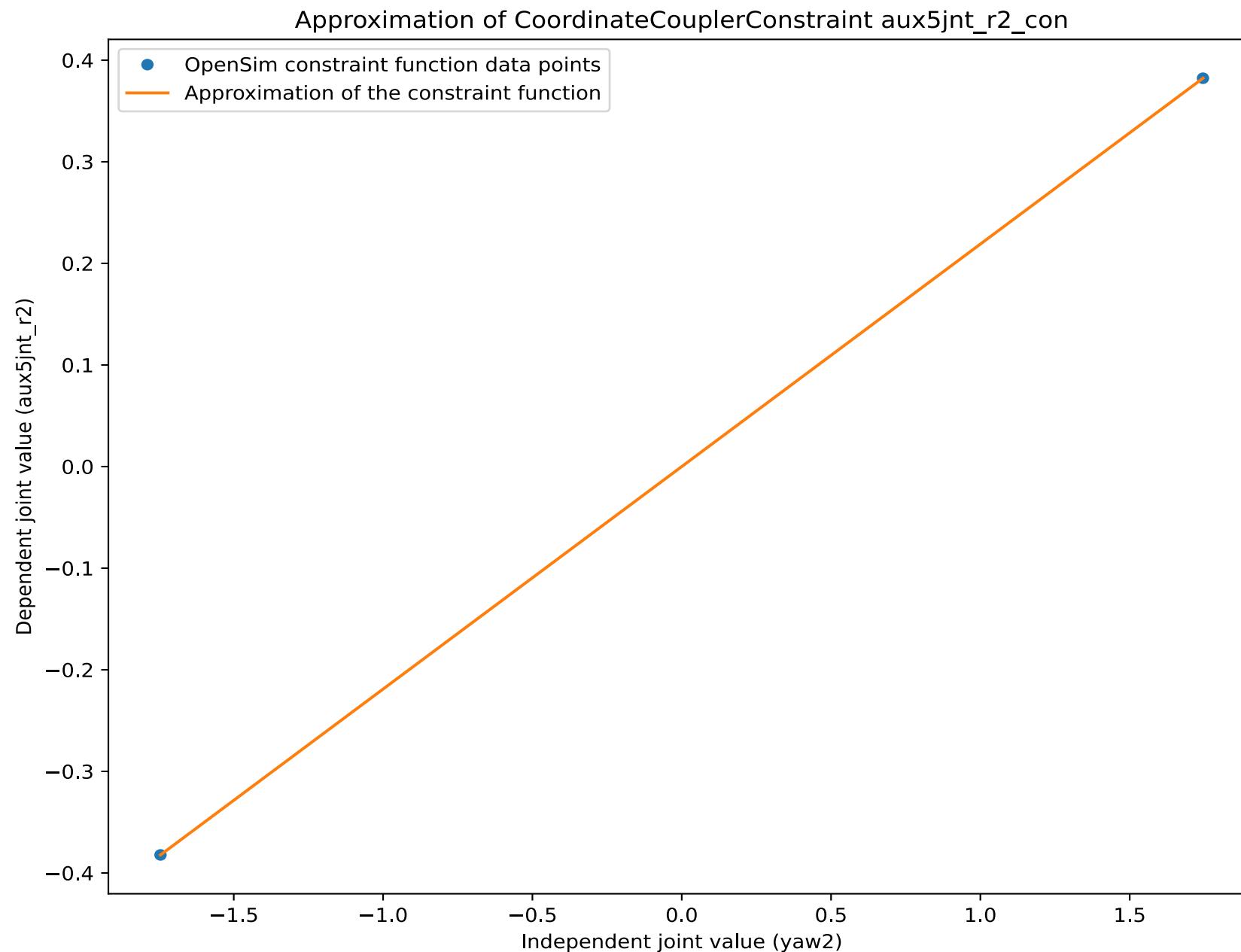
Approximation of coupling joints



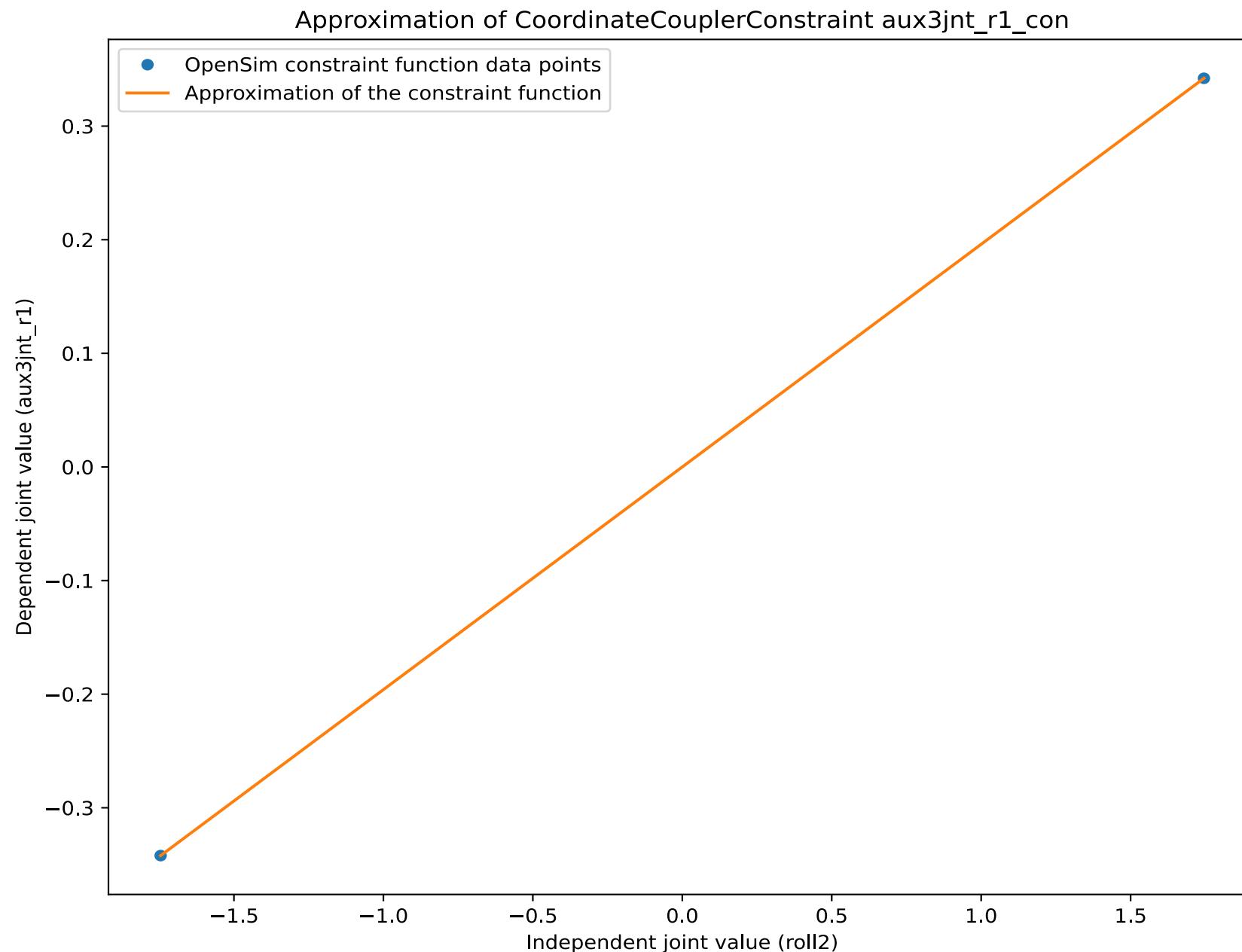
Approximation of coupling joints



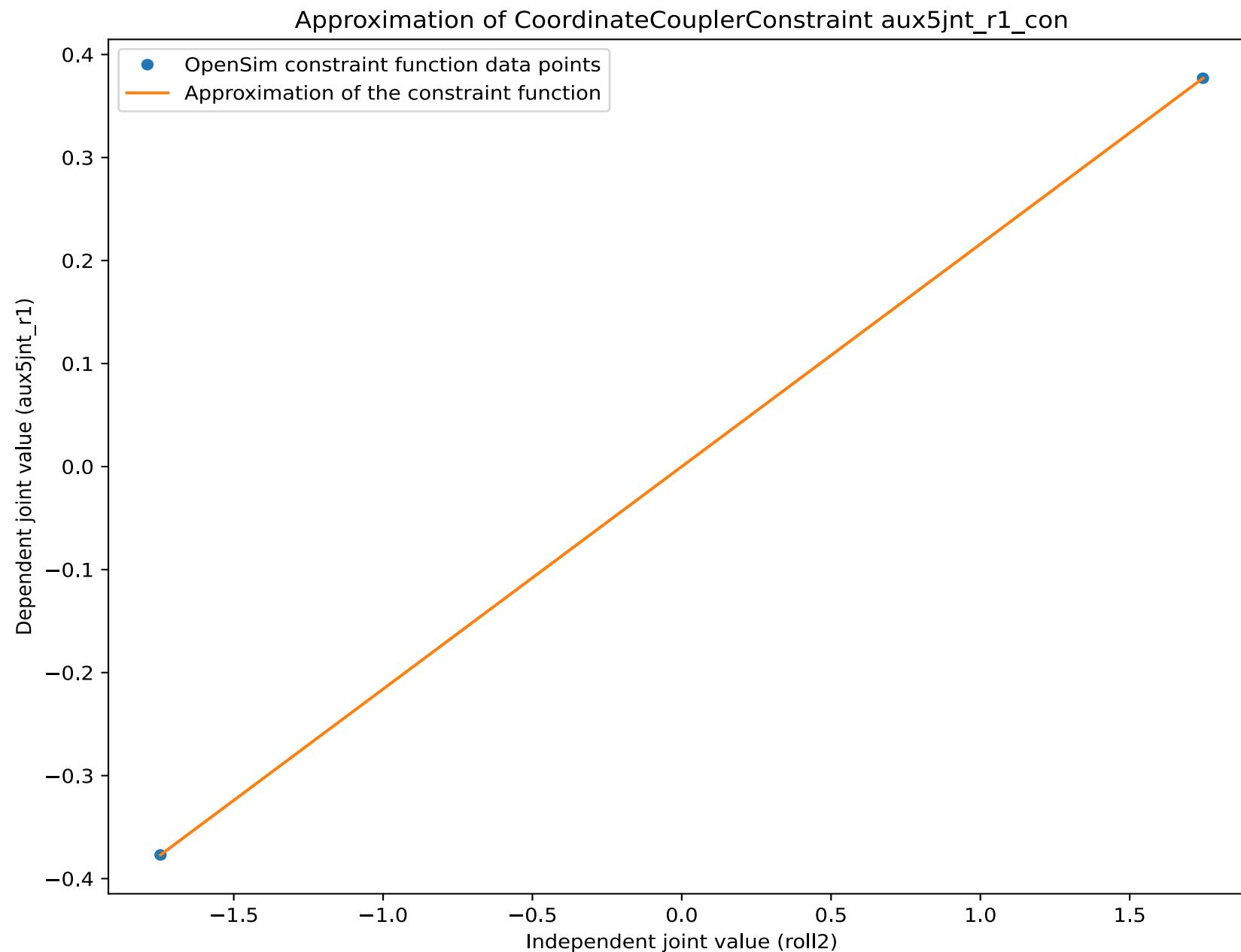
Approximation of coupling joints



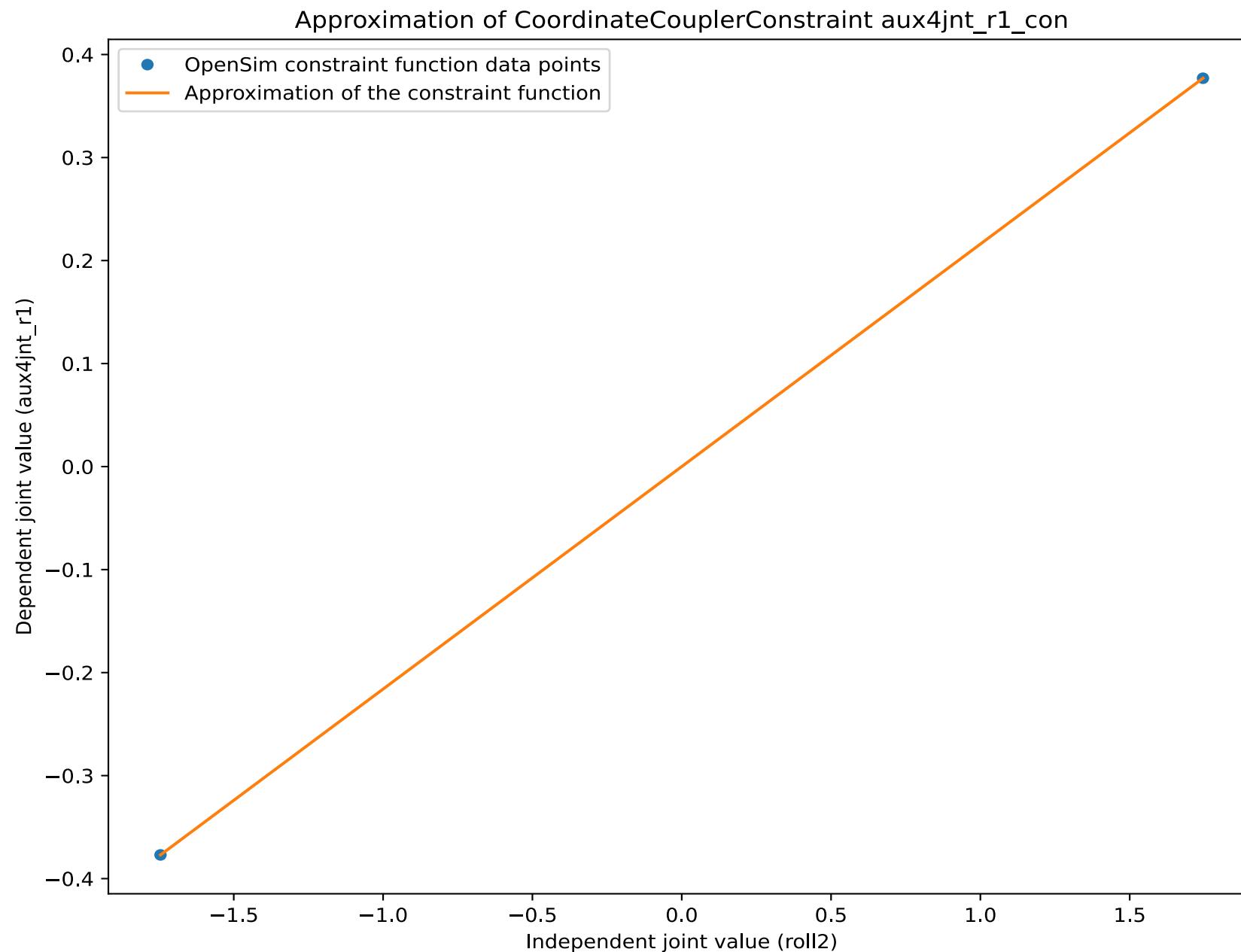
Approximation of coupling joints



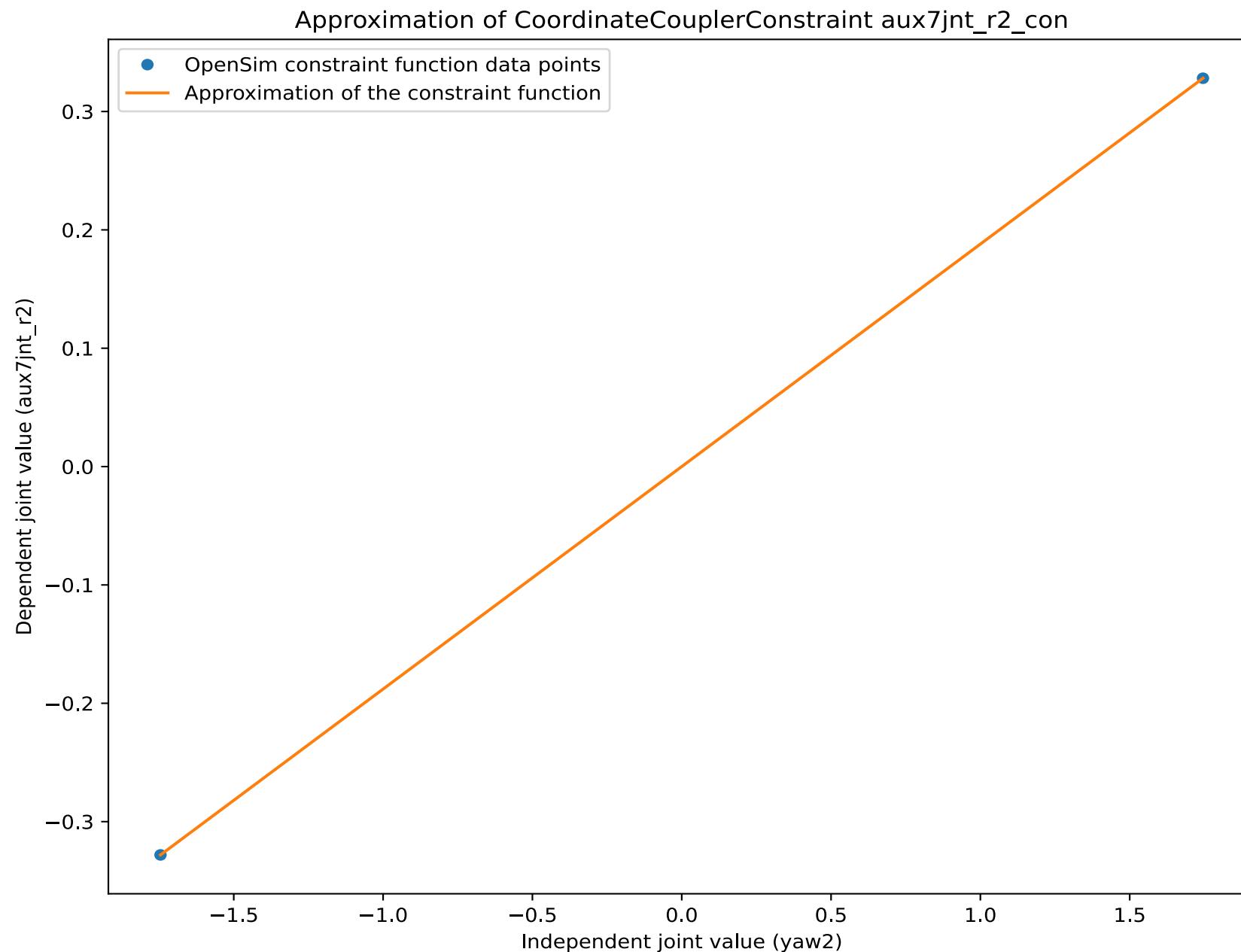
Approximation of coupling joints



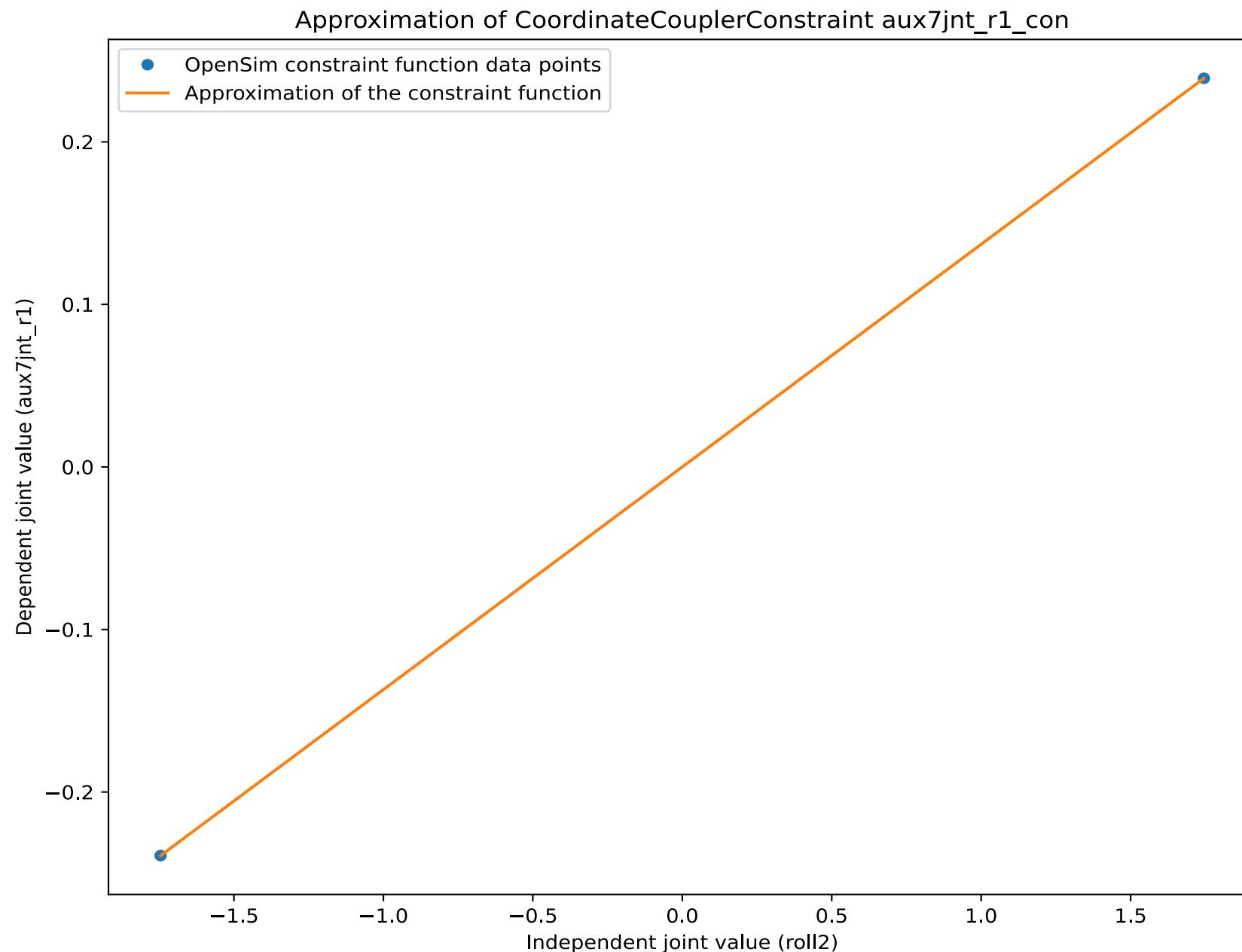
Approximation of coupling joints



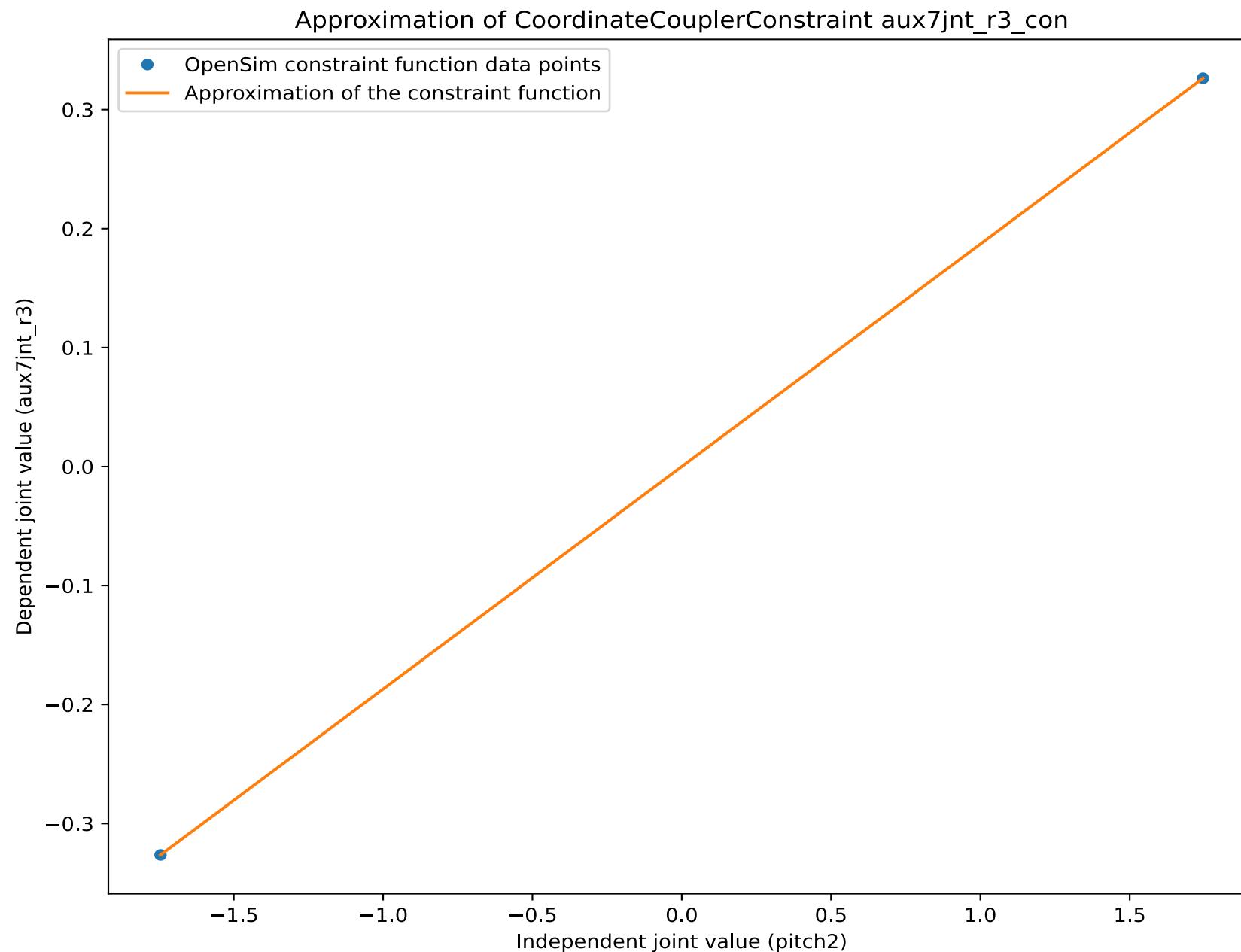
Approximation of coupling joints



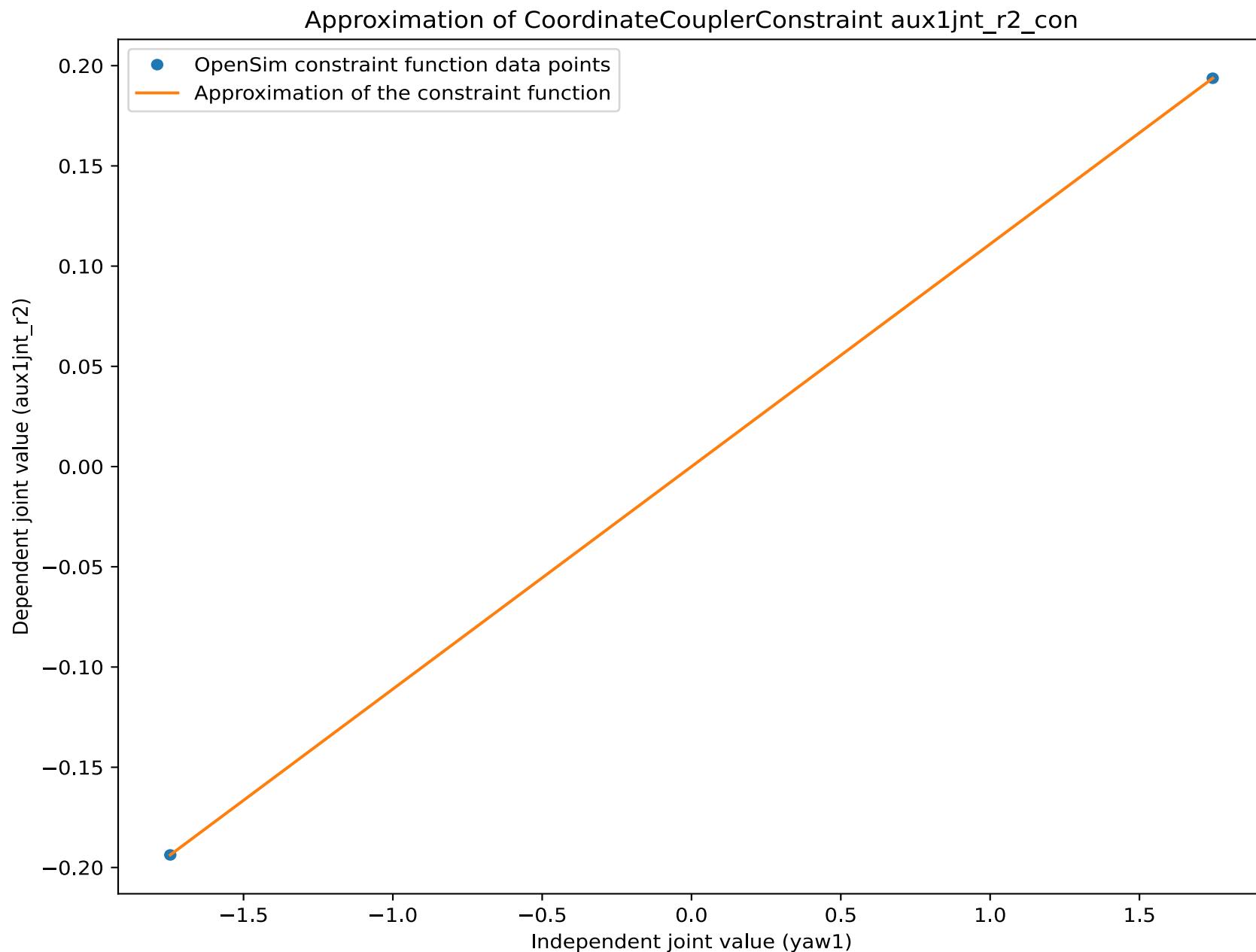
Approximation of coupling joints



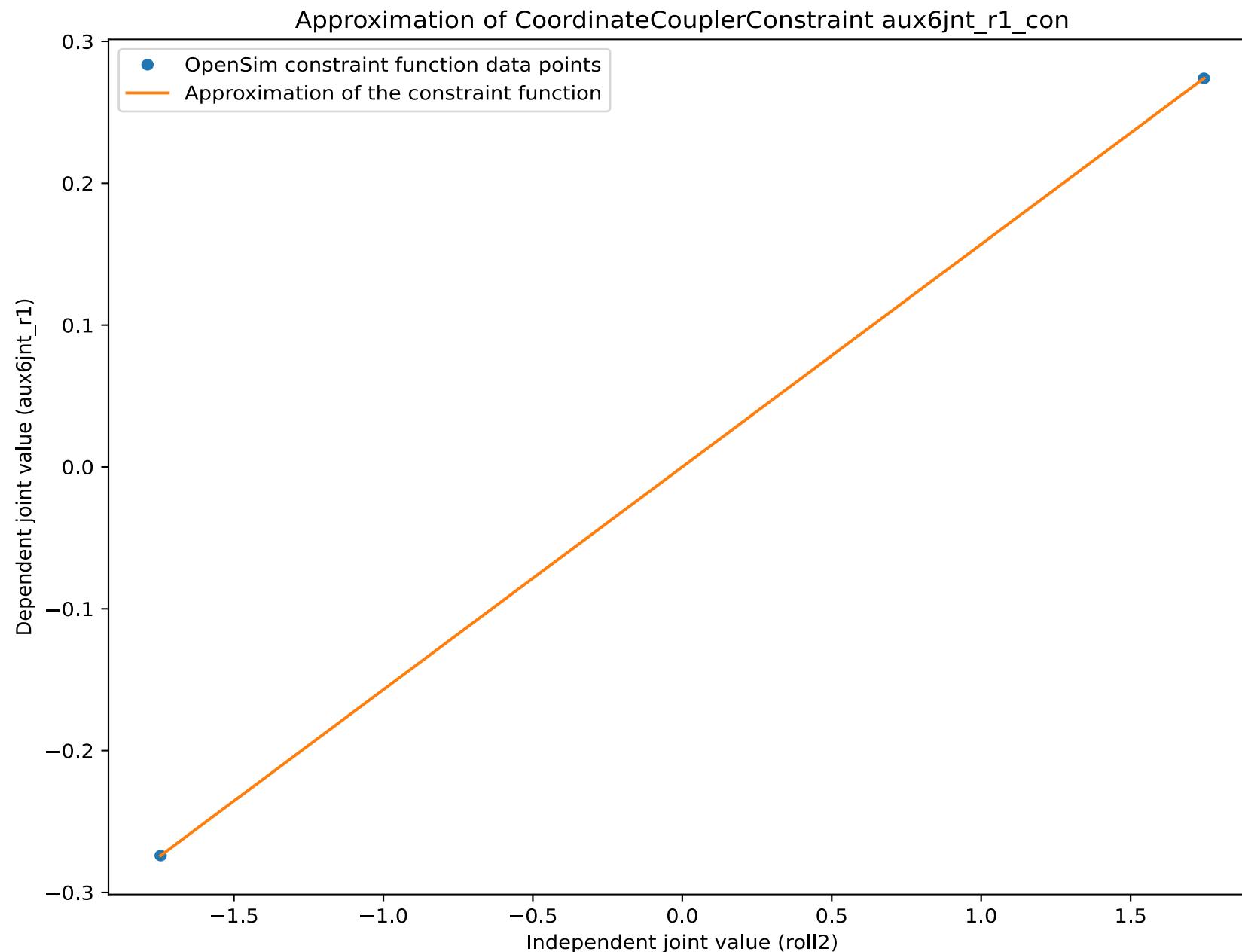
Approximation of coupling joints



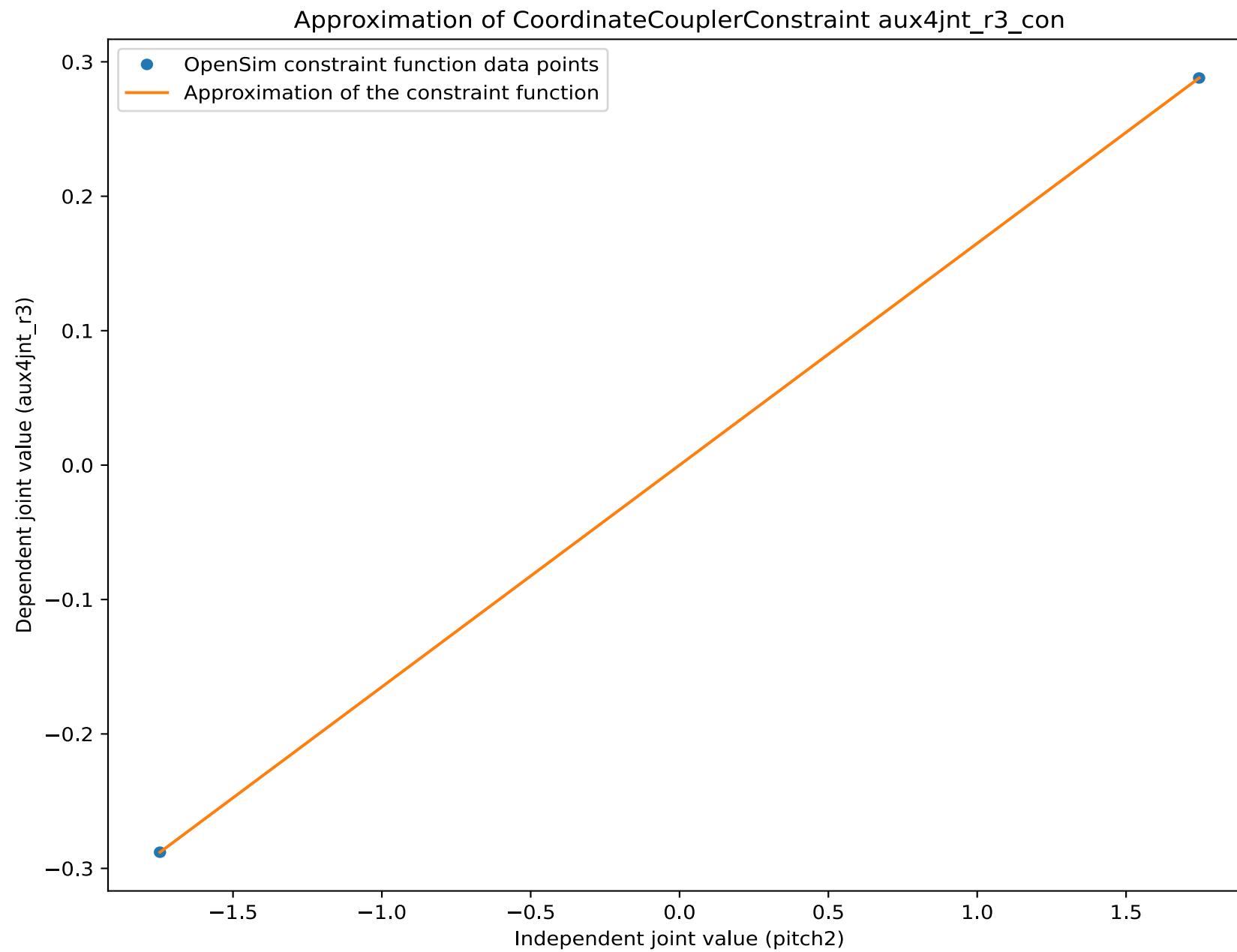
Approximation of coupling joints



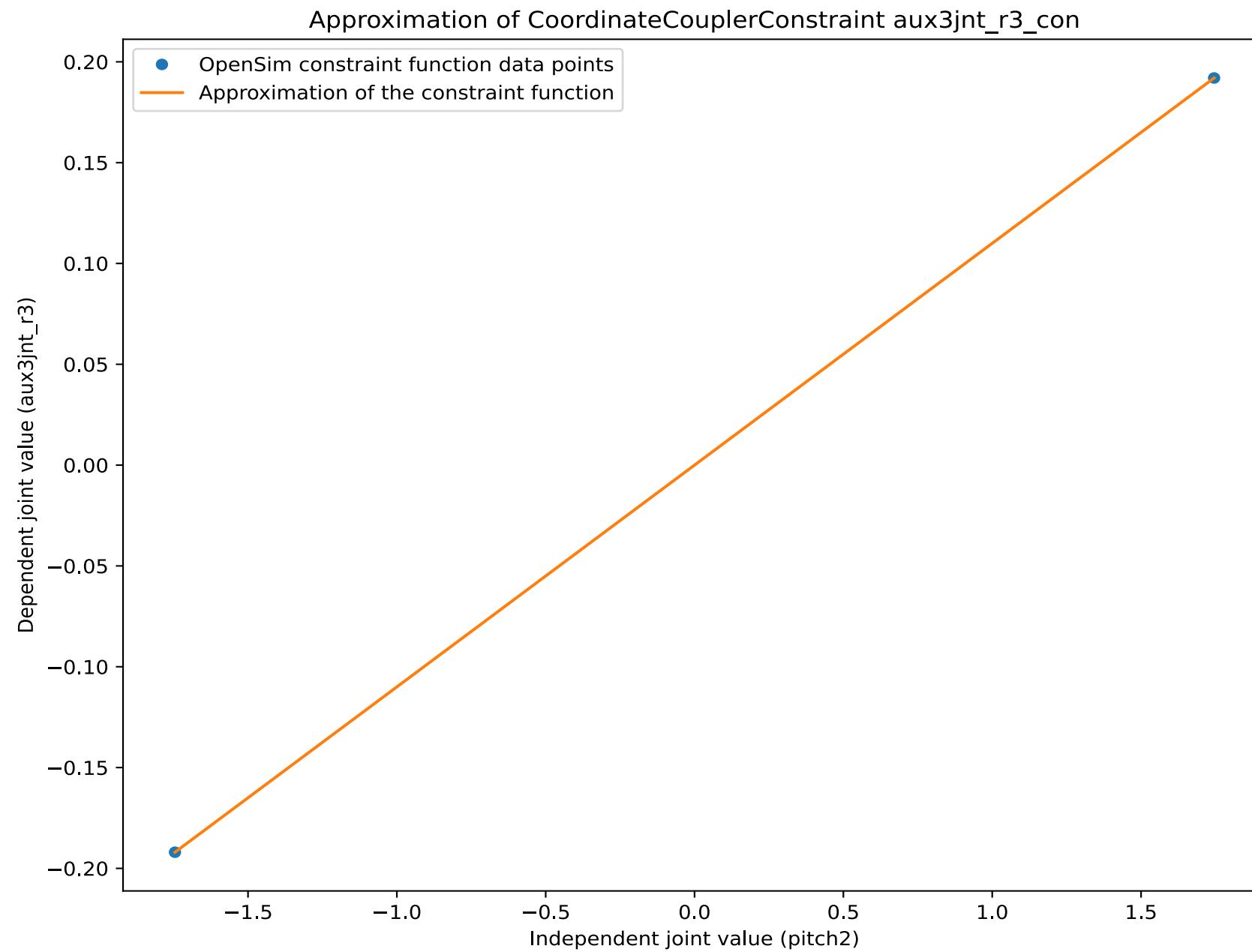
Approximation of coupling joints



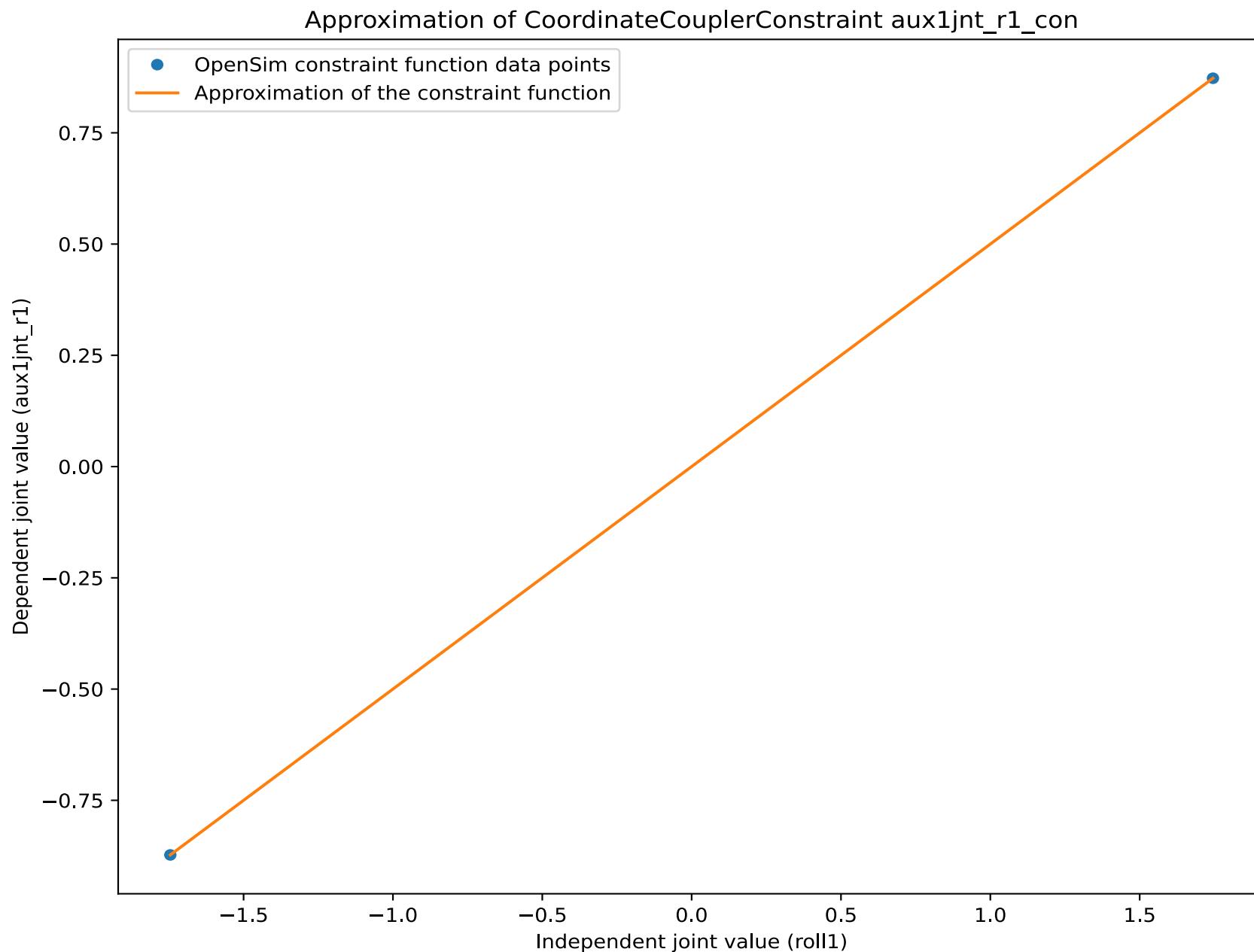
Approximation of coupling joints



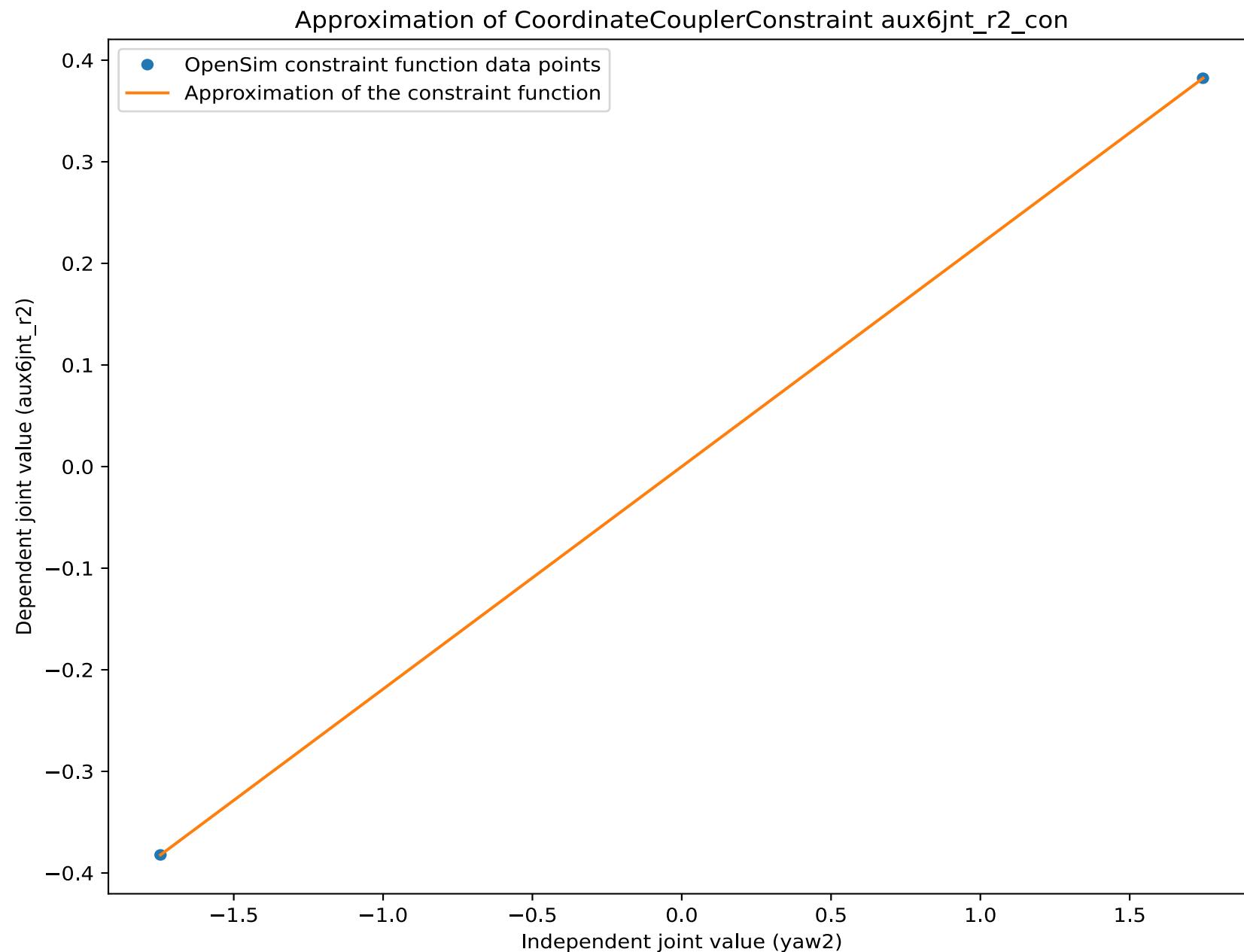
Approximation of coupling joints



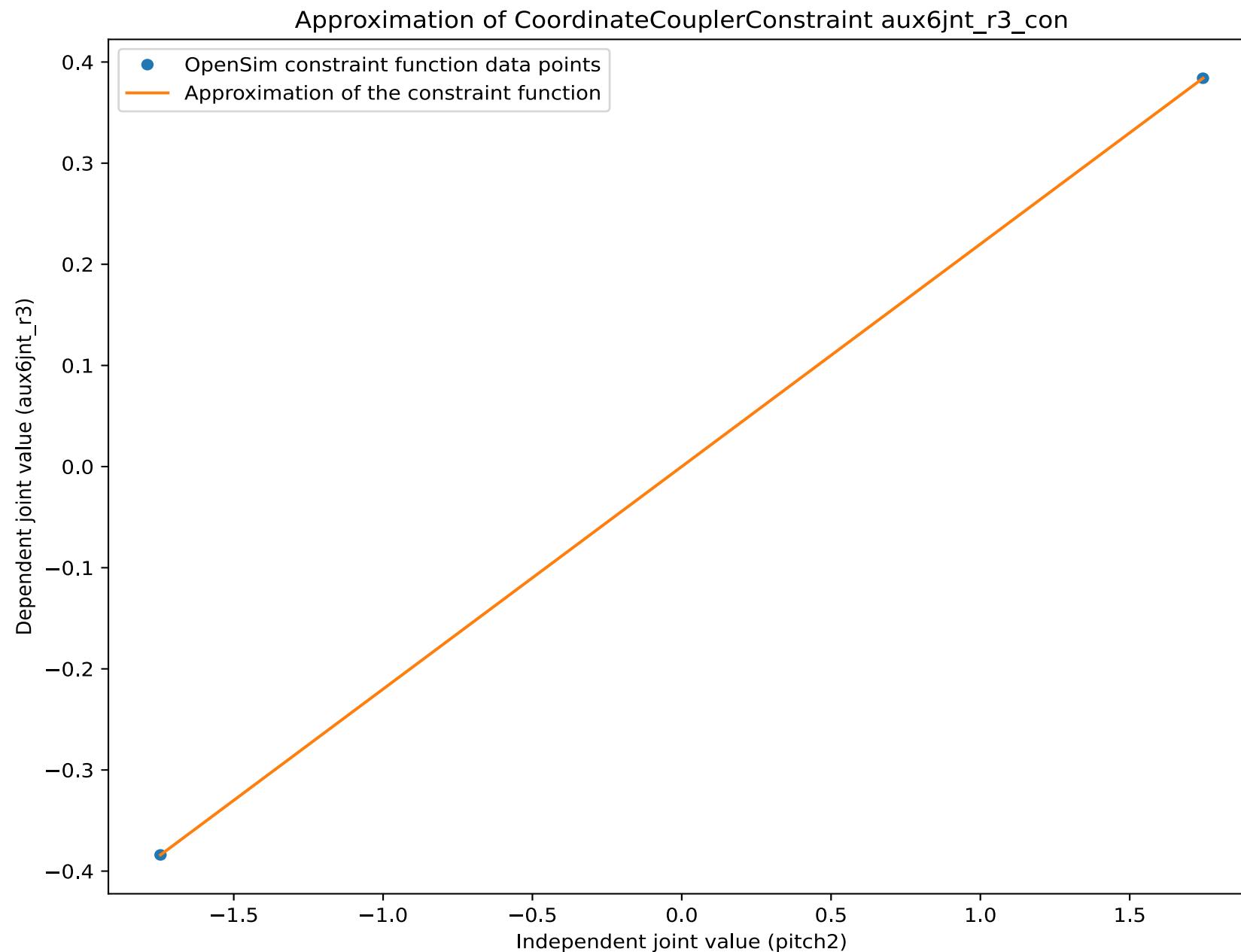
Approximation of coupling joints



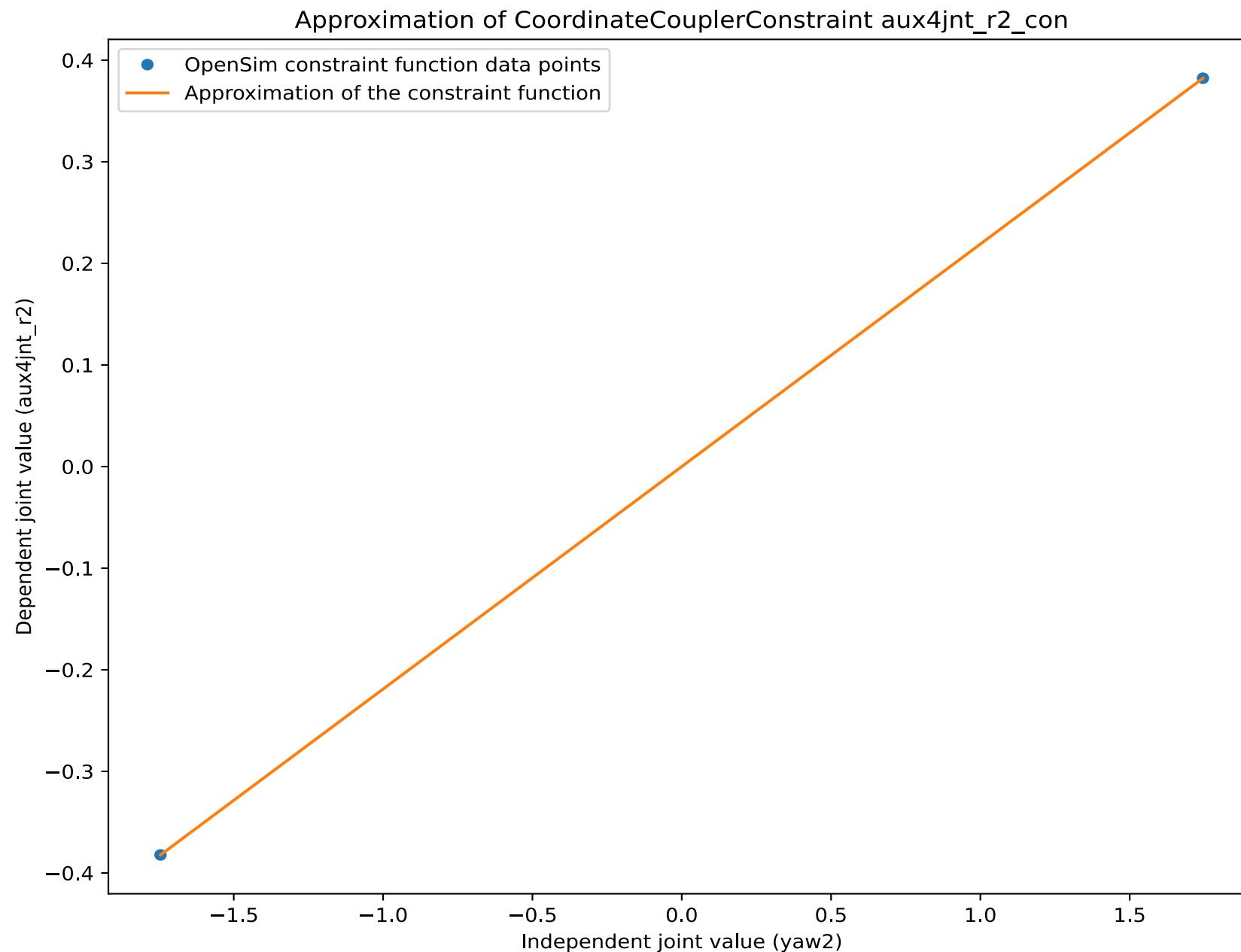
Approximation of coupling joints



Approximation of coupling joints



Approximation of coupling joints



Step 2: Muscle Kinematics Validation

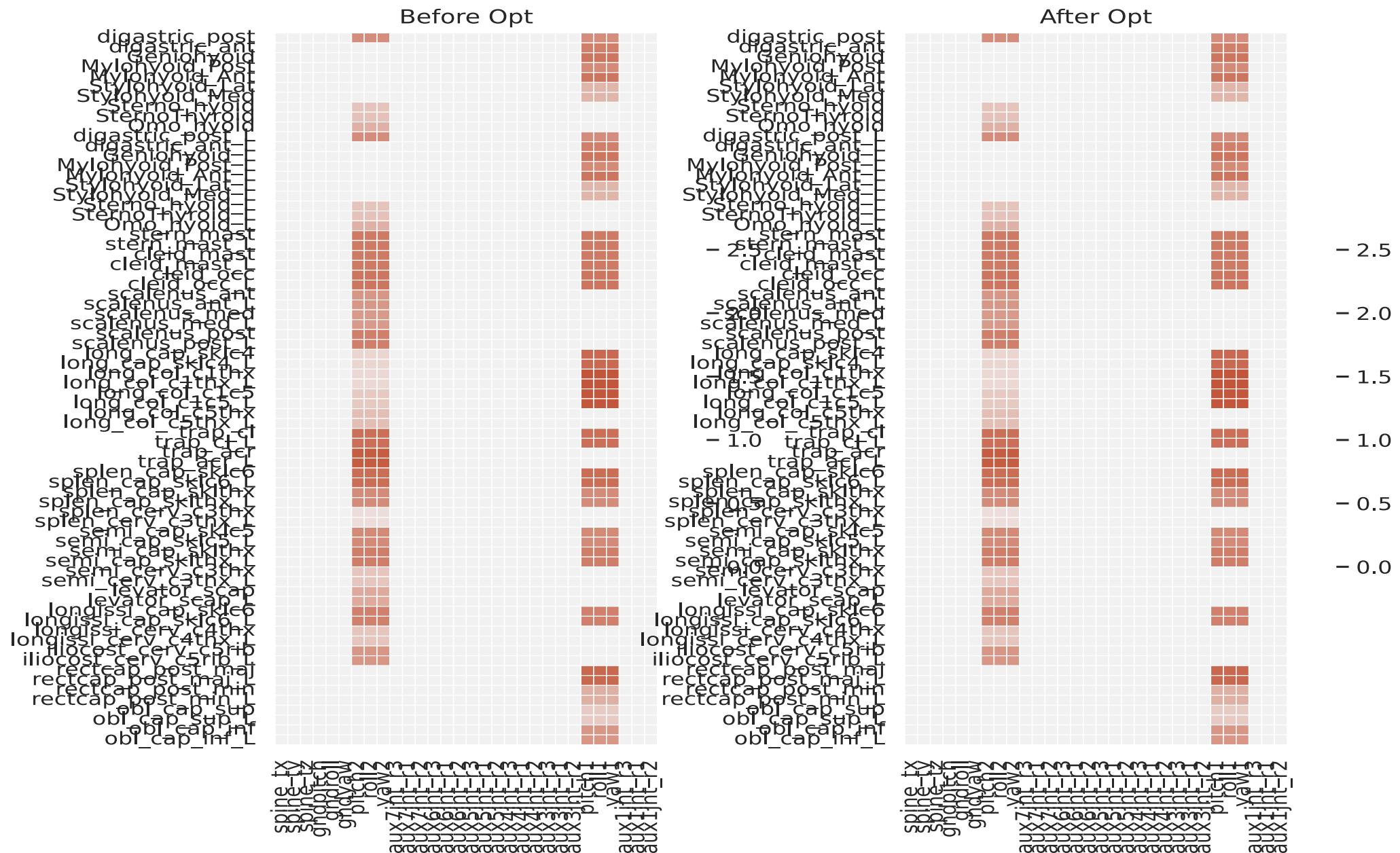
Moment arm of each muscle at each joint are compared between Osim and converted MJC model. A overall heatmap is included to indicate the overall moment arm errors before and after optimization. Then detail moment arm curves are plotted for comparison. For the muscles that wrap over multiple joints, moment arms with respect to one joint maybe affected by several other joints. In this case, several mesh points were check of these affecting joints, when plotting moment arms at one joint. This is why there are multiple lines (with different grey levels) plotted for one muscle on one joint.

How to interpret the plot:

Global title indicate the muscle and joints that affecting the moment arms in the plots. X axis indicate the joint that moment arms were extracted. Grey level of the lines indicate the mesh postures of other relevant joints (in the global title, but not the x axis)

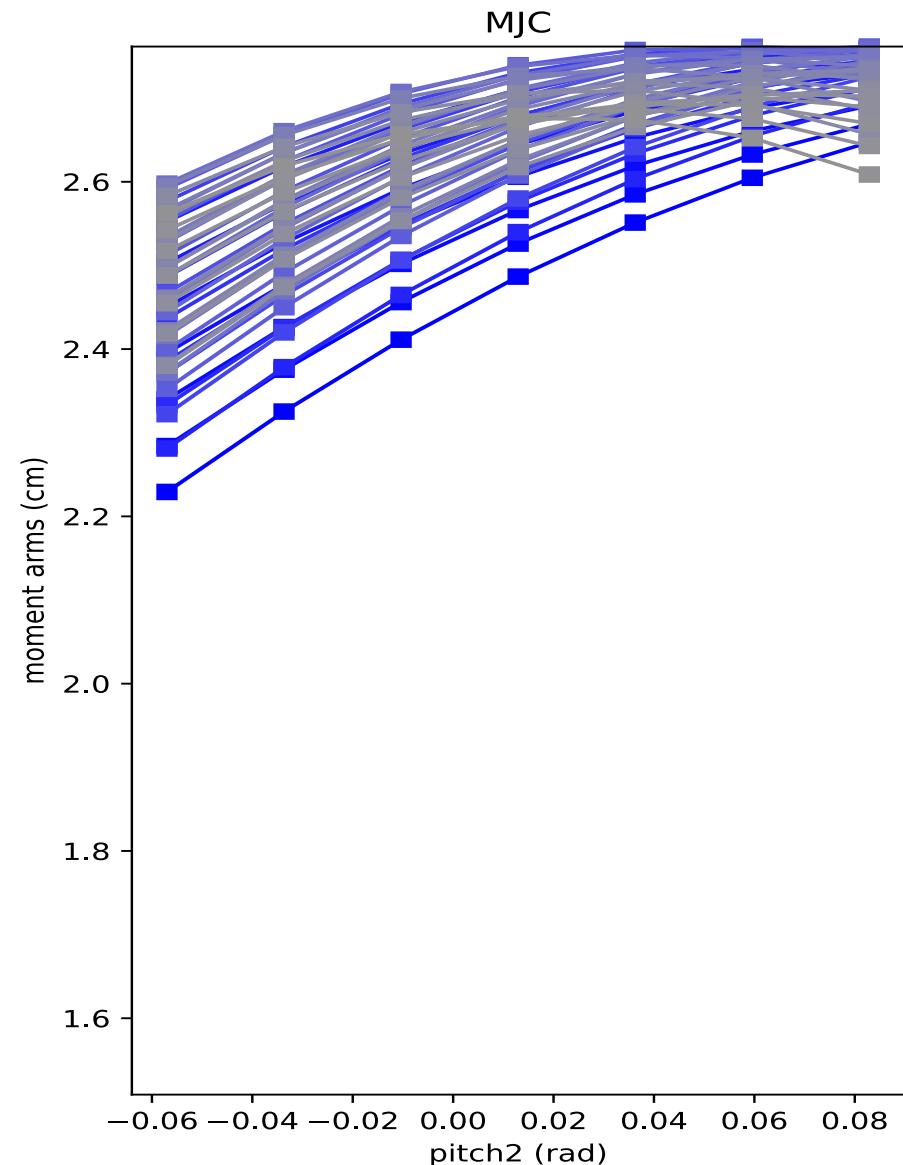
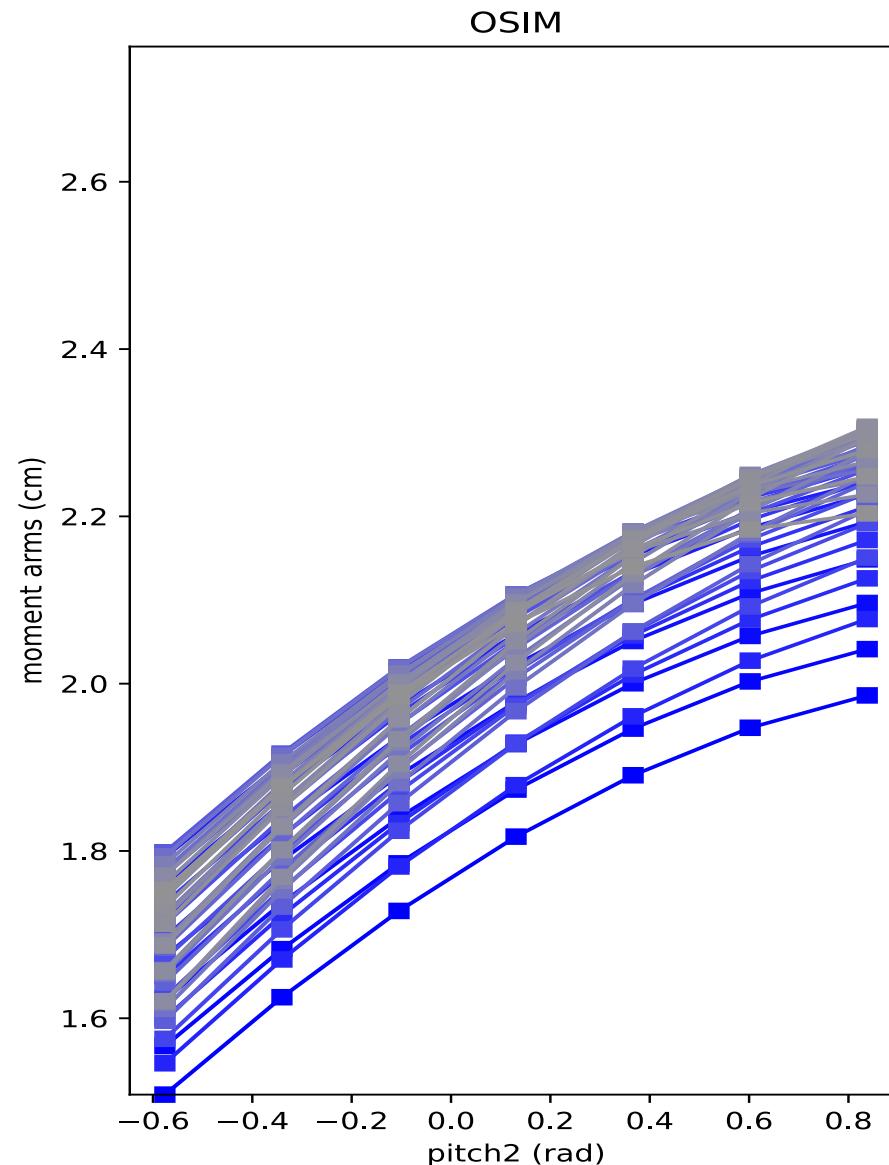
Overall comparison of muscle moment arms before/after optimization

Moment arm comparison of all muscles (cm)



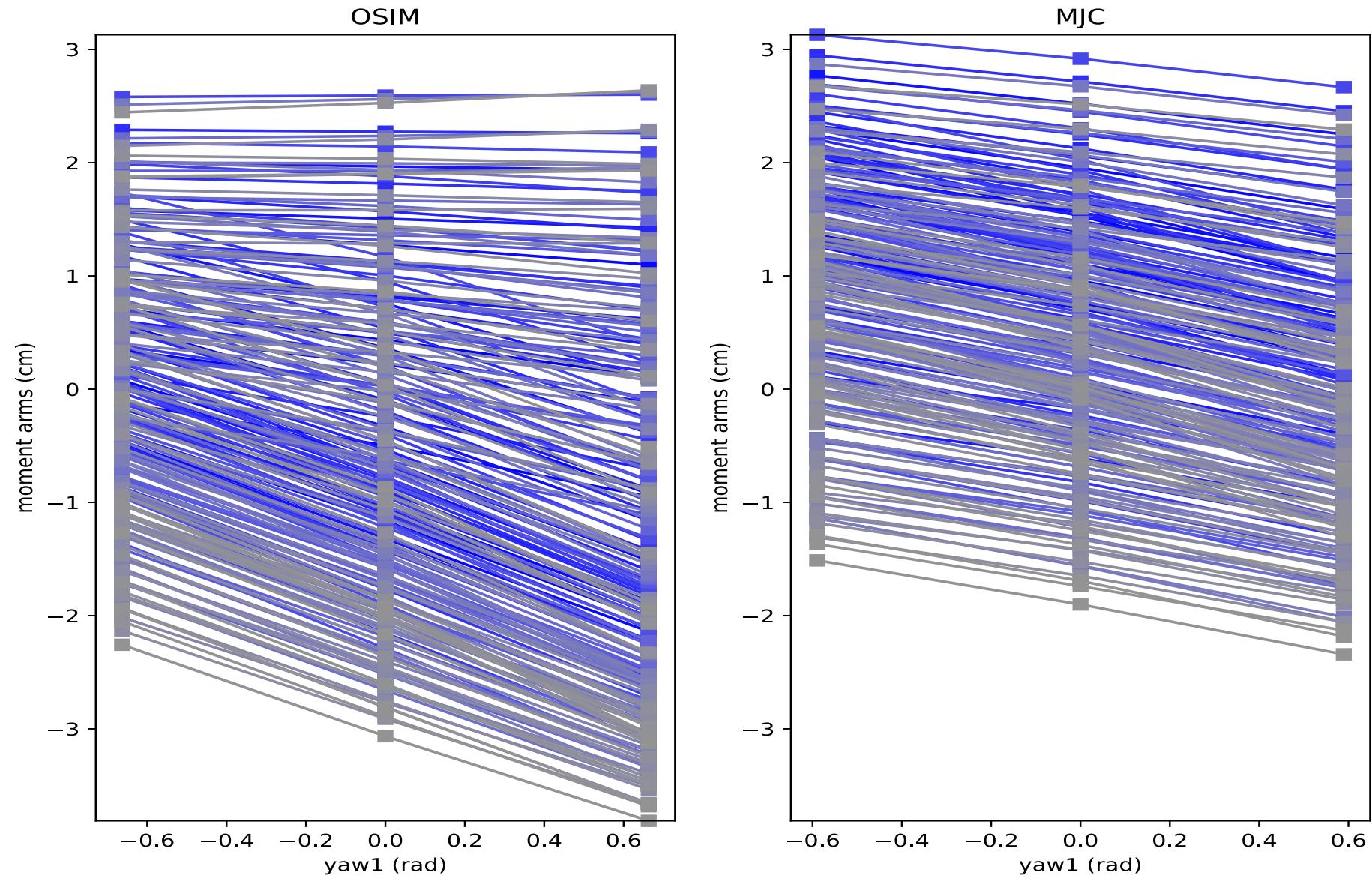
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx_L - pitch2 - roll2 - yaw2



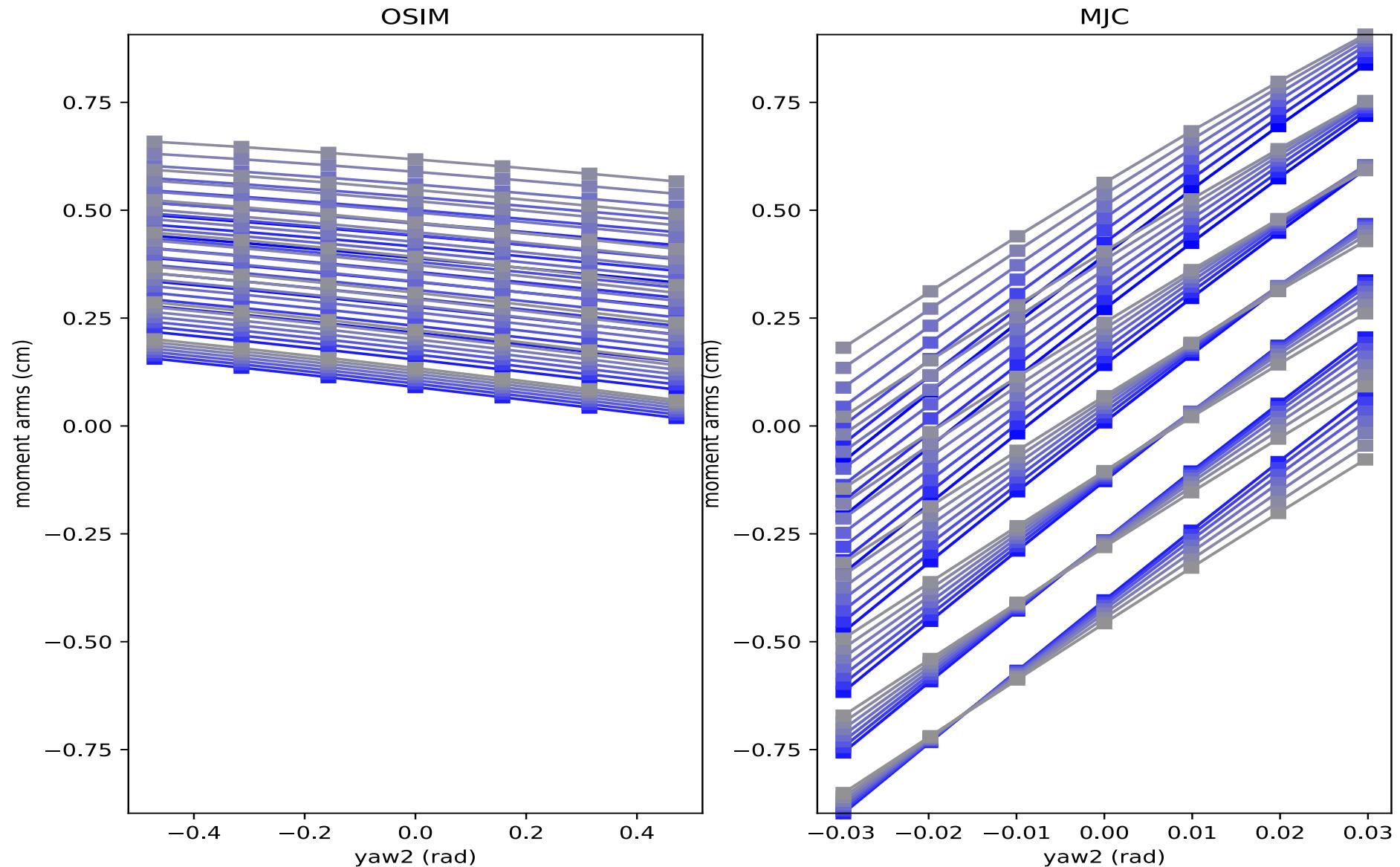
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



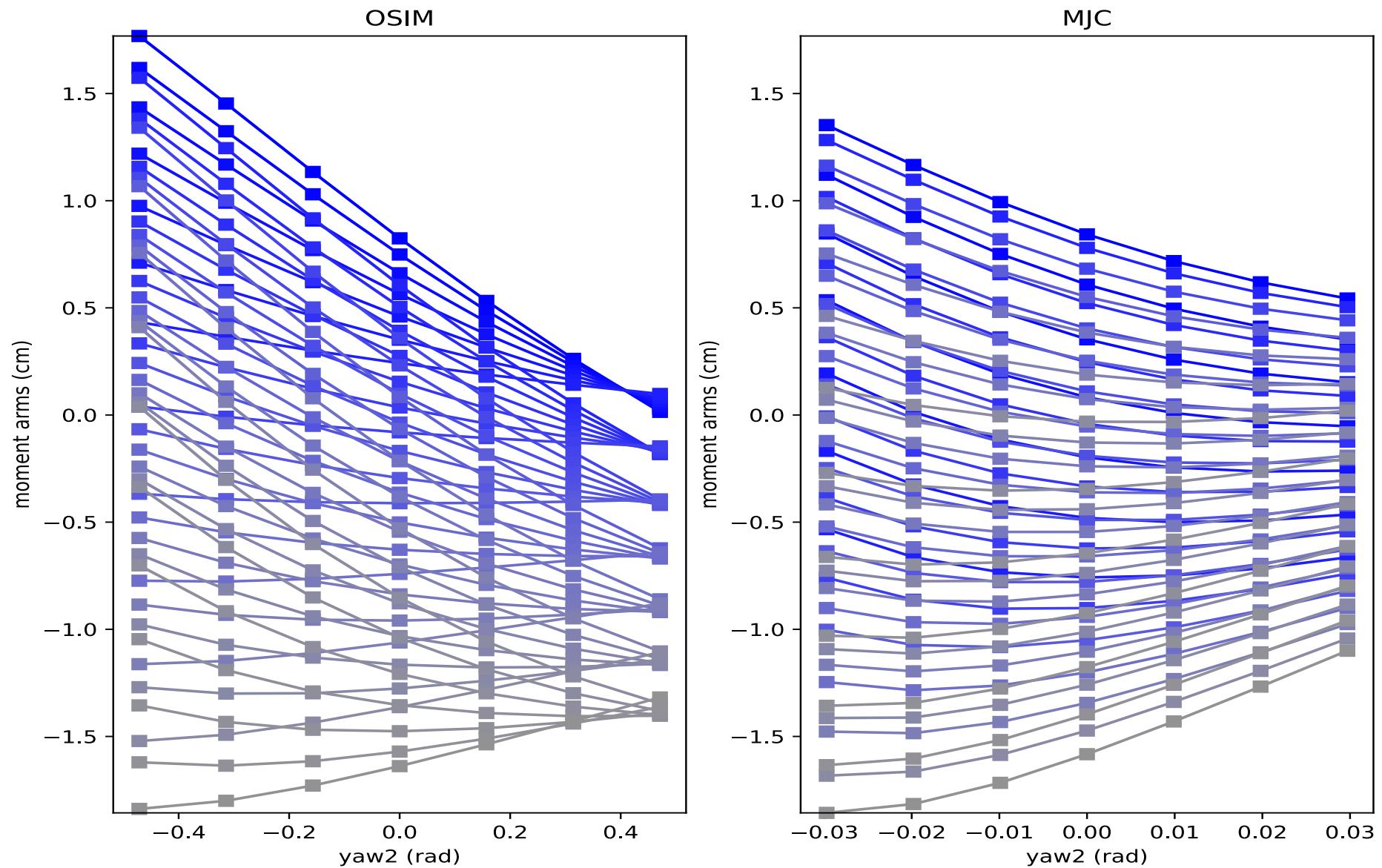
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post - pitch2 - roll2 - yaw2



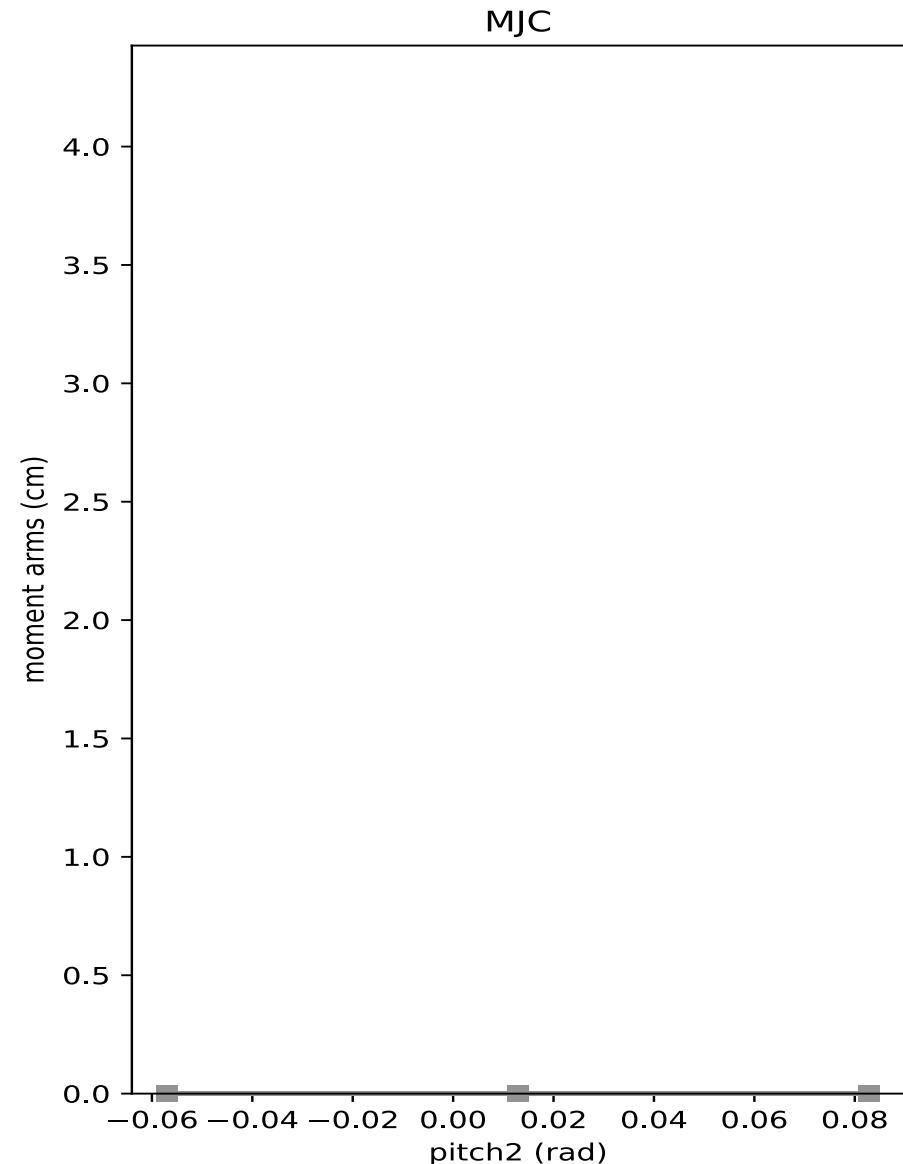
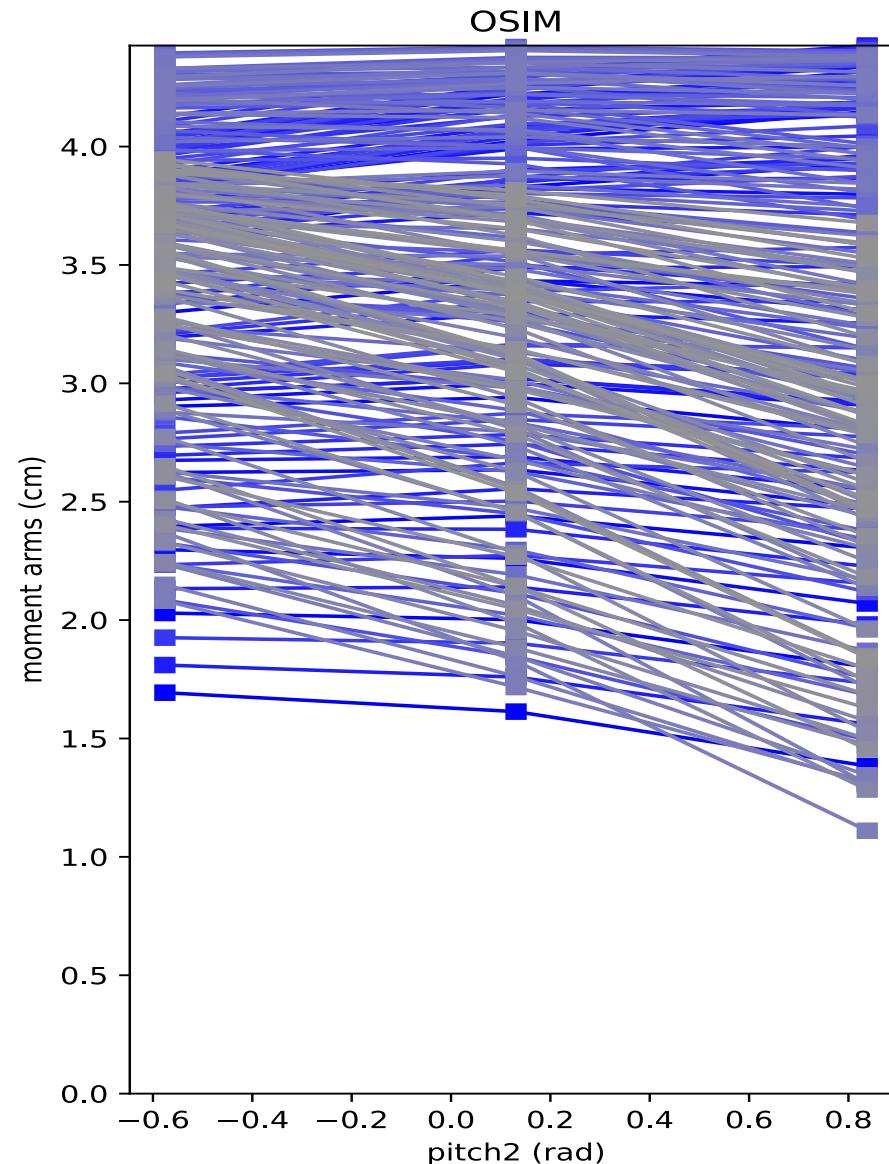
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid - pitch2 - roll2 - yaw2



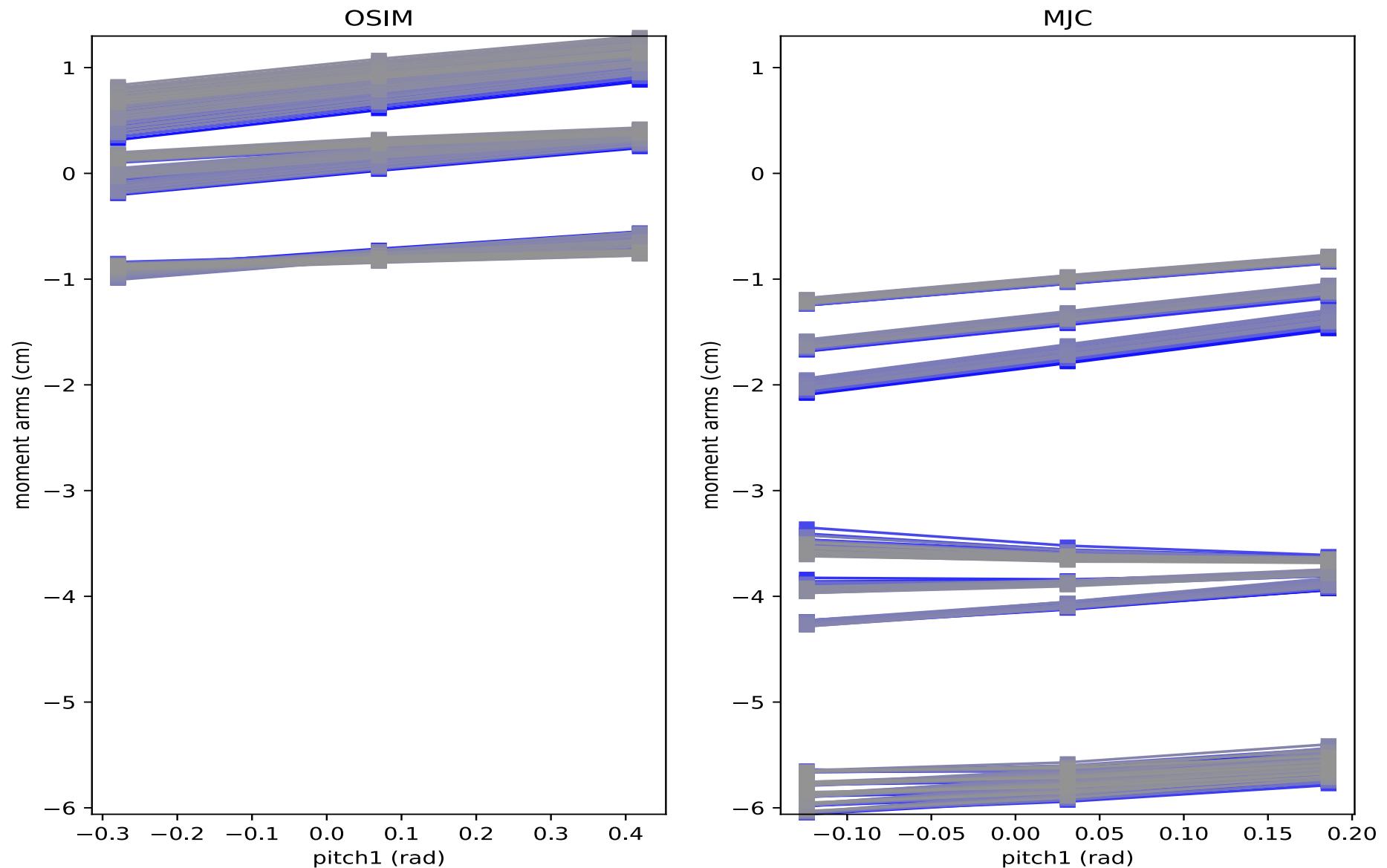
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



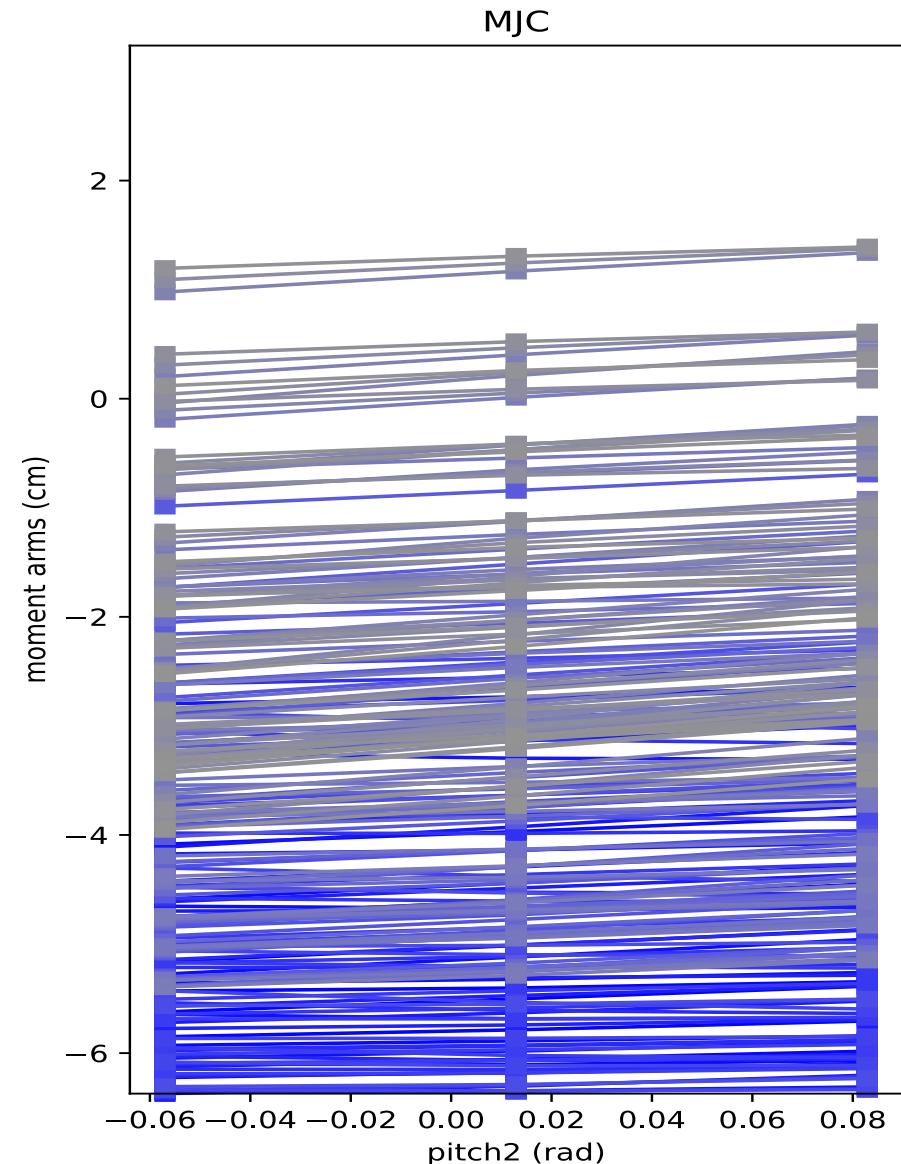
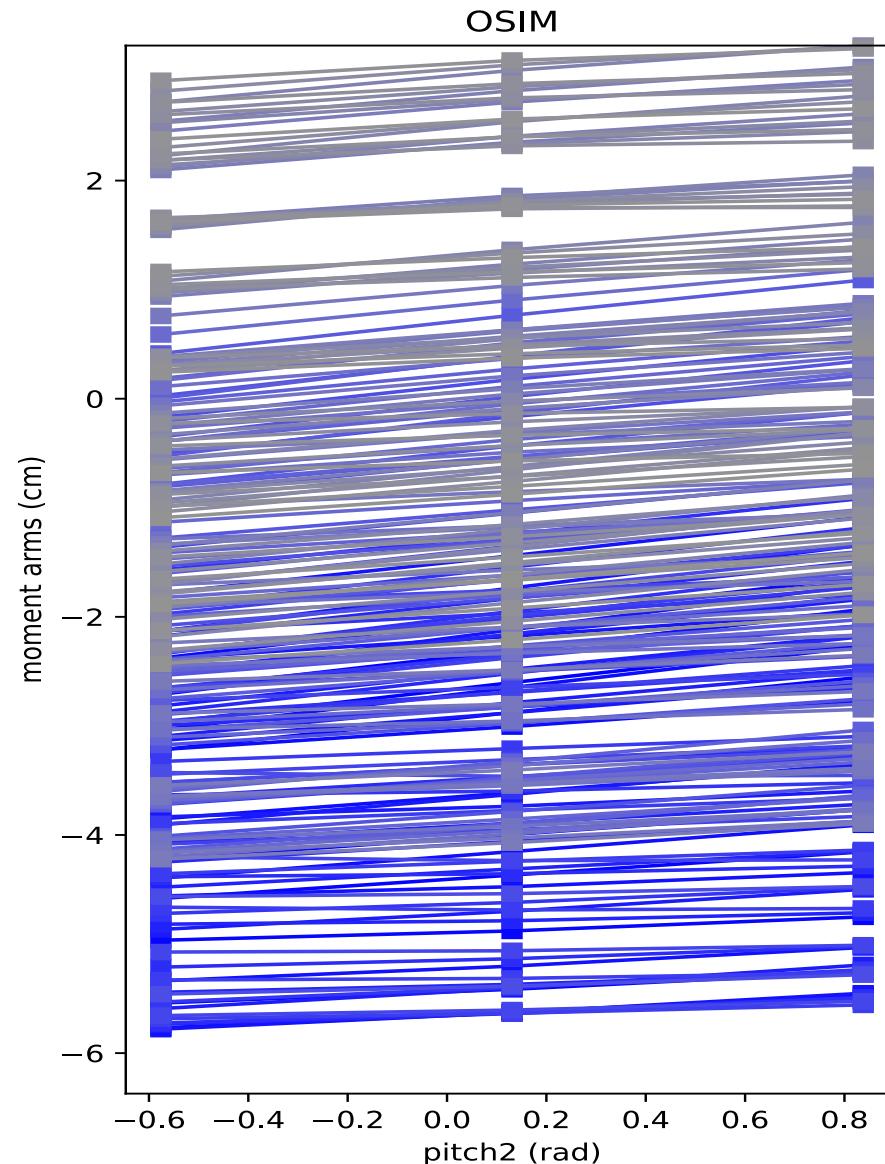
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



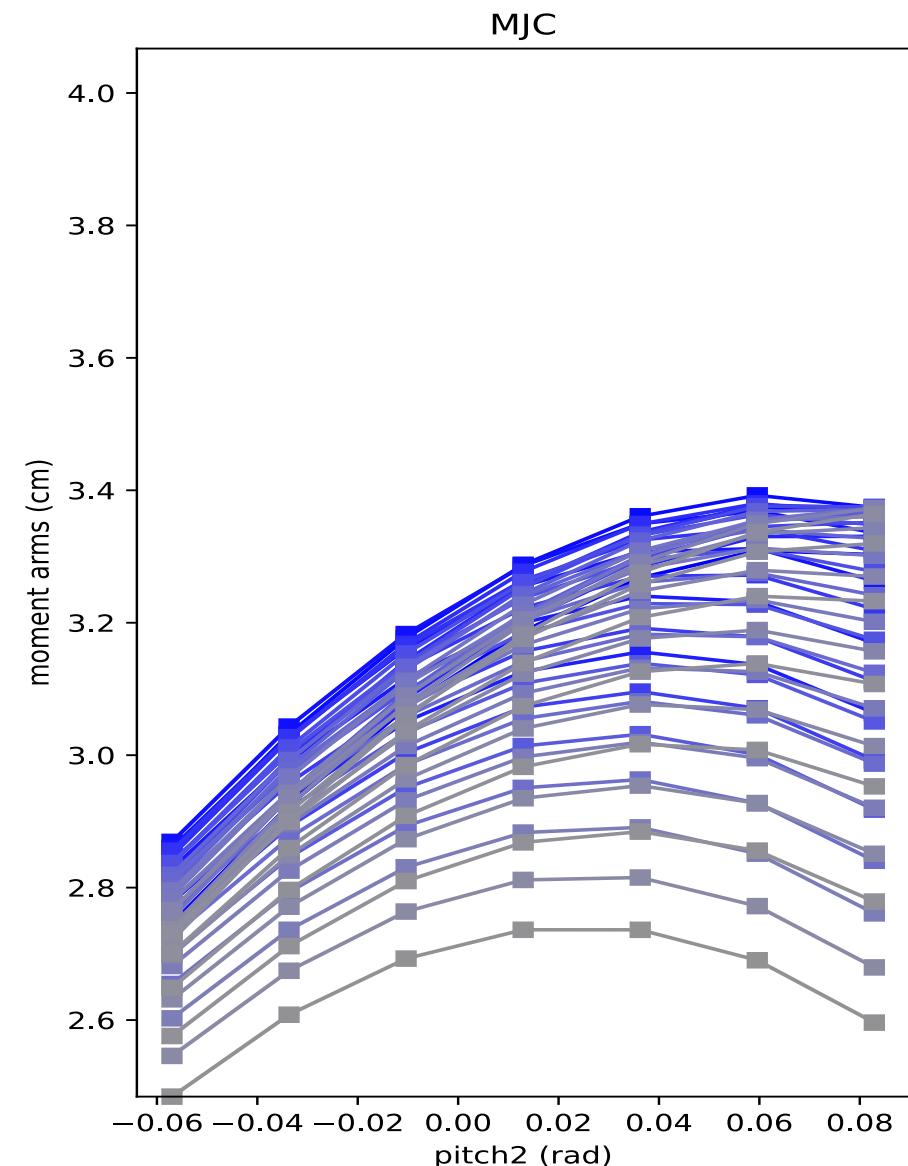
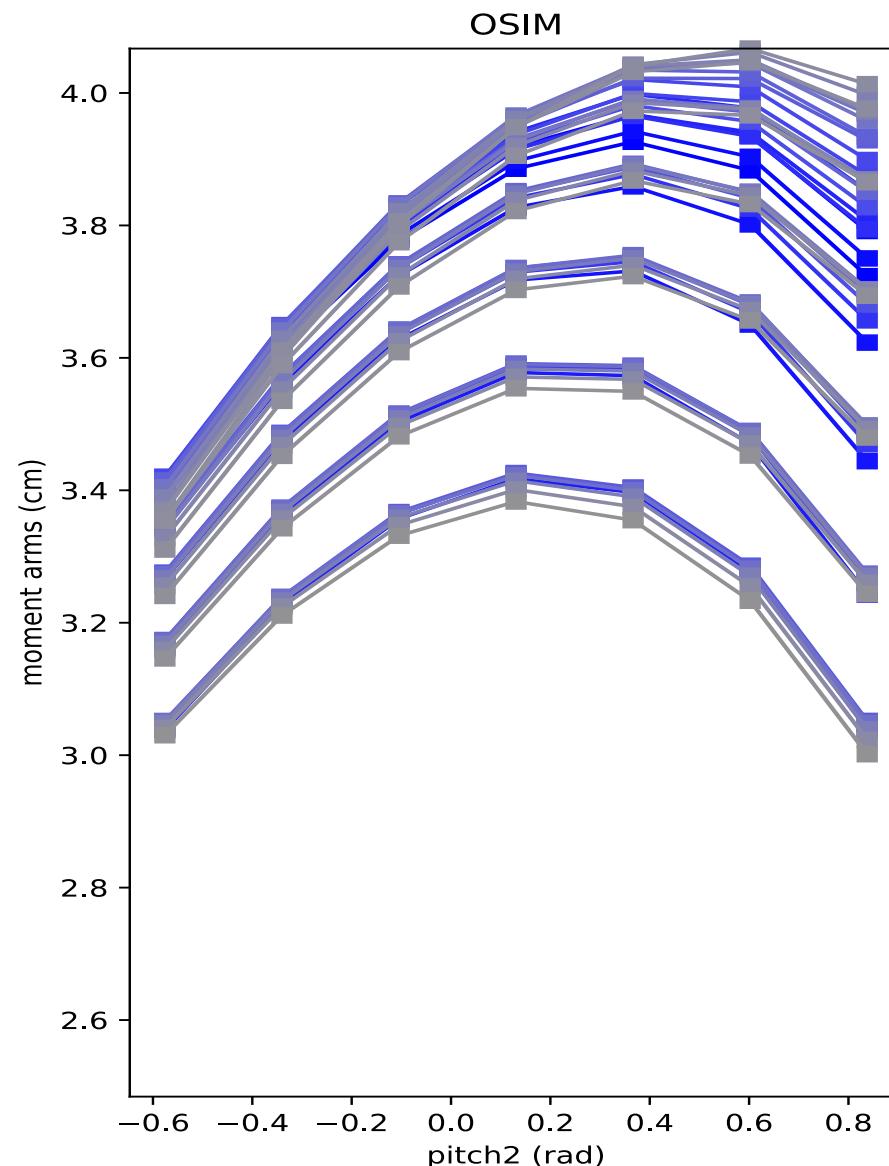
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



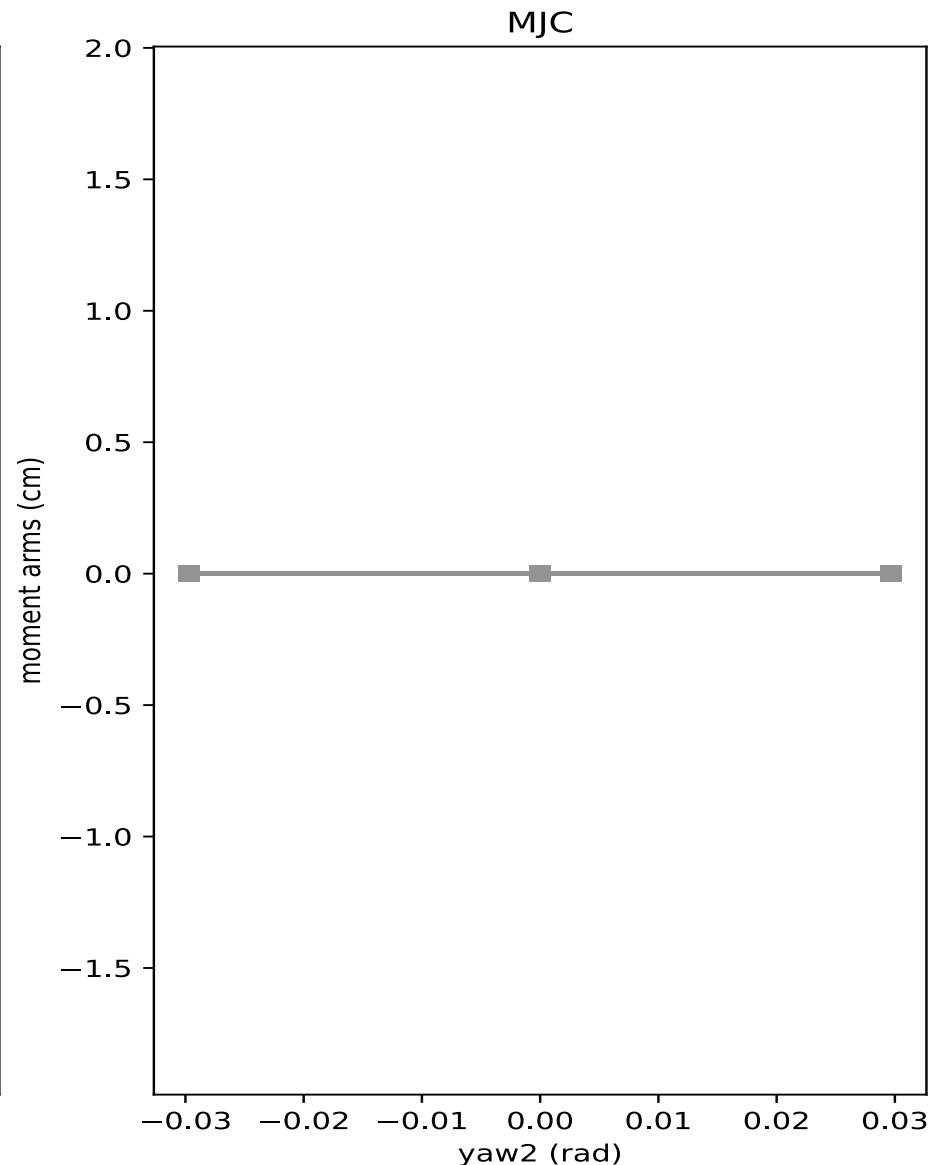
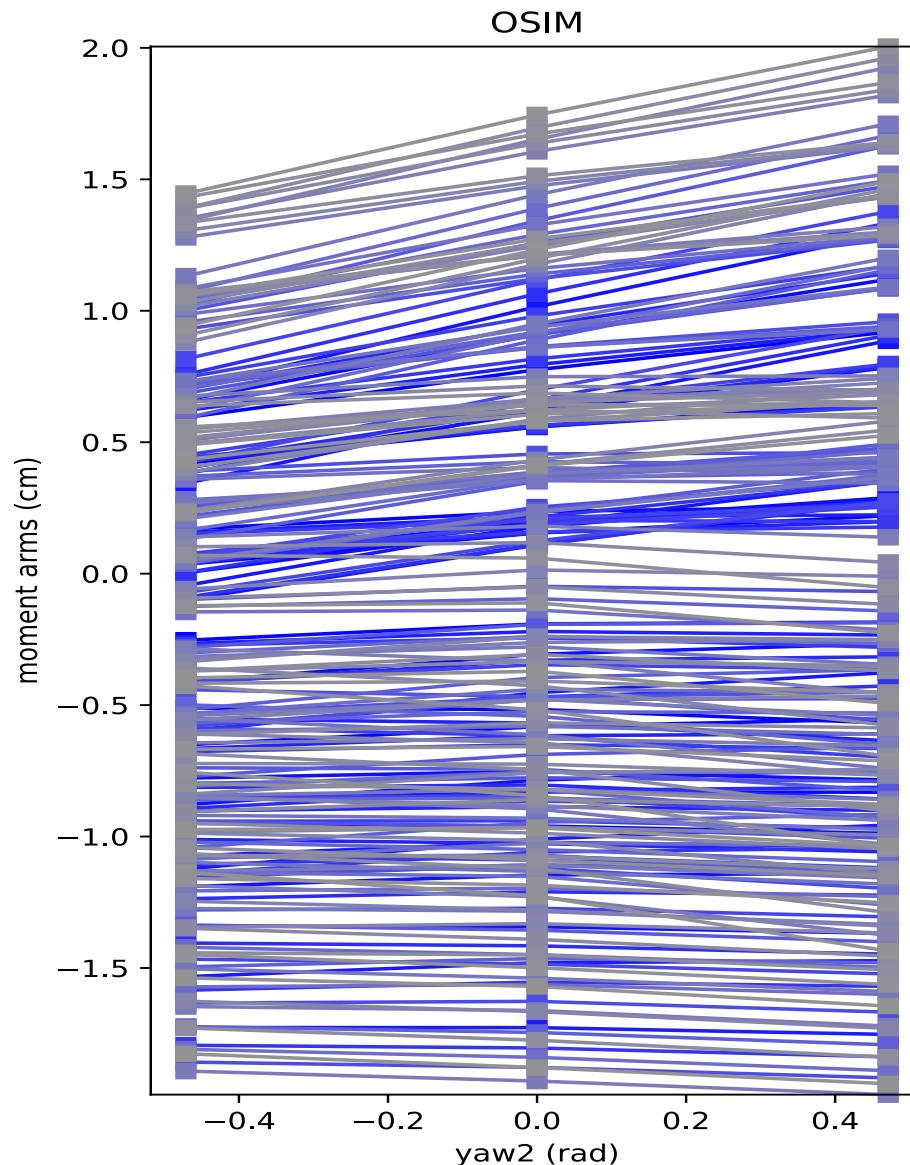
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx_L - pitch2 - roll2 - yaw2



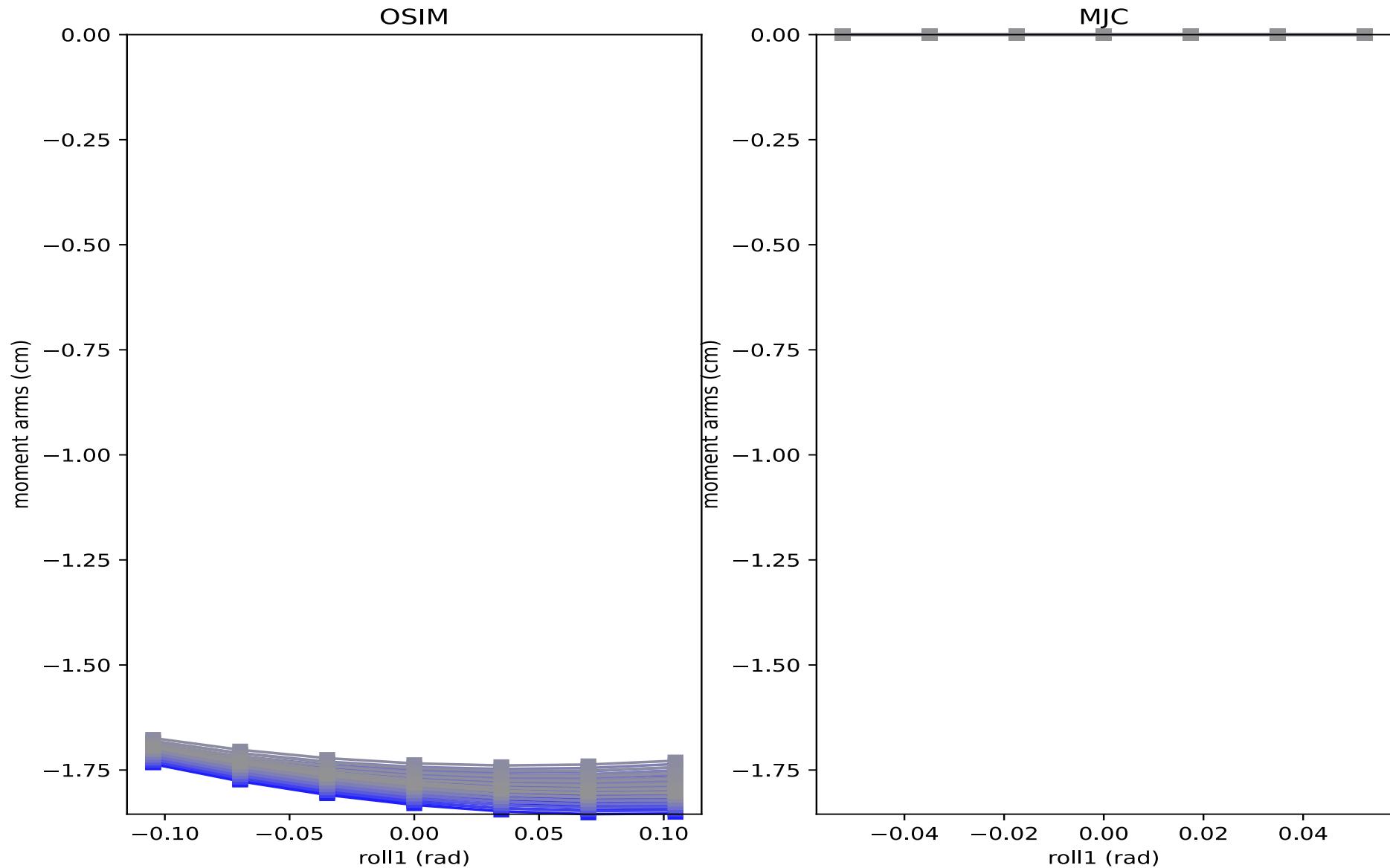
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



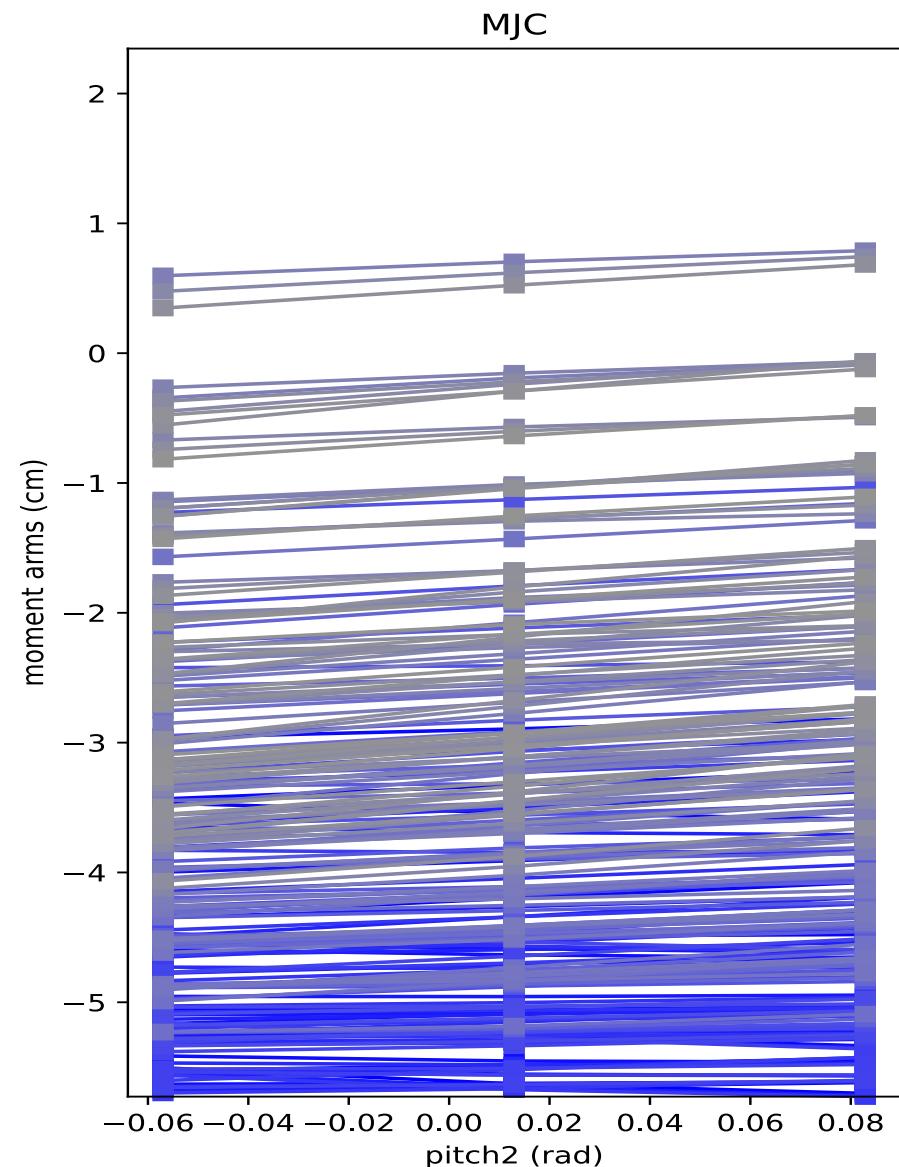
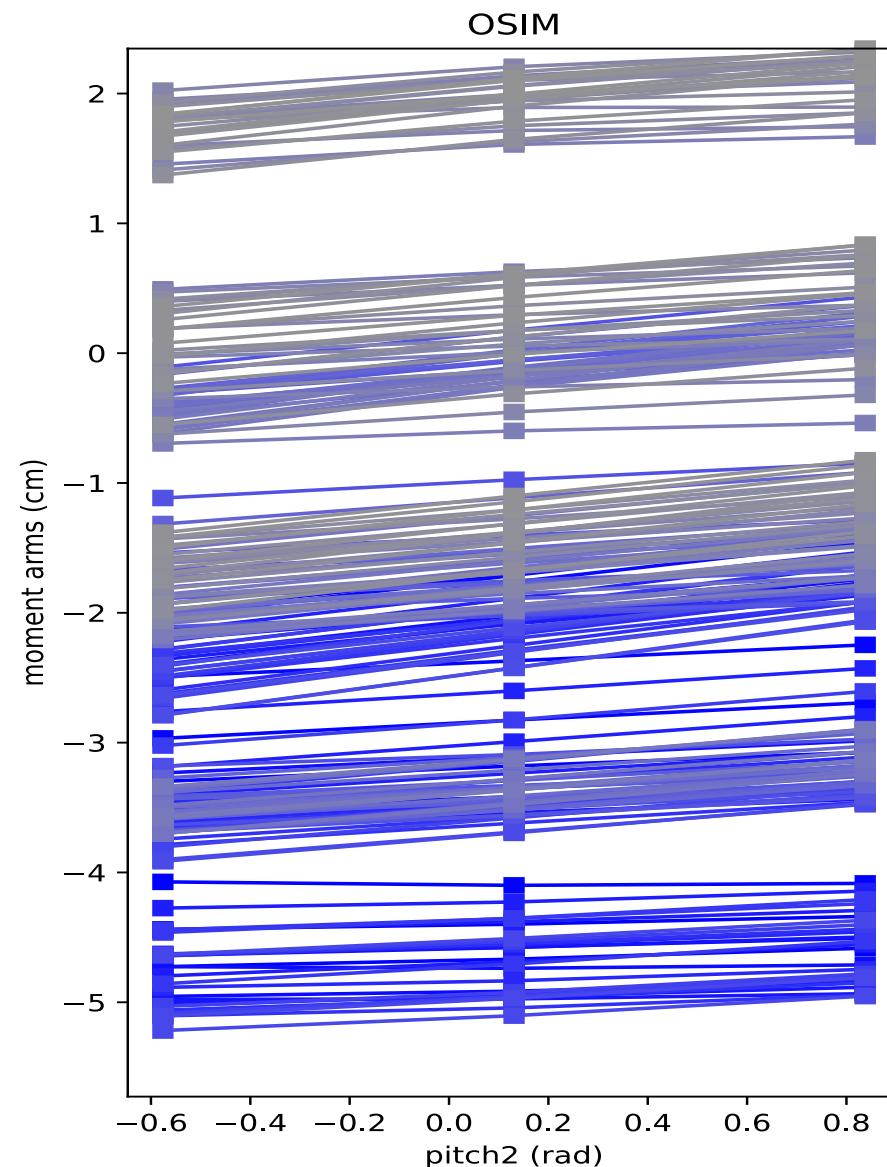
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat_L - pitch1 - roll1 - yaw1



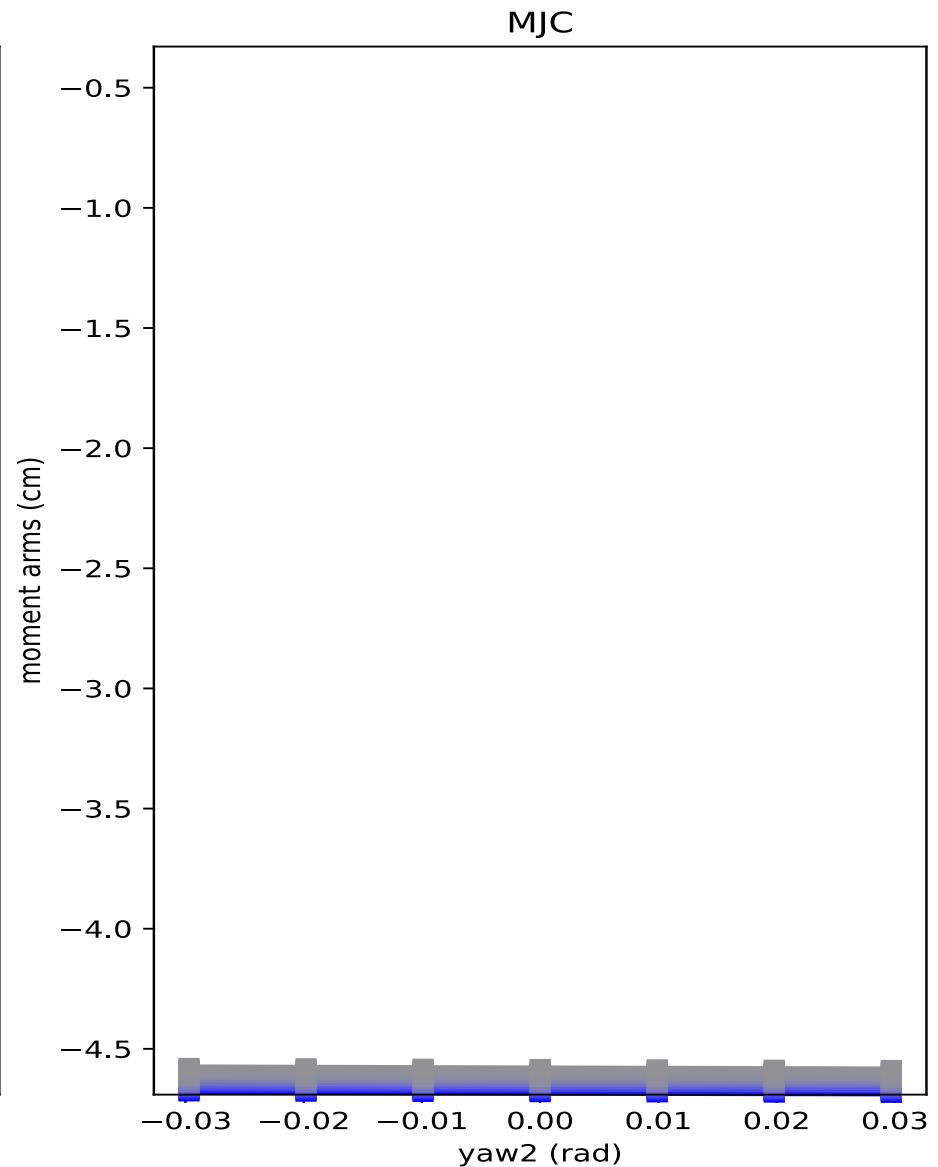
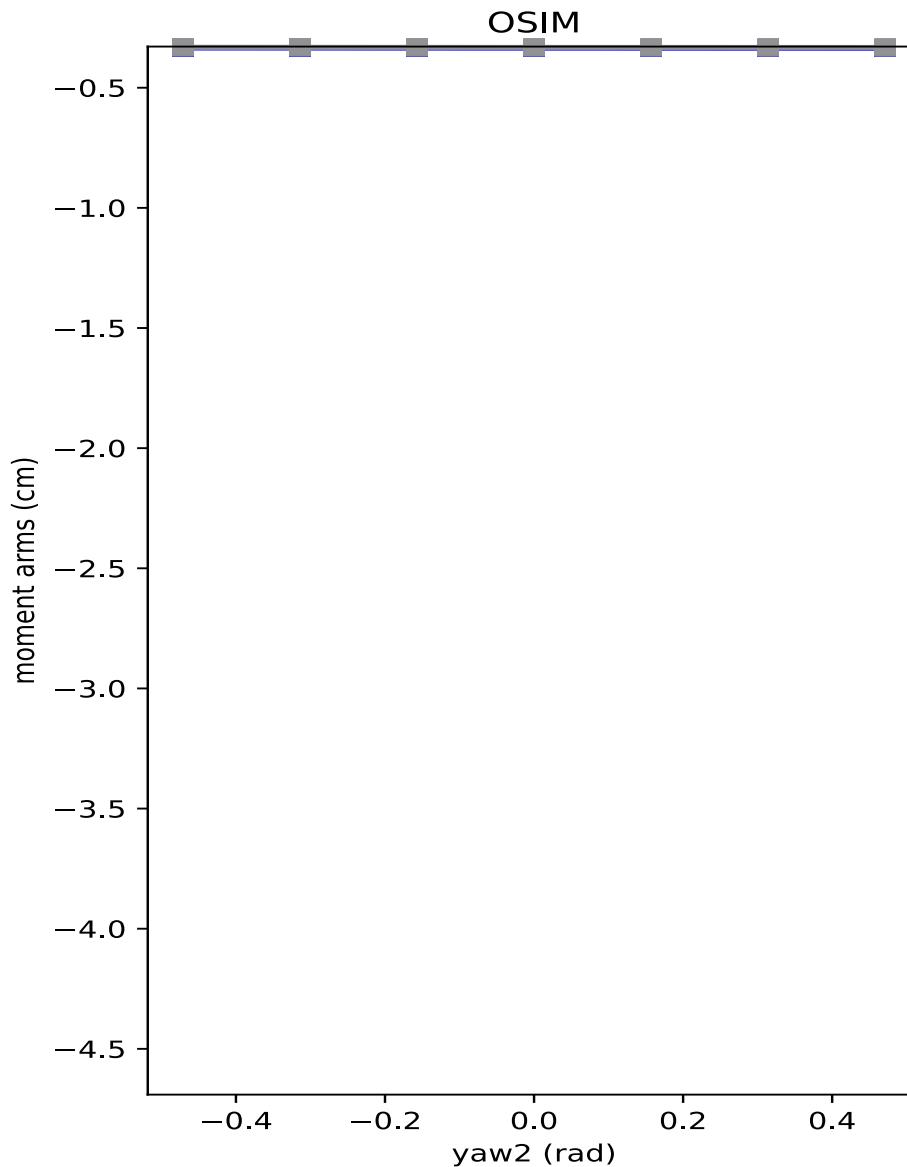
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



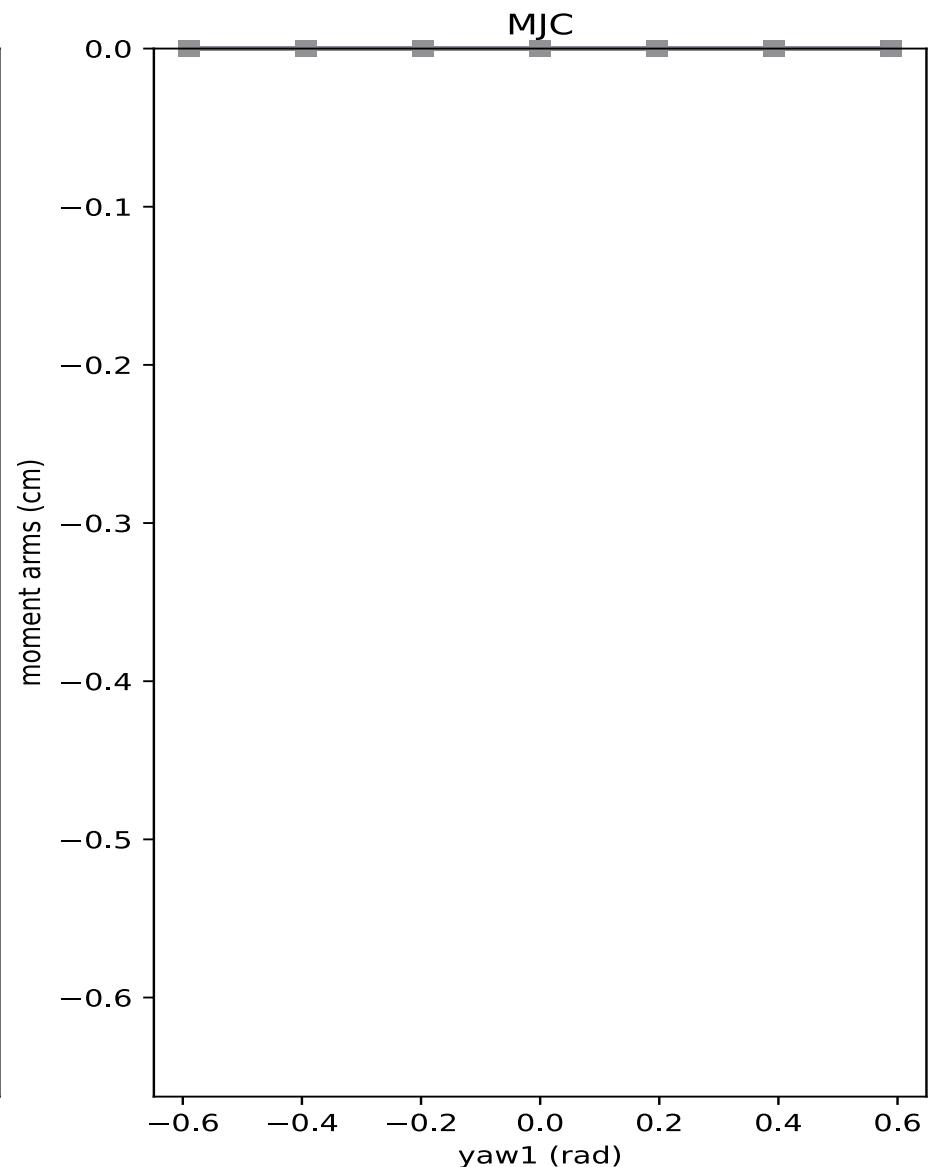
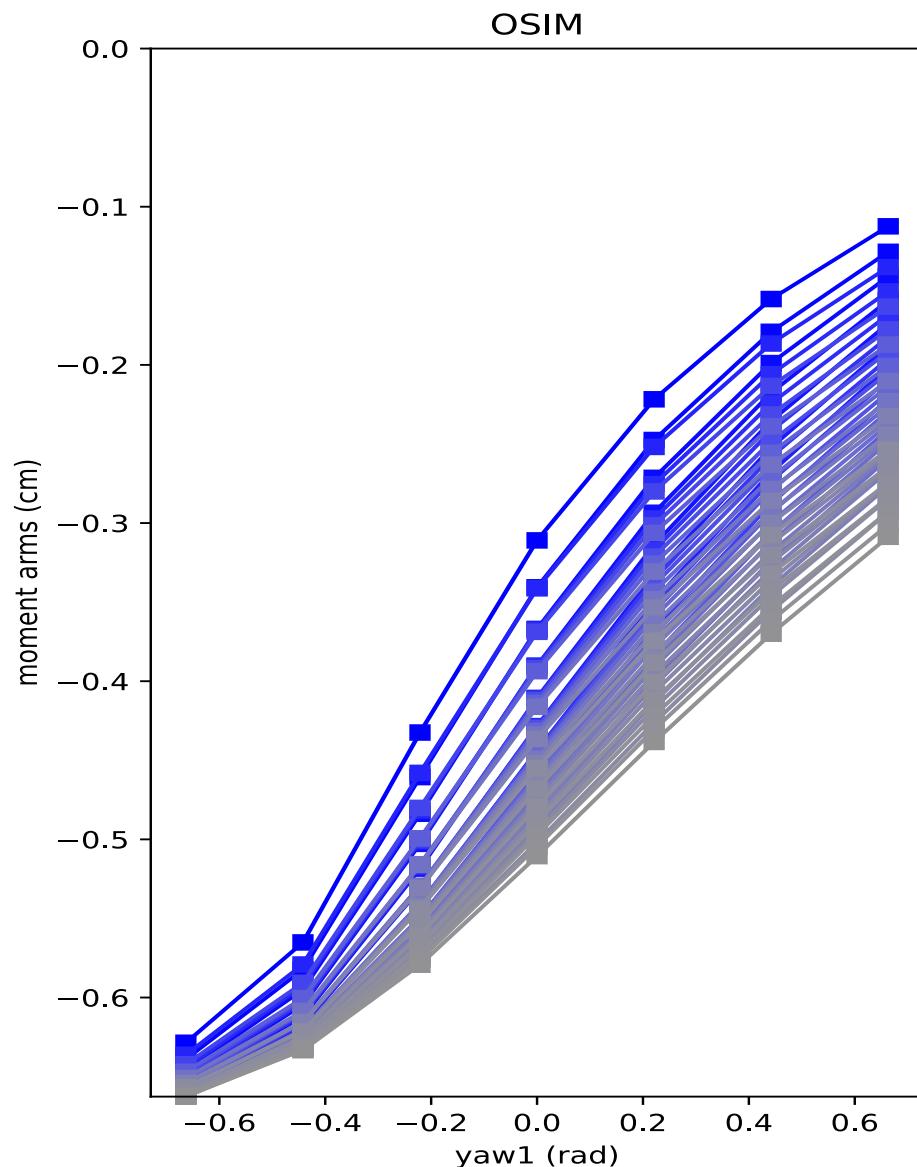
Muscle specific moment arm comparison with Osim model after optimization

trap_acr_L - pitch2 - roll2 - yaw2



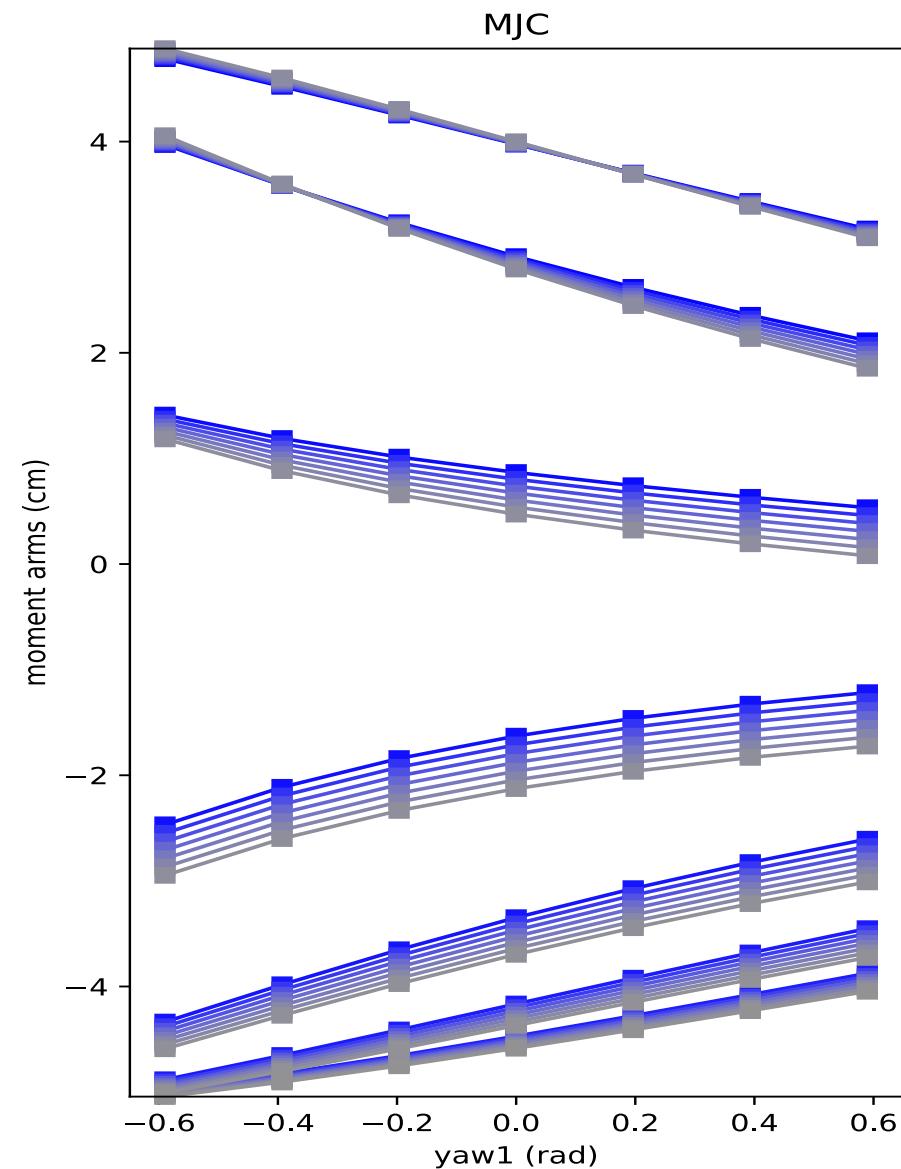
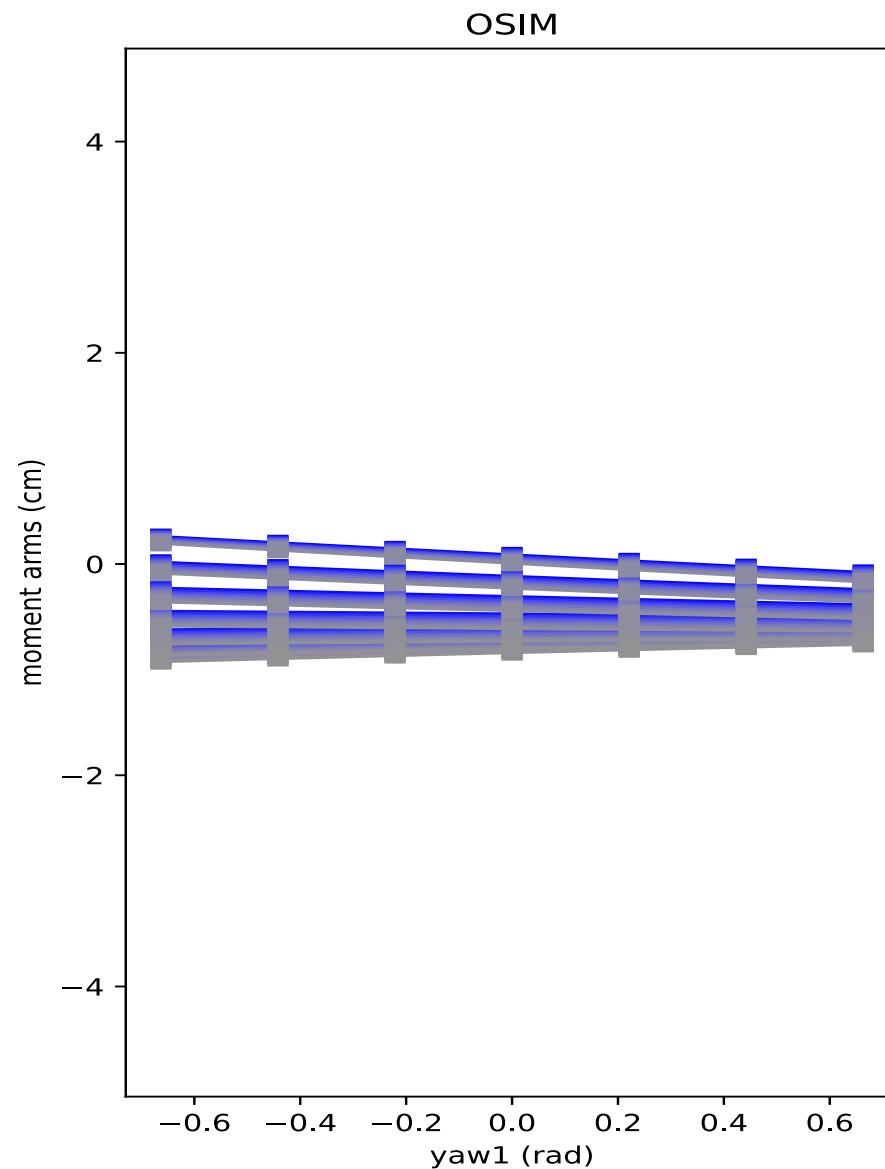
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant_L - pitch1 - roll1 - yaw1



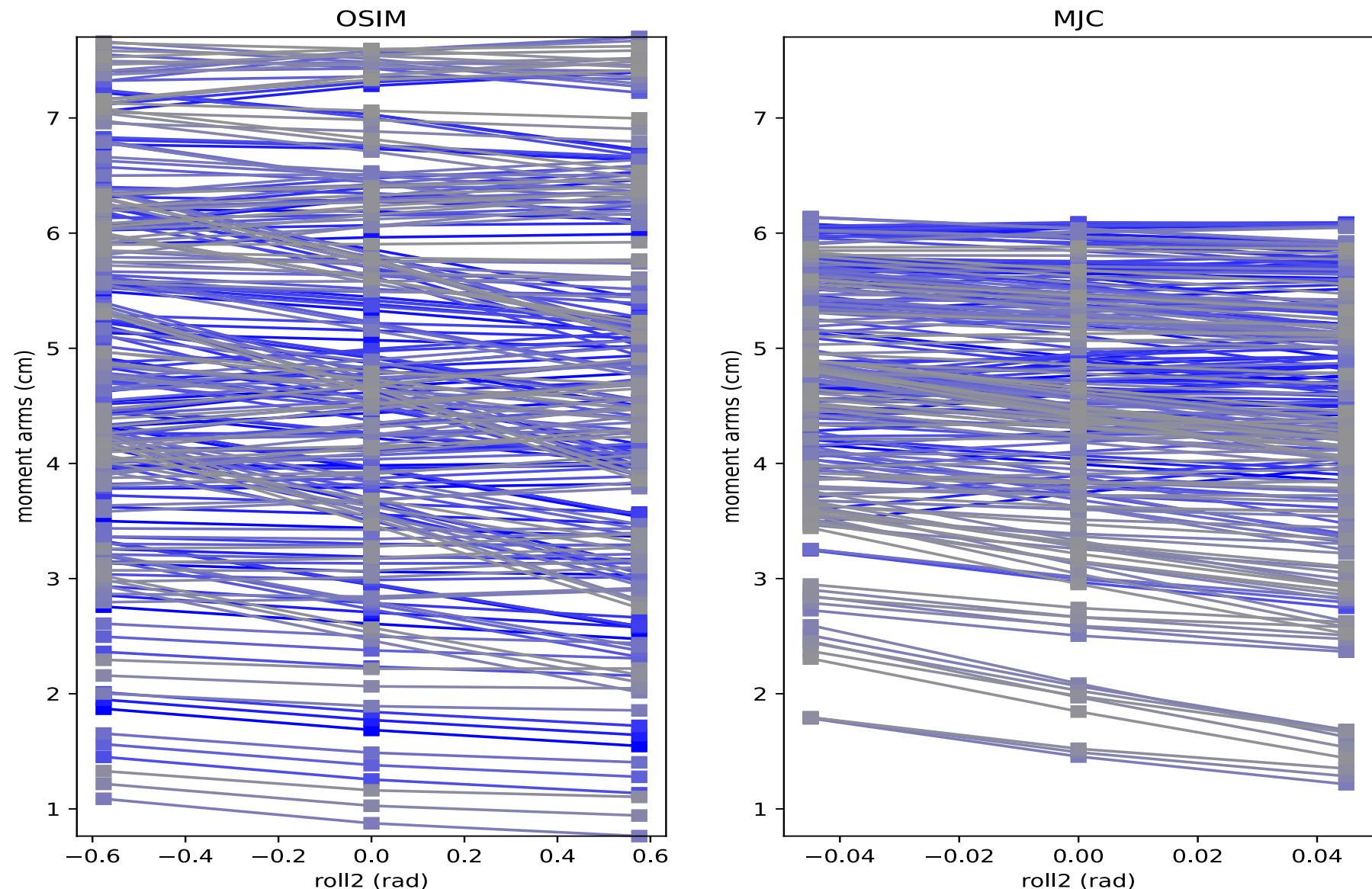
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch1 - roll1 - yaw1



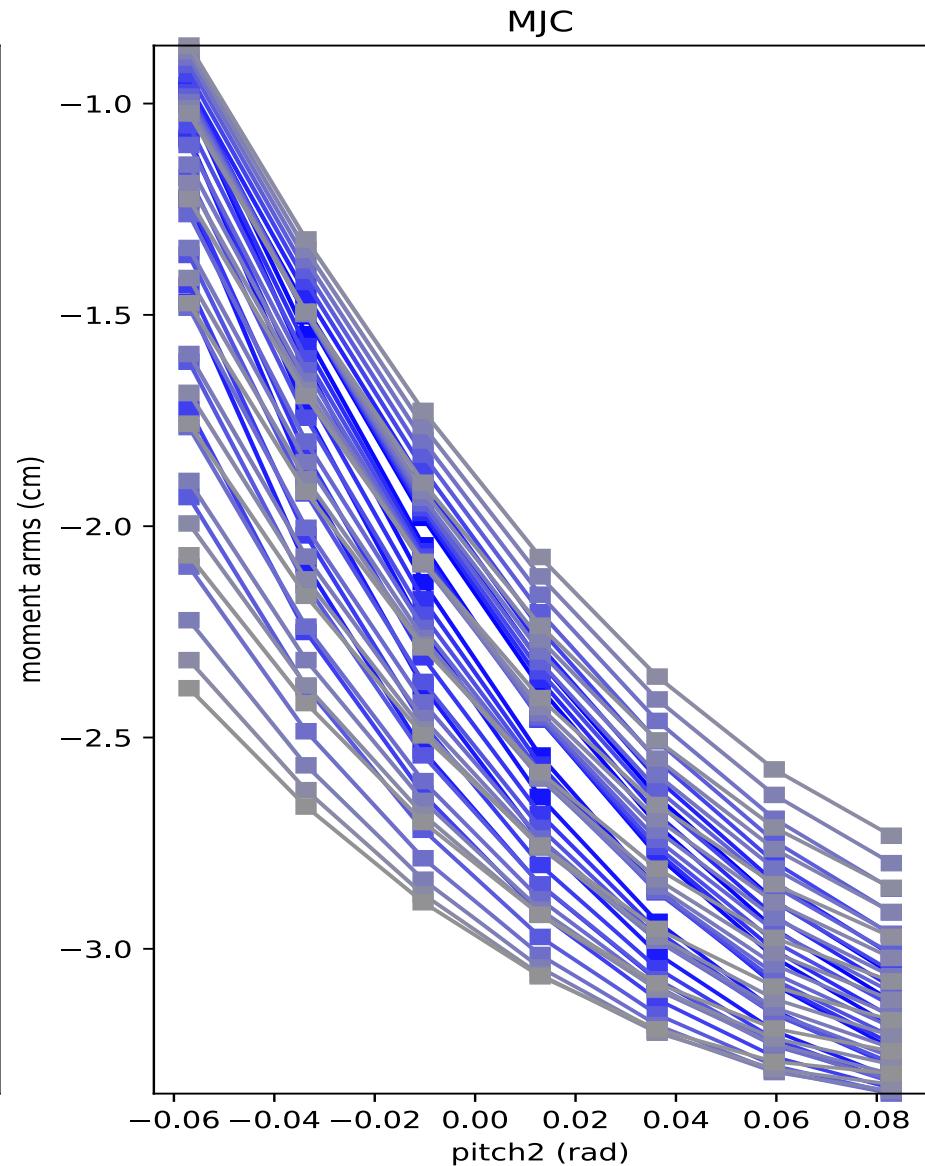
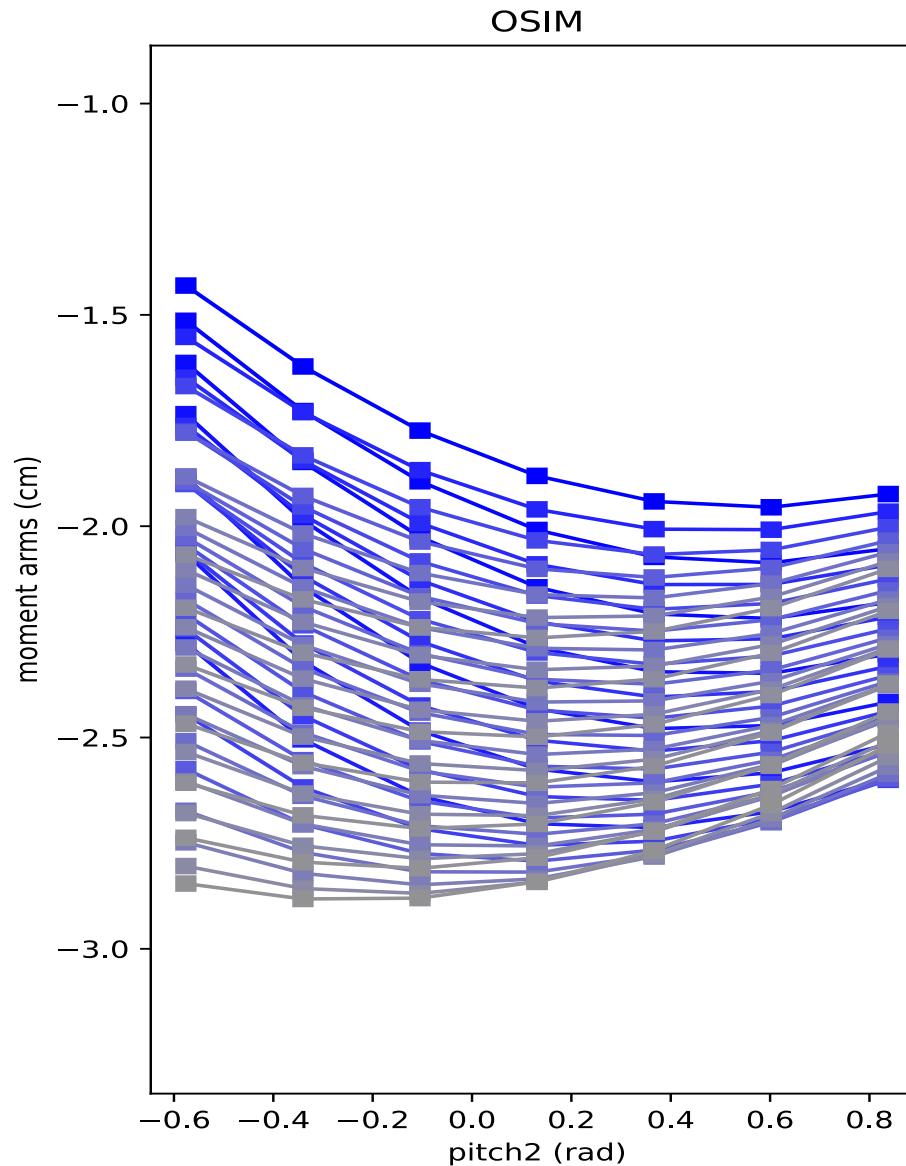
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



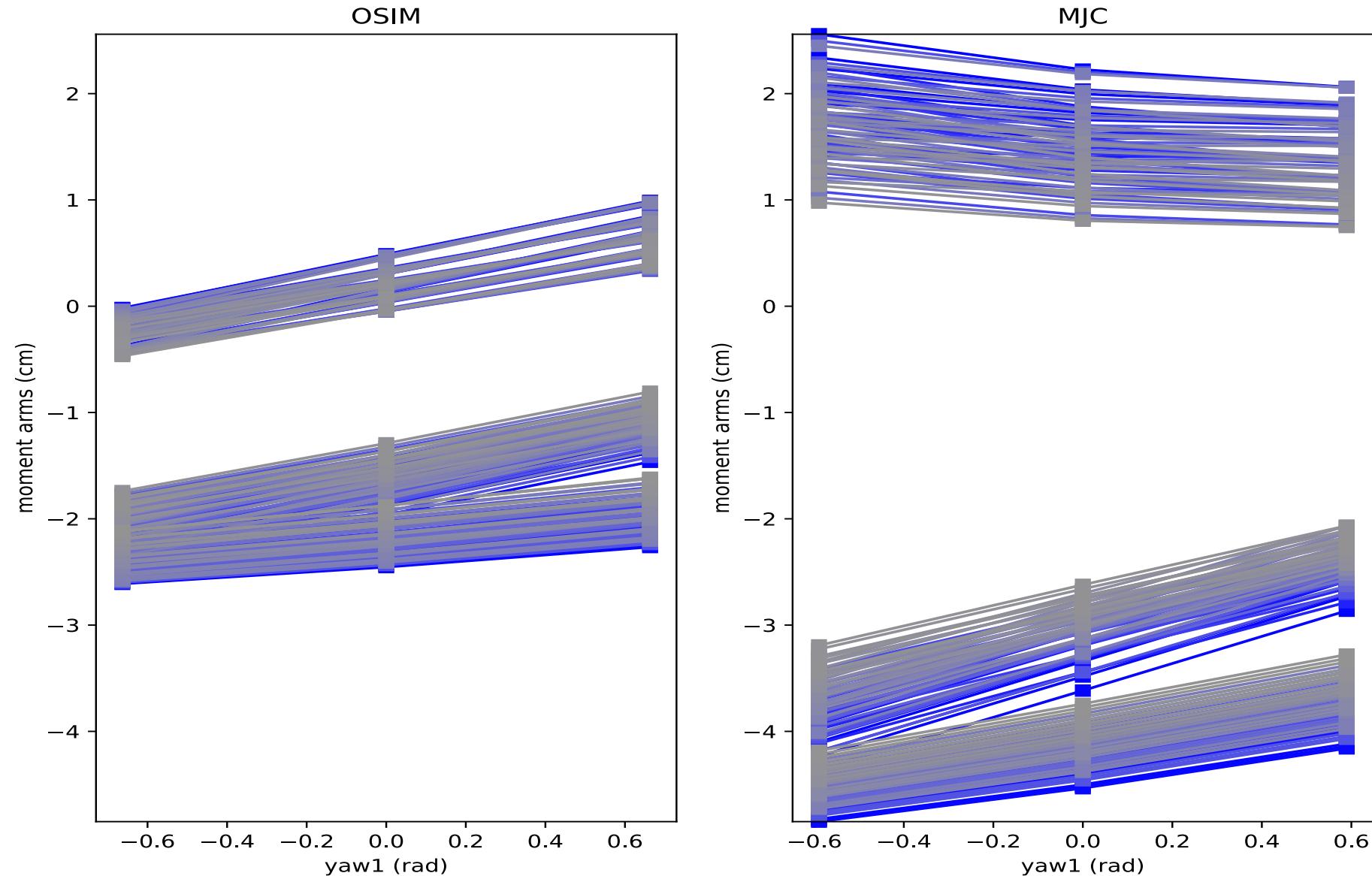
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyooid_L - pitch2 - roll2 - yaw2



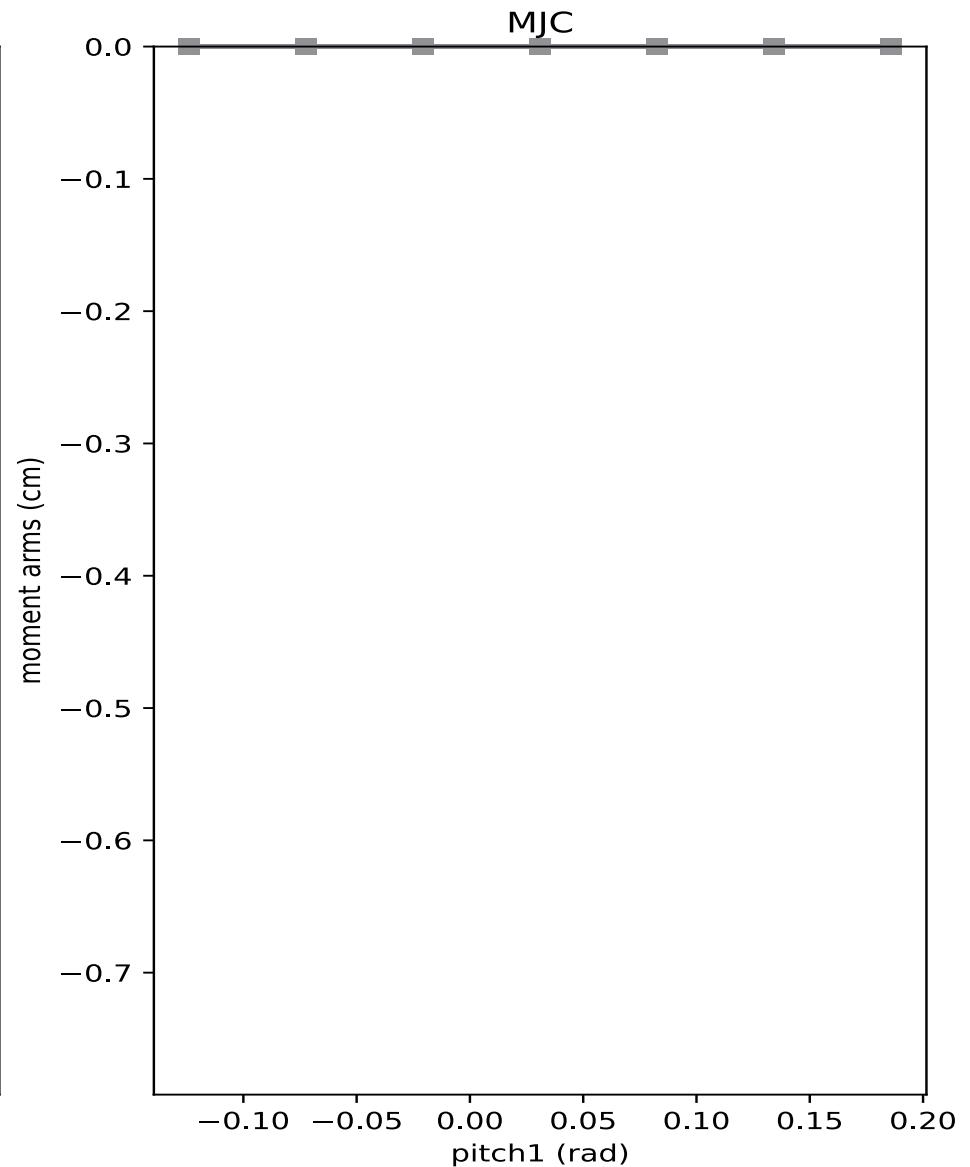
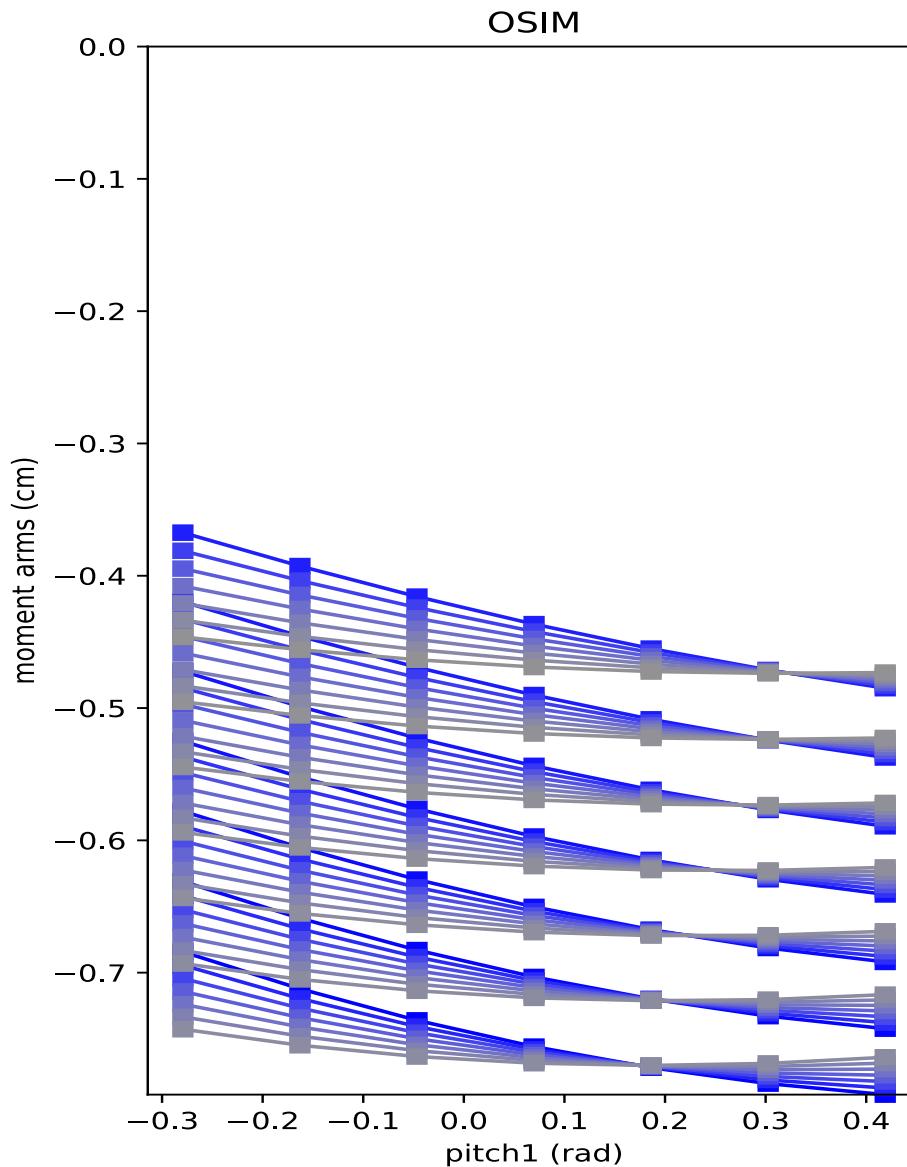
Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



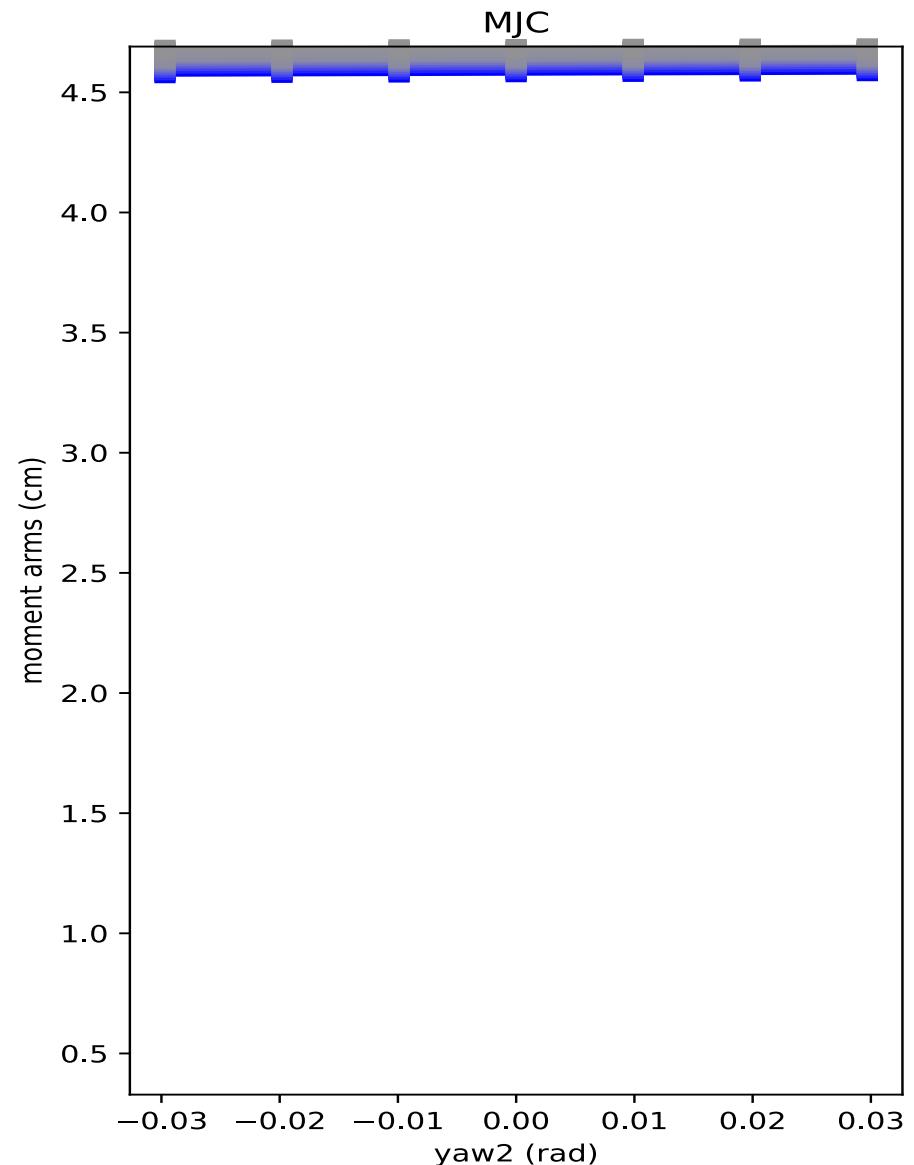
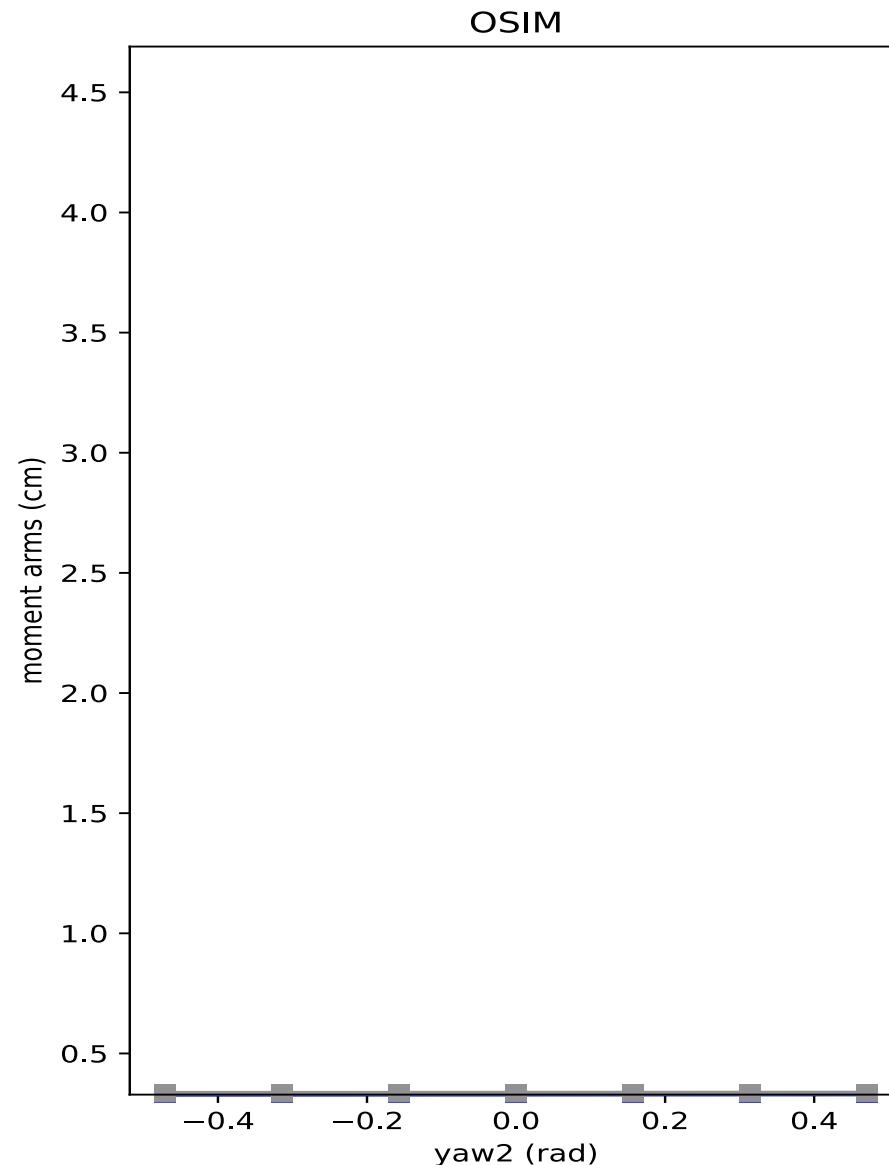
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med_L - pitch1 - roll1 - yaw1



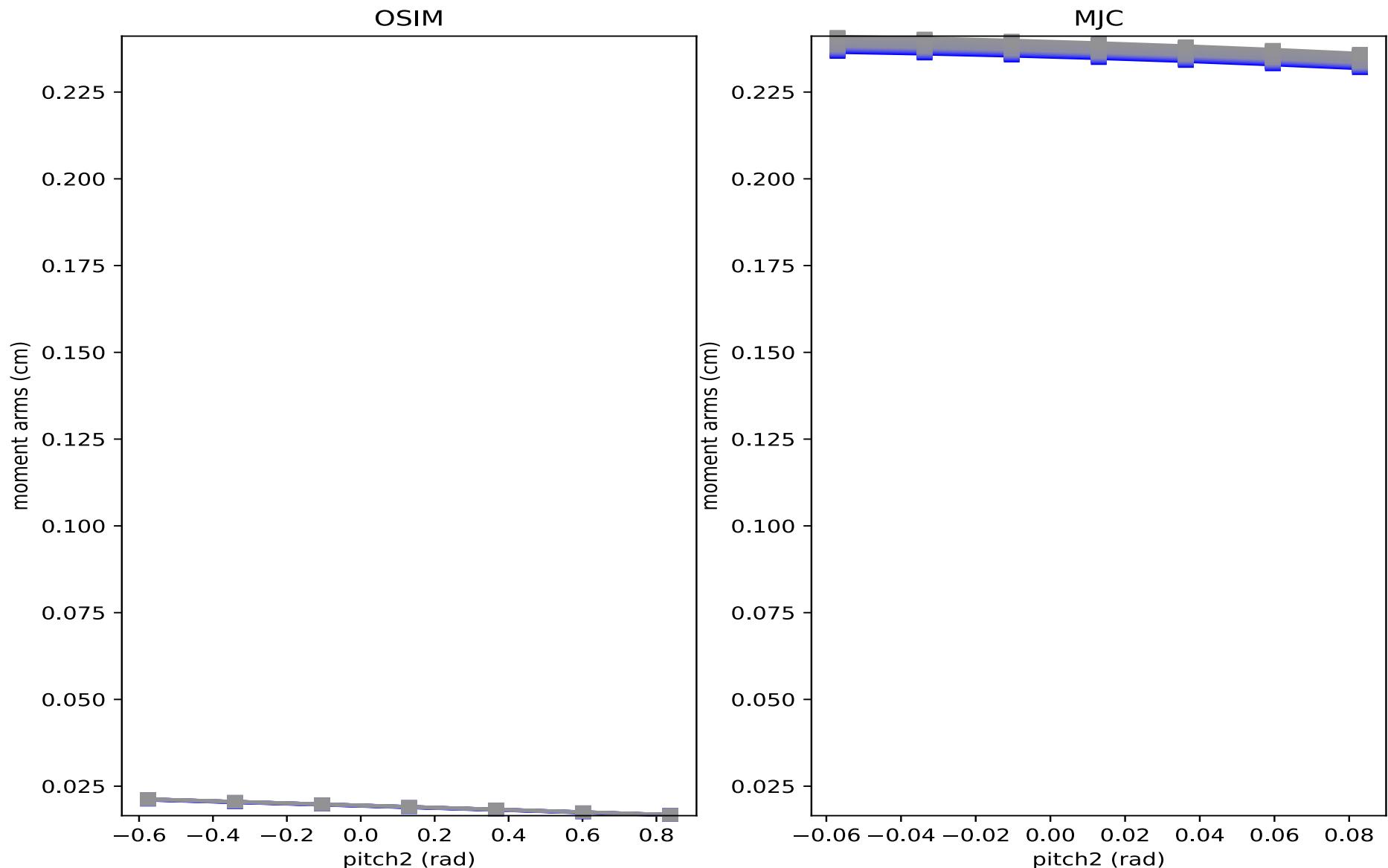
Muscle specific moment arm comparison with Osim model after optimization

trap_acr - pitch2 - roll2 - yaw2



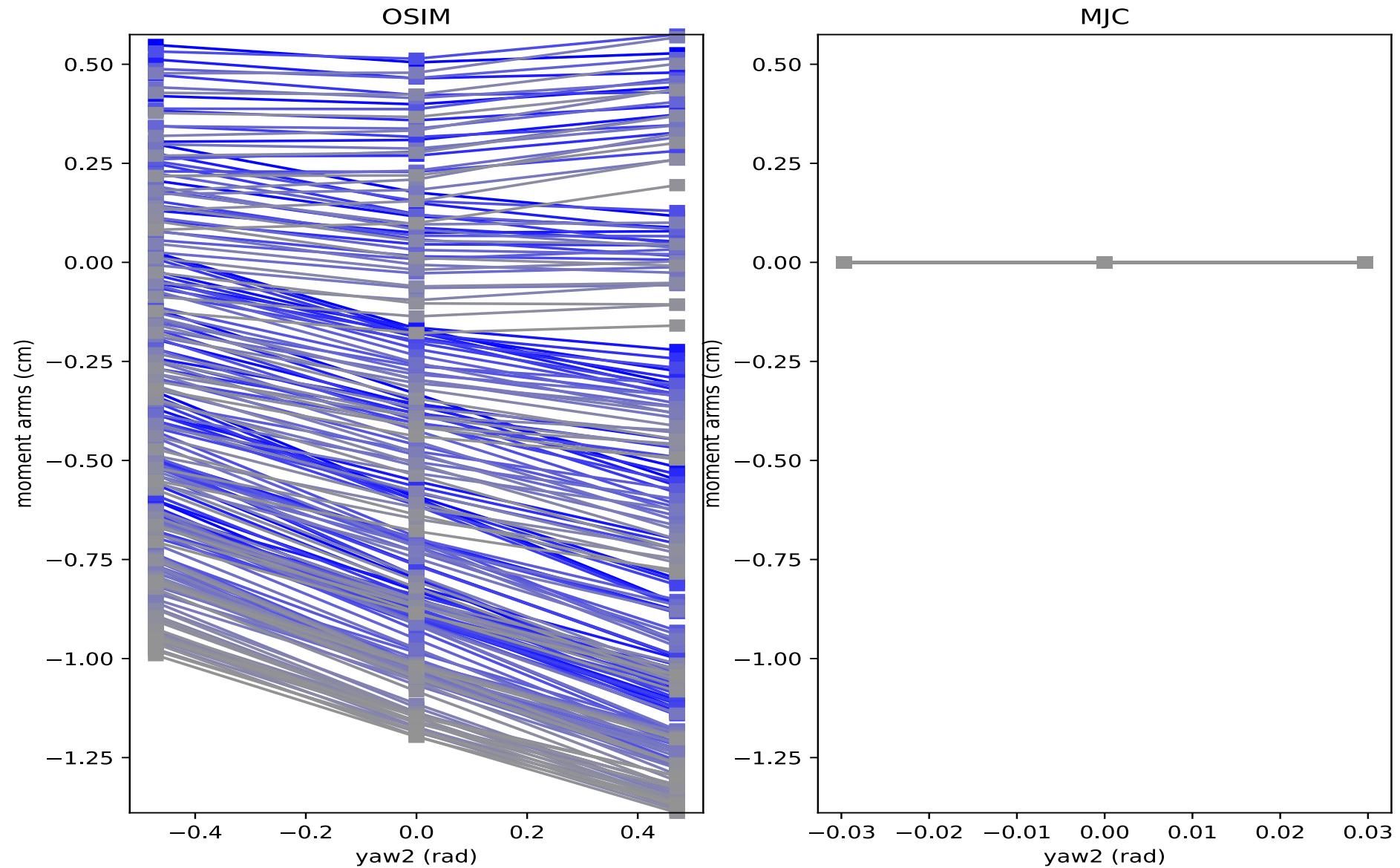
Muscle specific moment arm comparison with Osim model after optimization

trap_acr - pitch2 - roll2 - yaw2



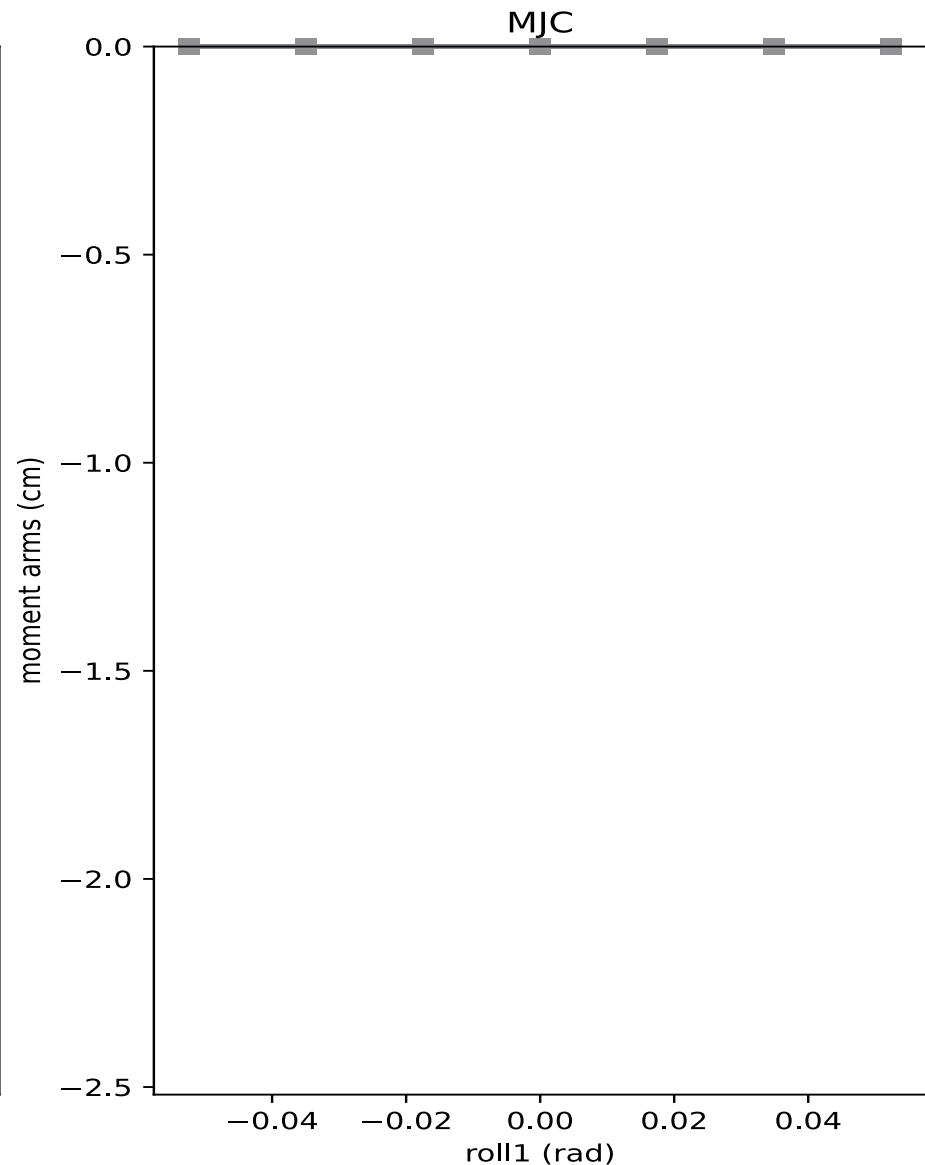
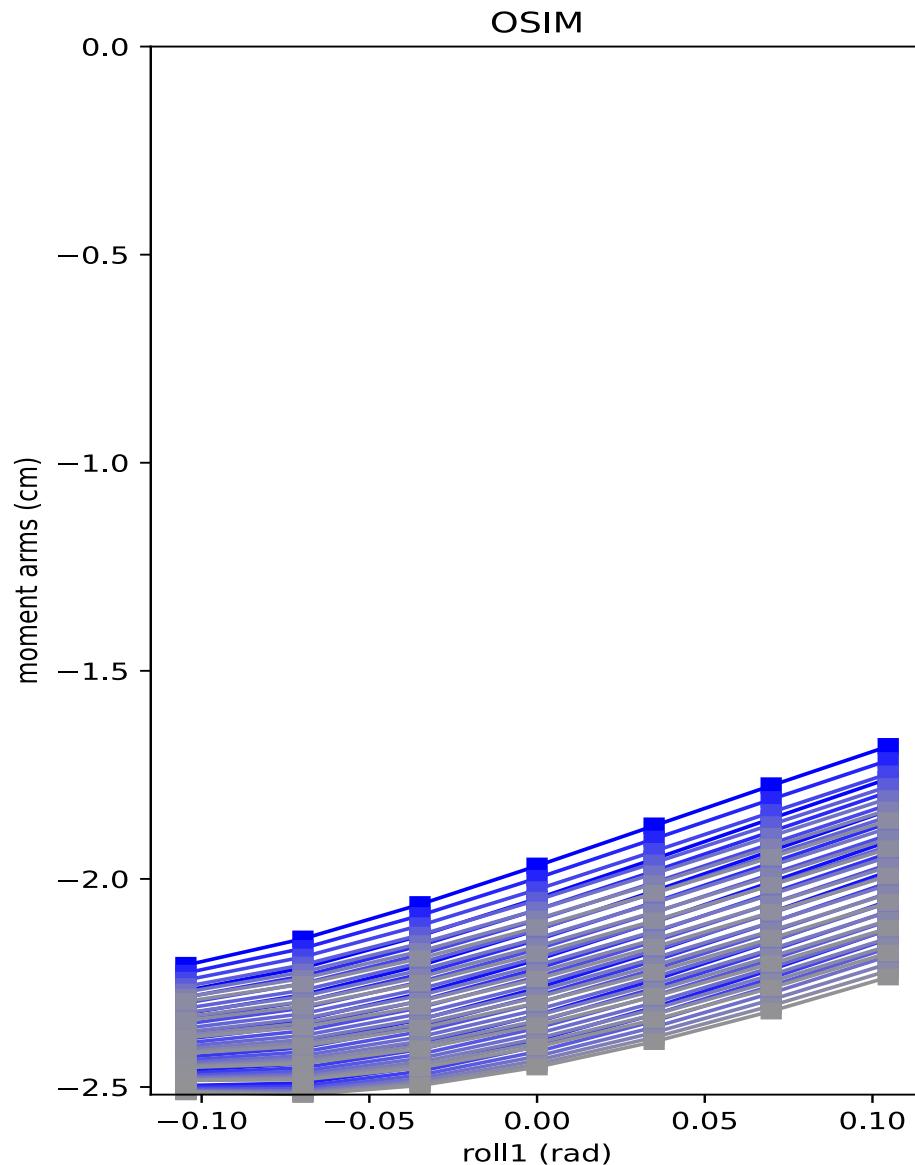
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



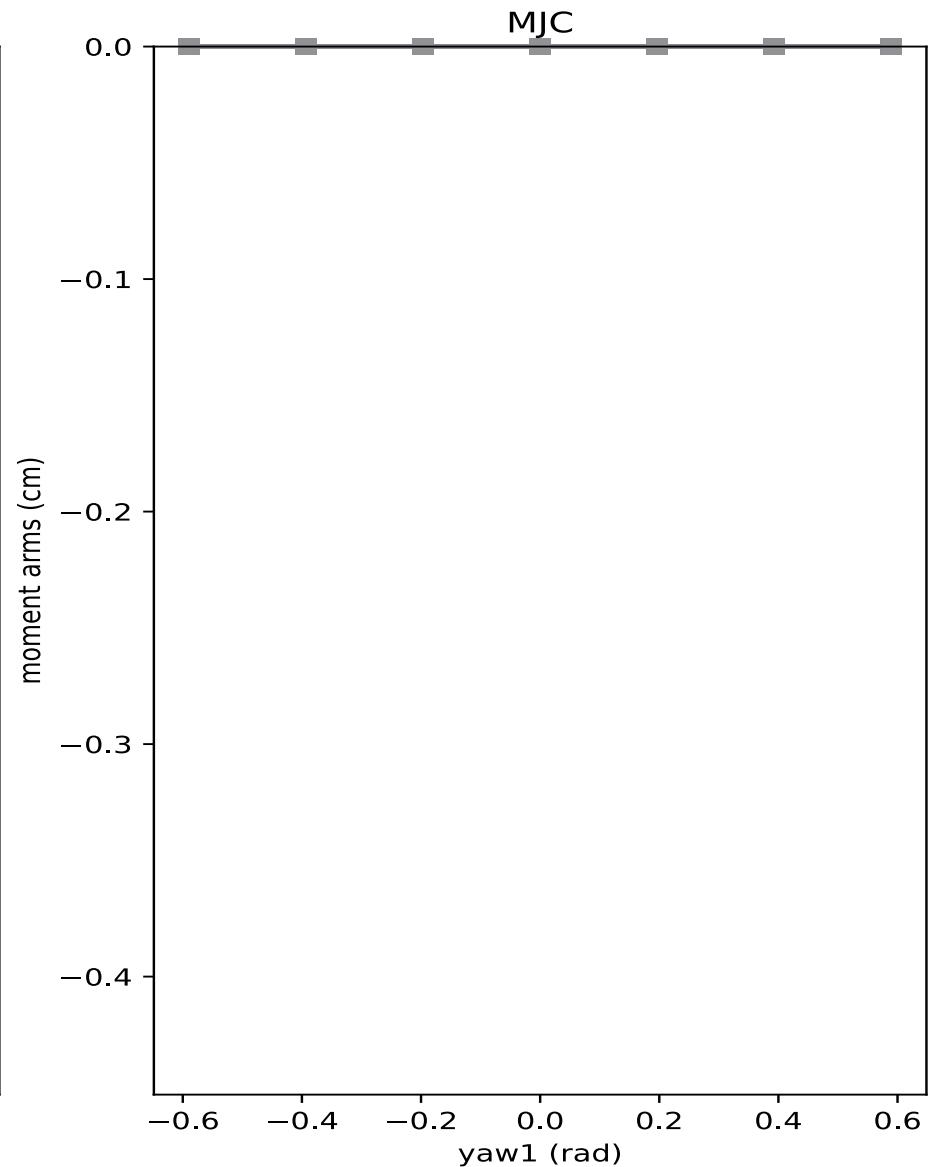
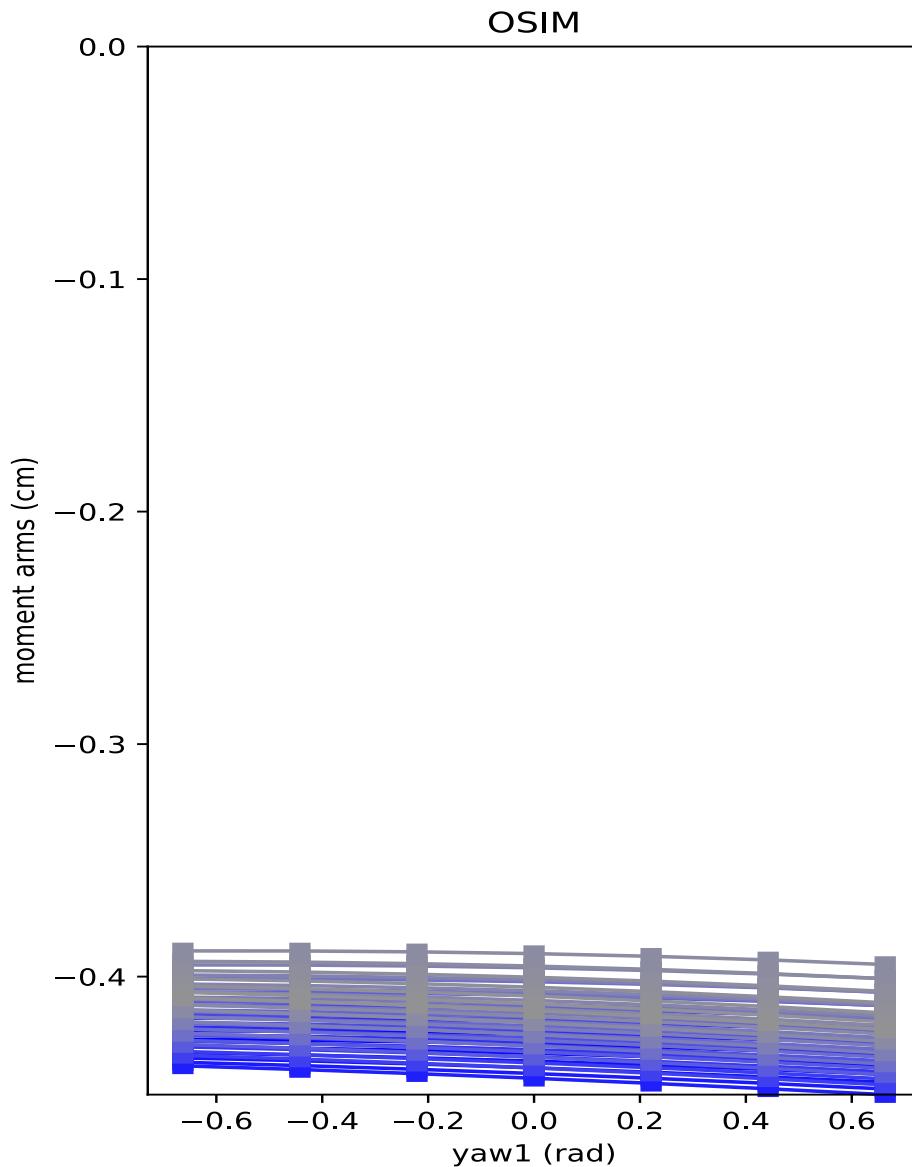
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post_L - pitch1 - roll1 - yaw1



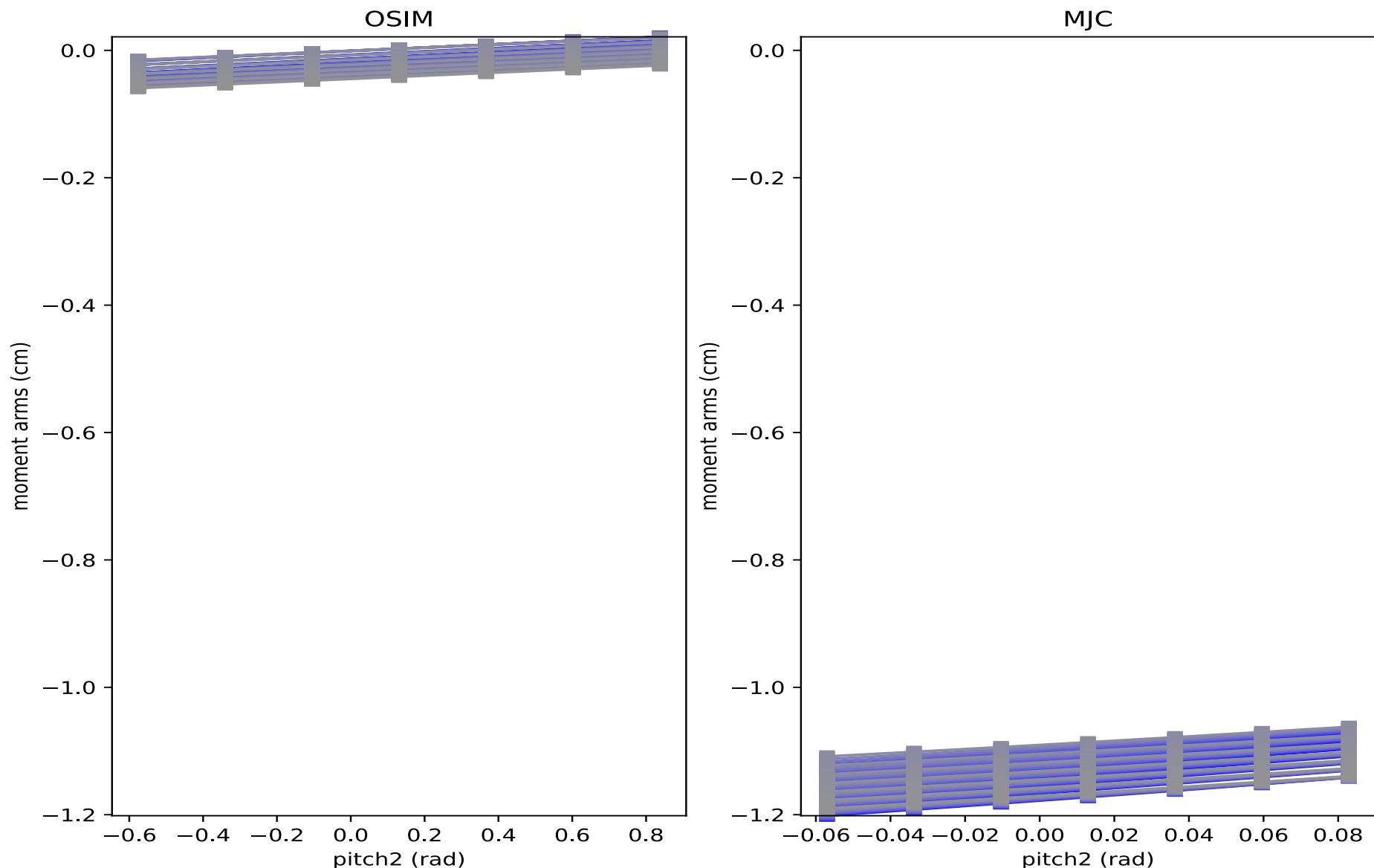
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup_L - pitch1 - roll1 - yaw1



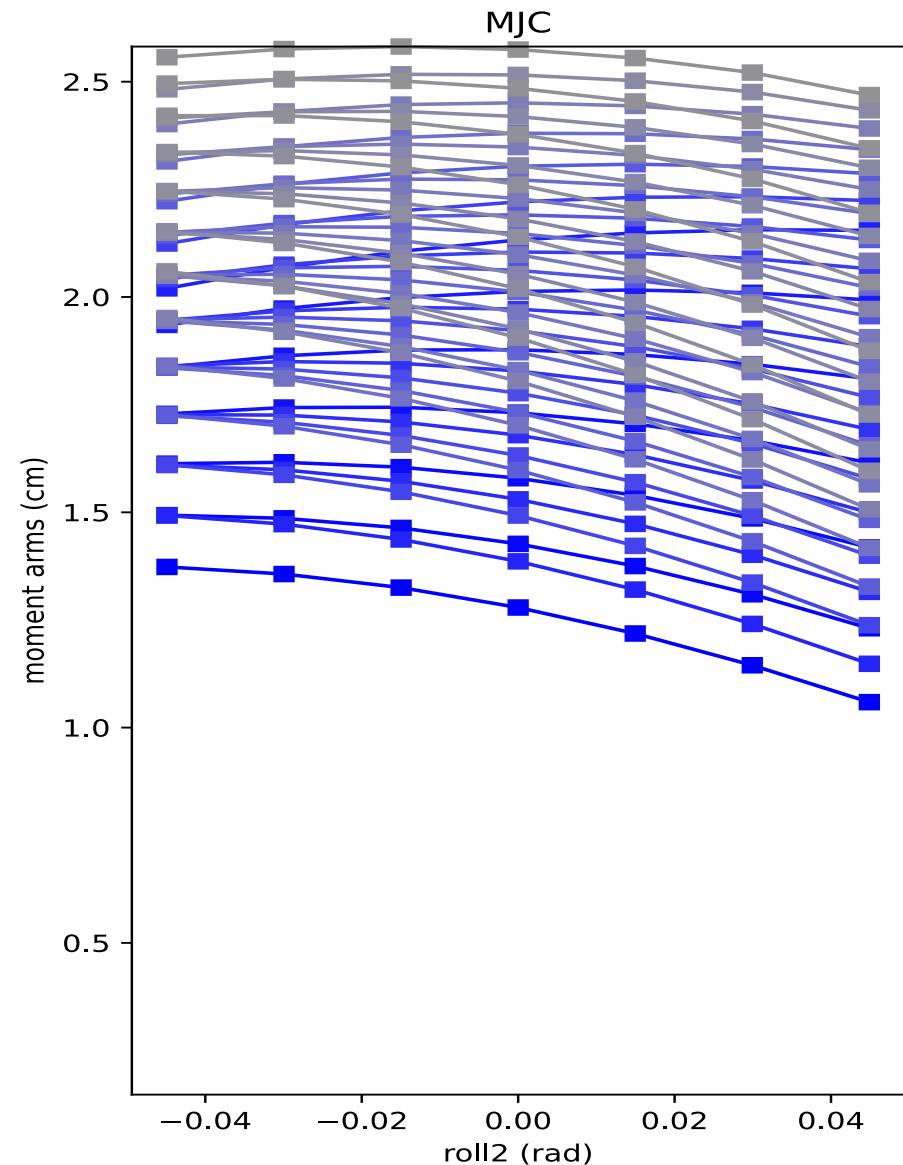
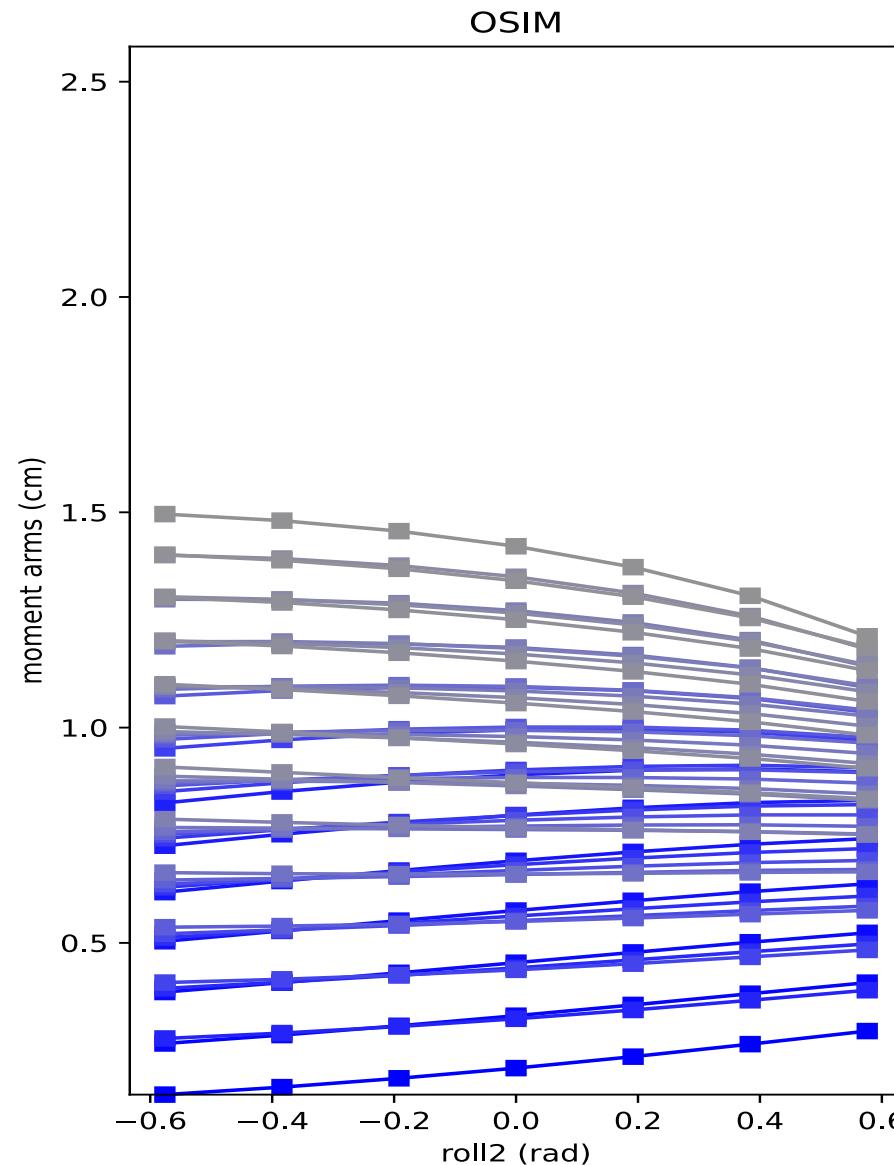
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx - pitch2 - roll2 - yaw2



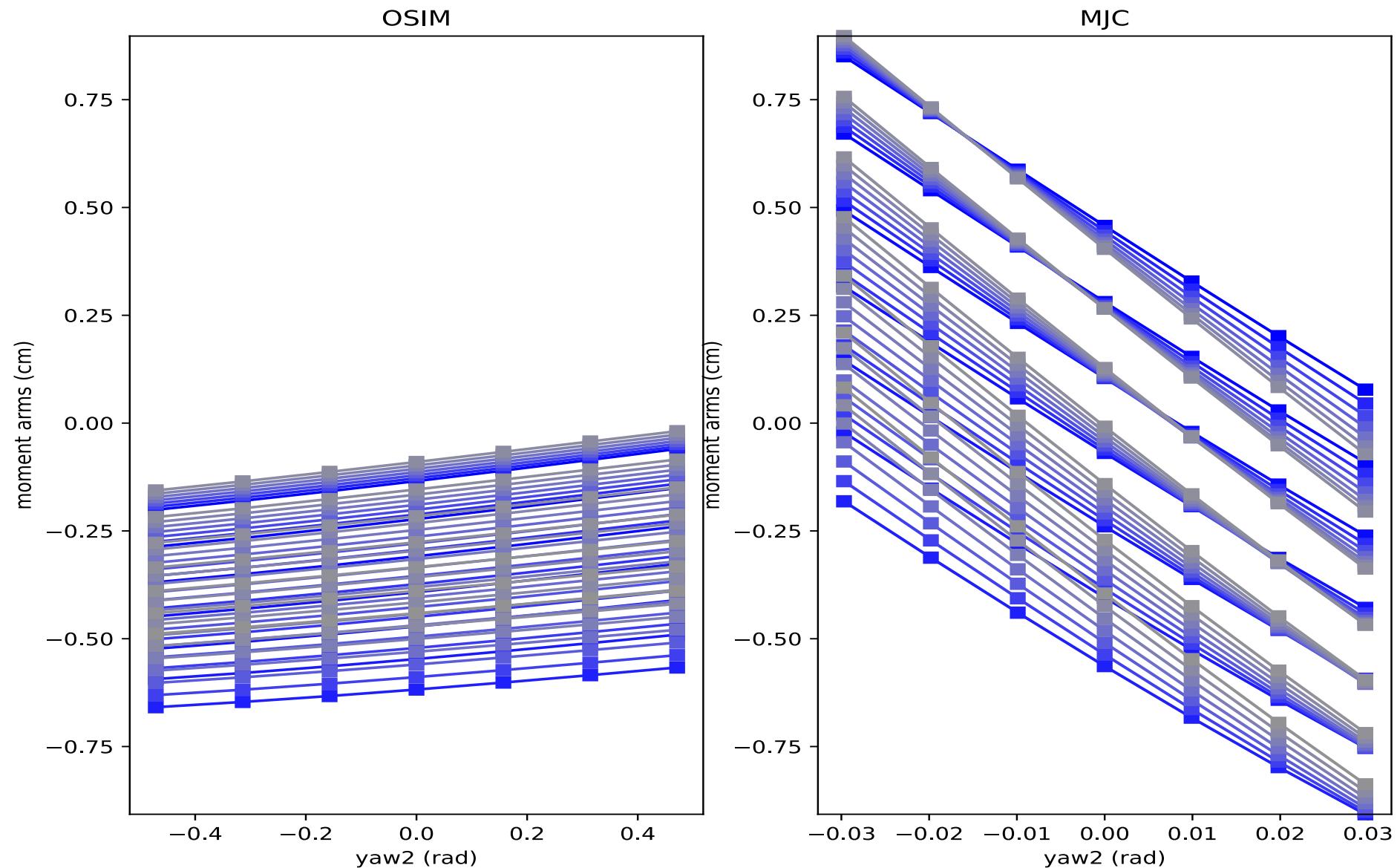
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx - pitch2 - roll2 - yaw2



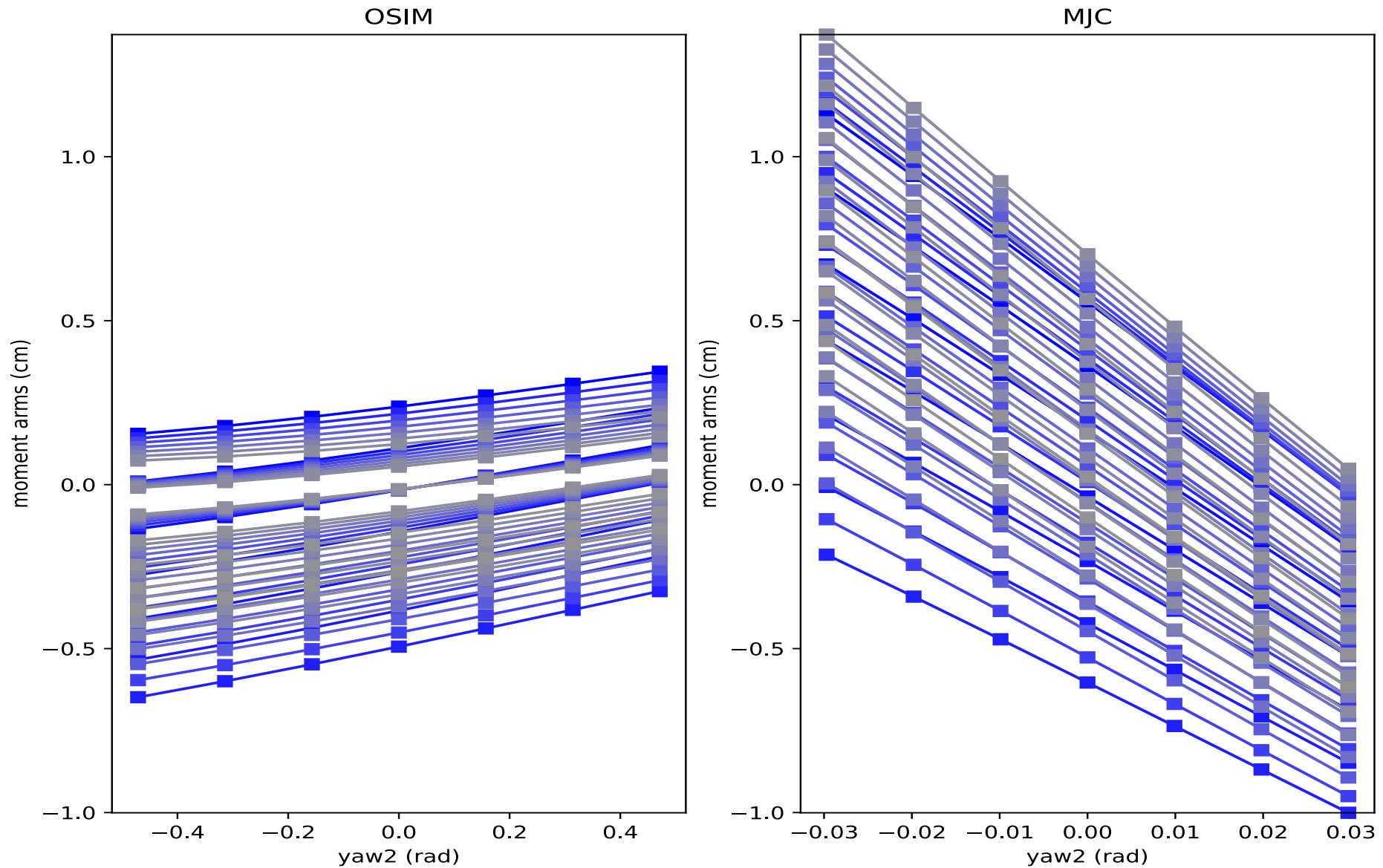
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post_L - pitch2 - roll2 - yaw2



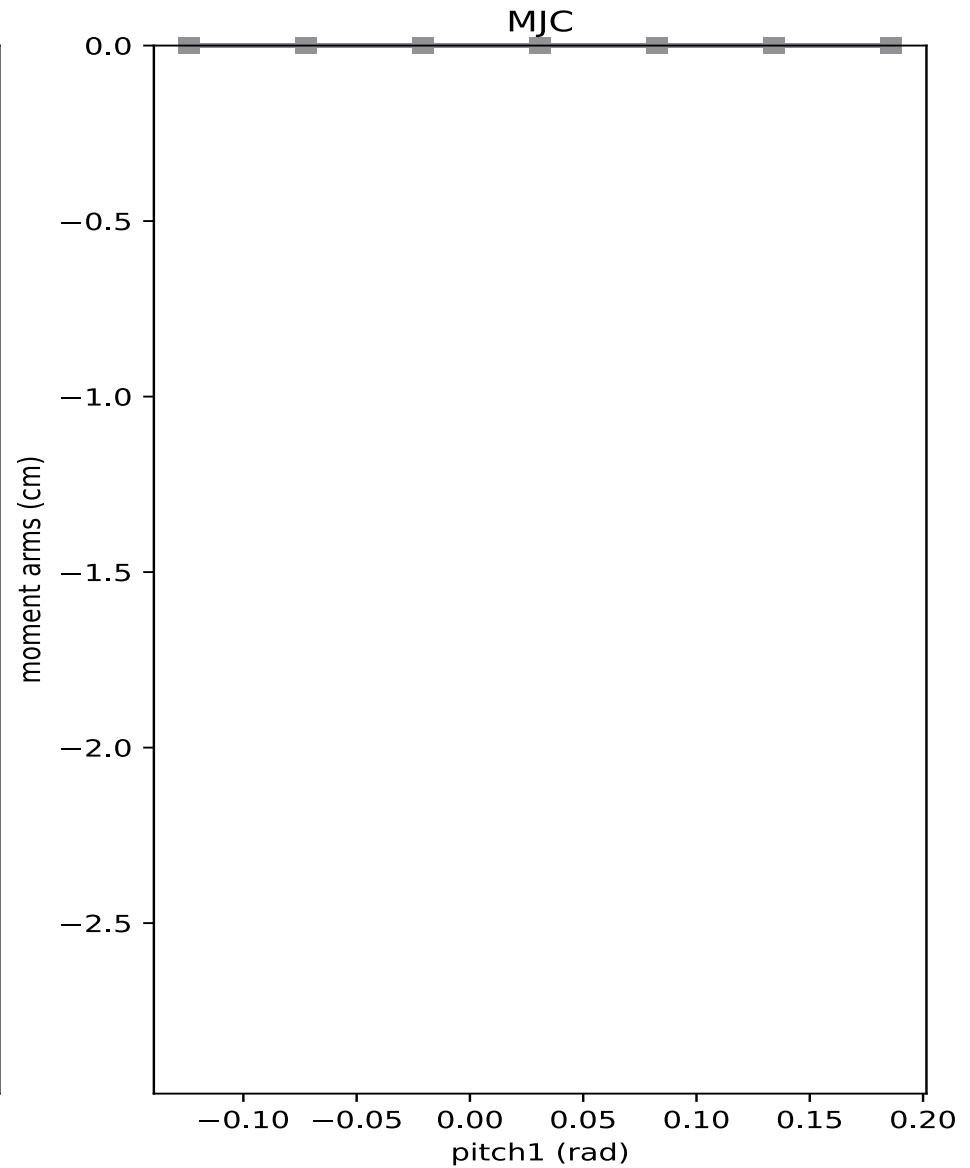
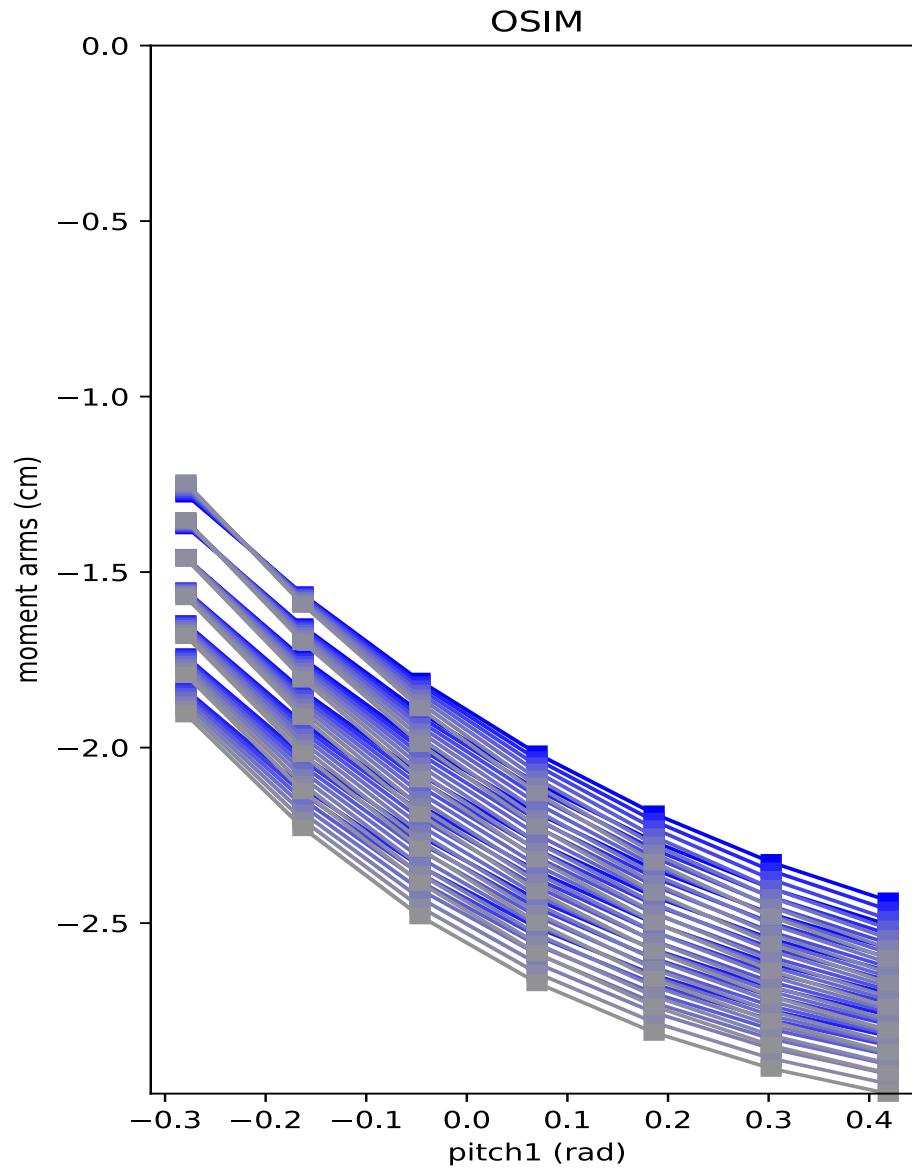
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant_L - pitch2 - roll2 - yaw2



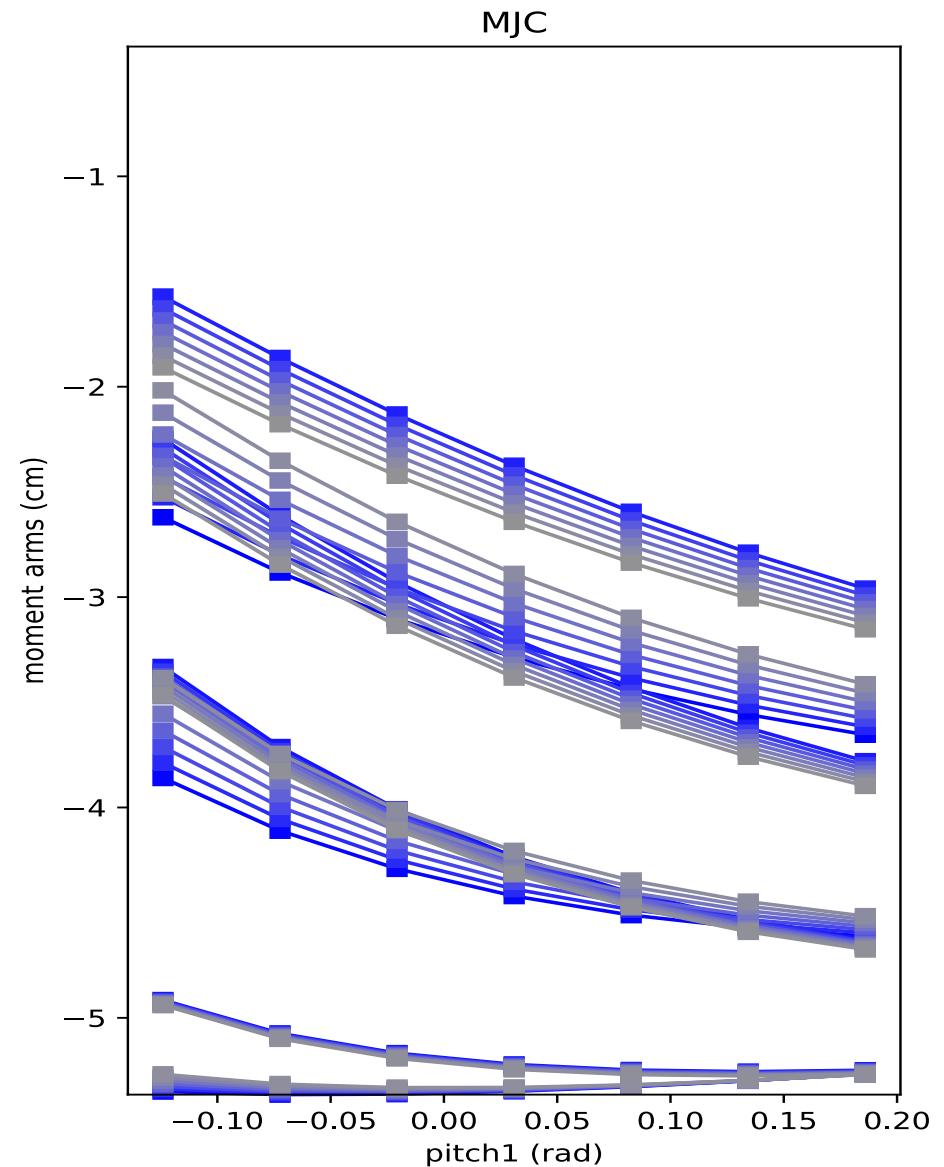
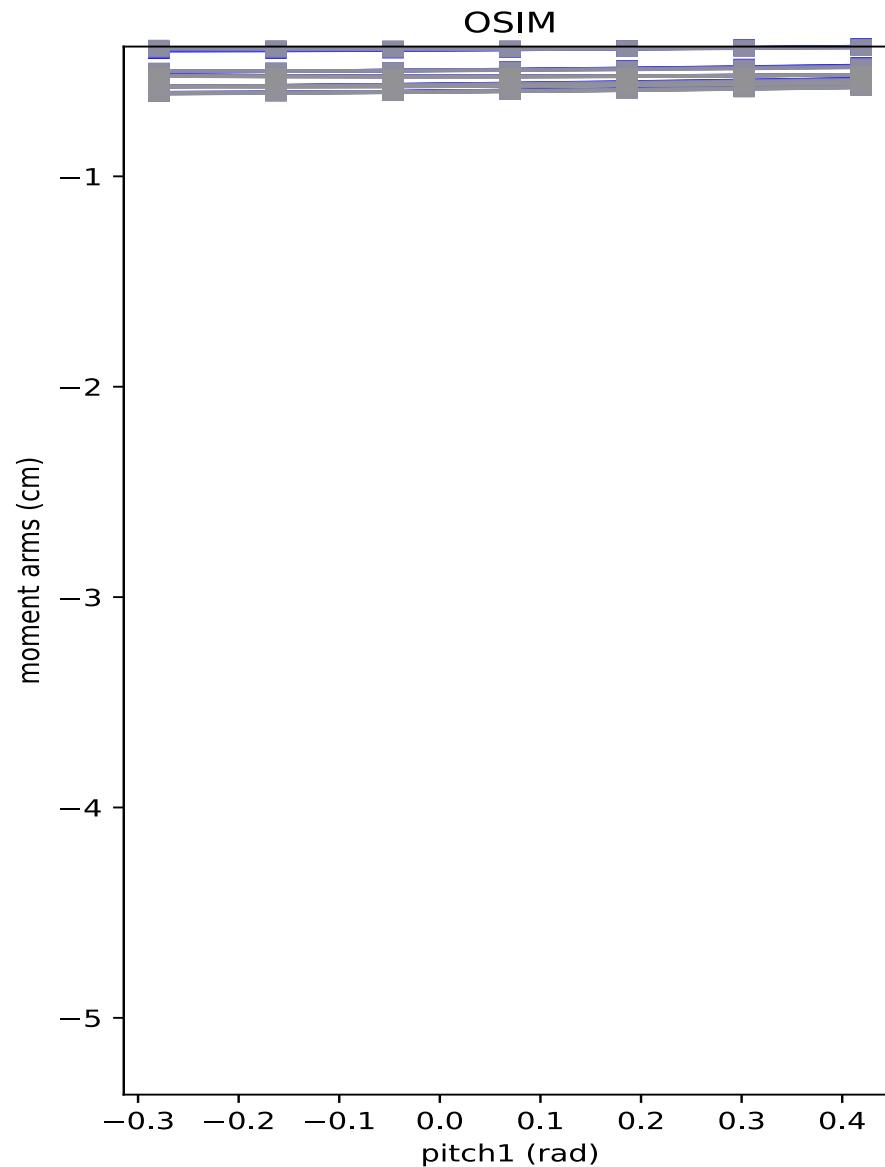
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post - pitch1 - roll1 - yaw1



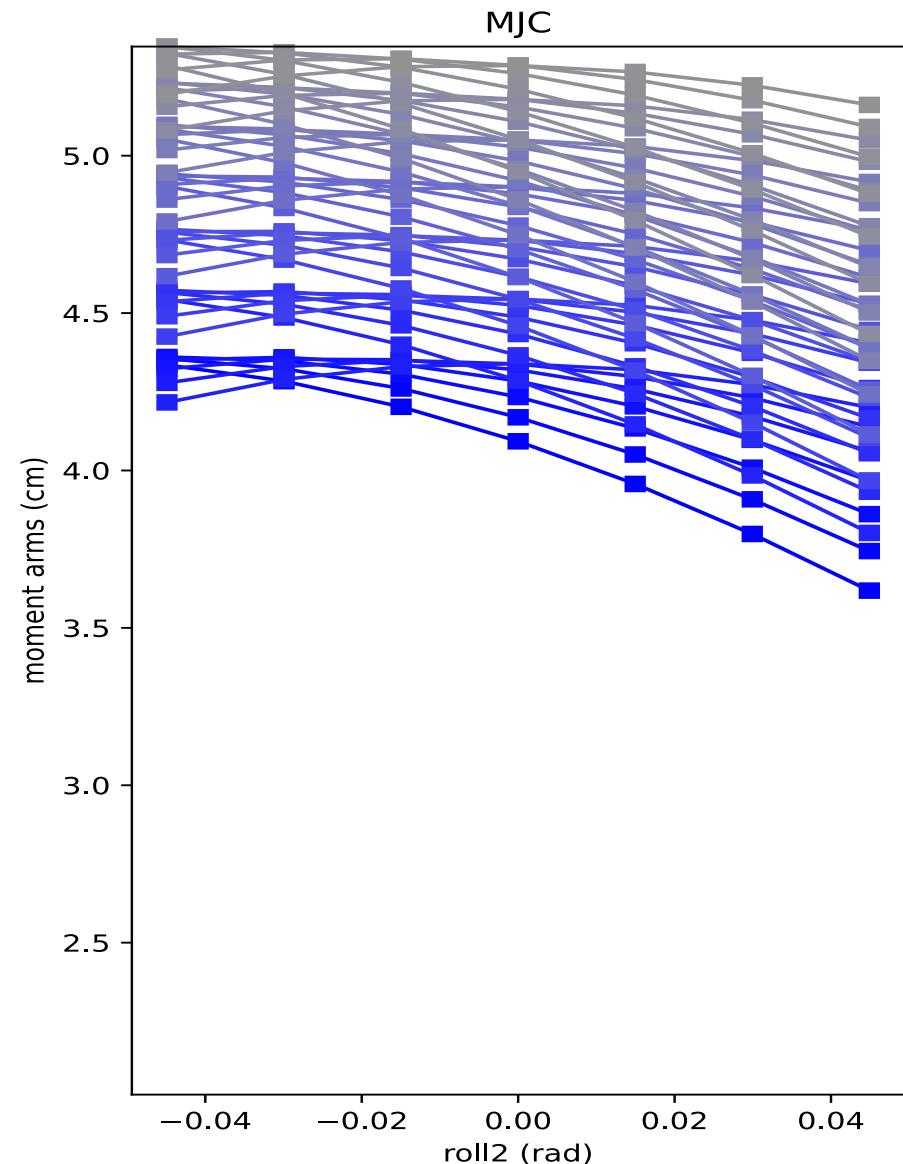
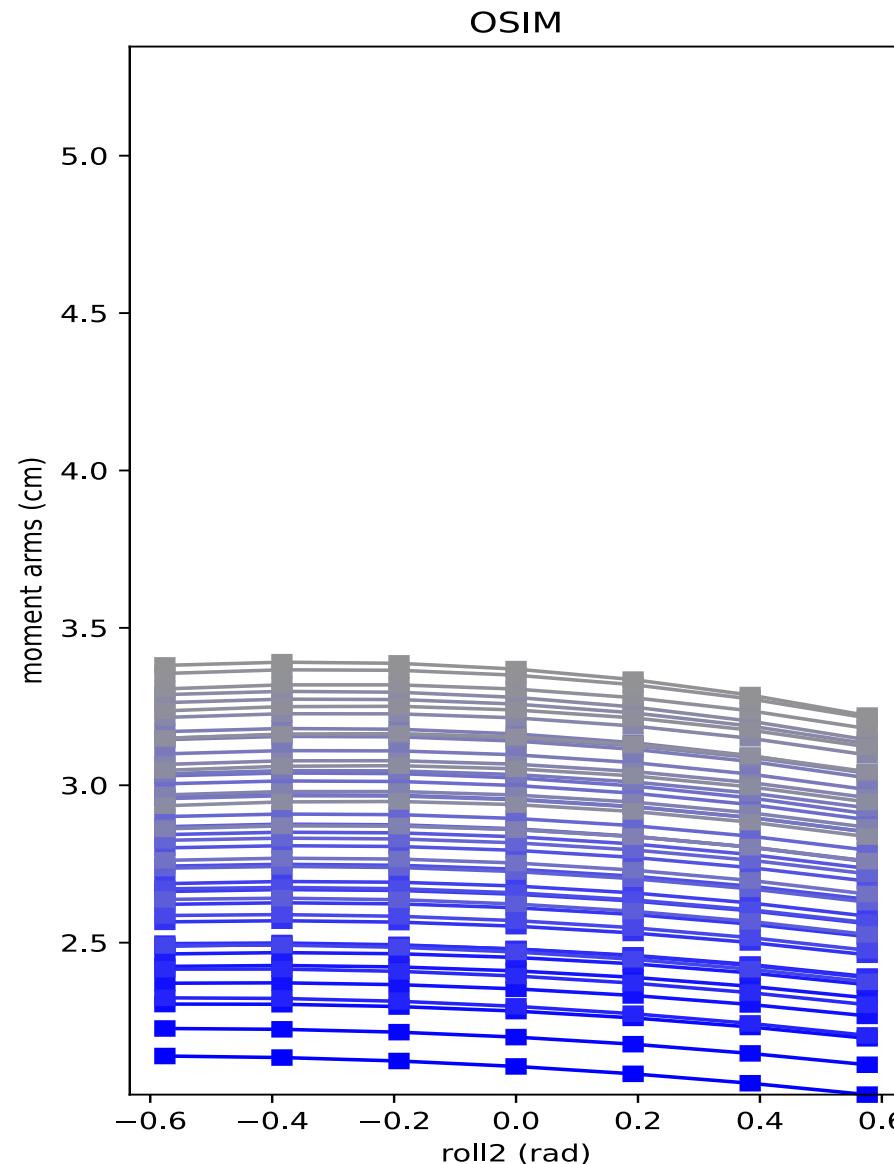
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch1 - roll1 - yaw1



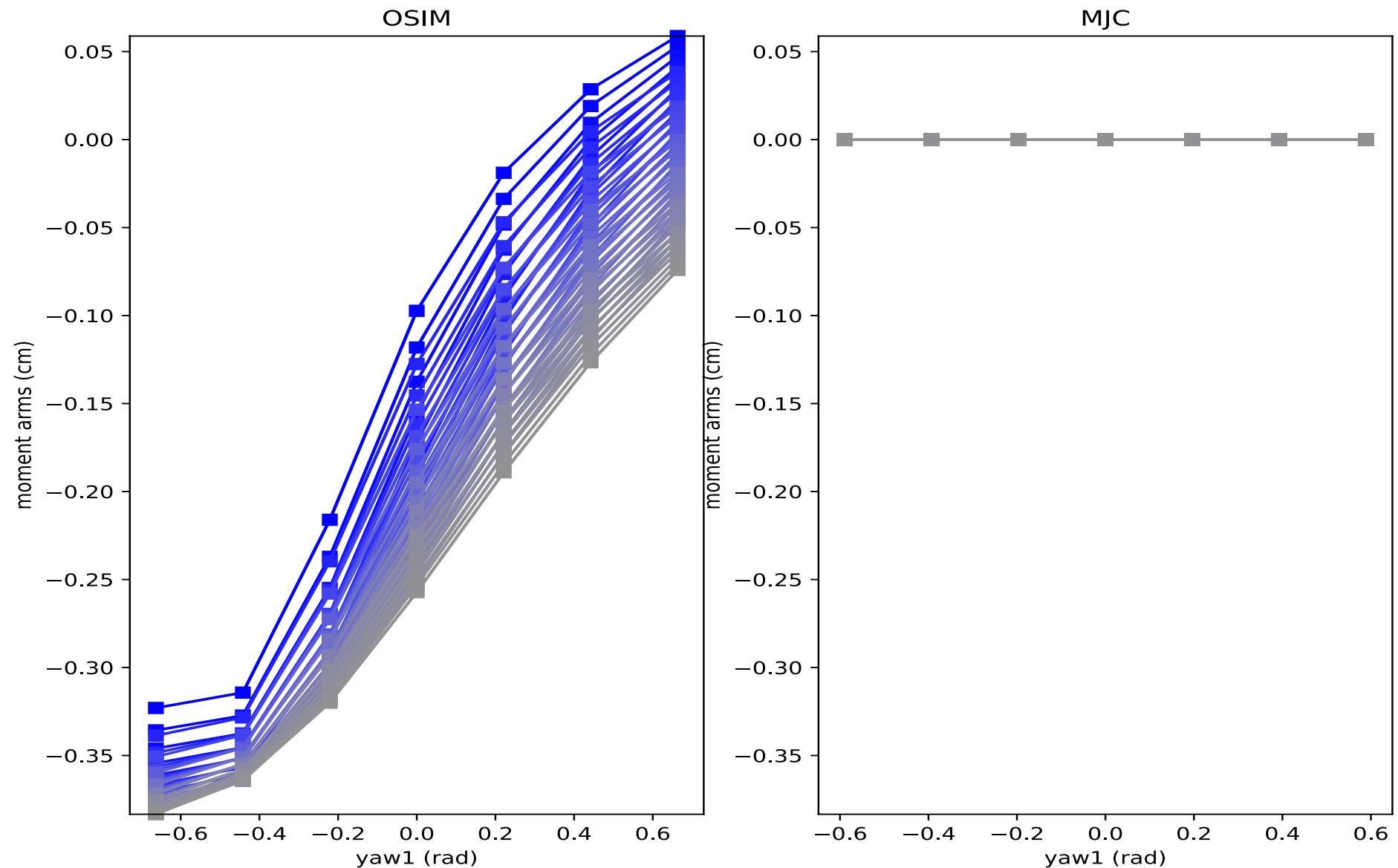
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med - pitch2 - roll2 - yaw2



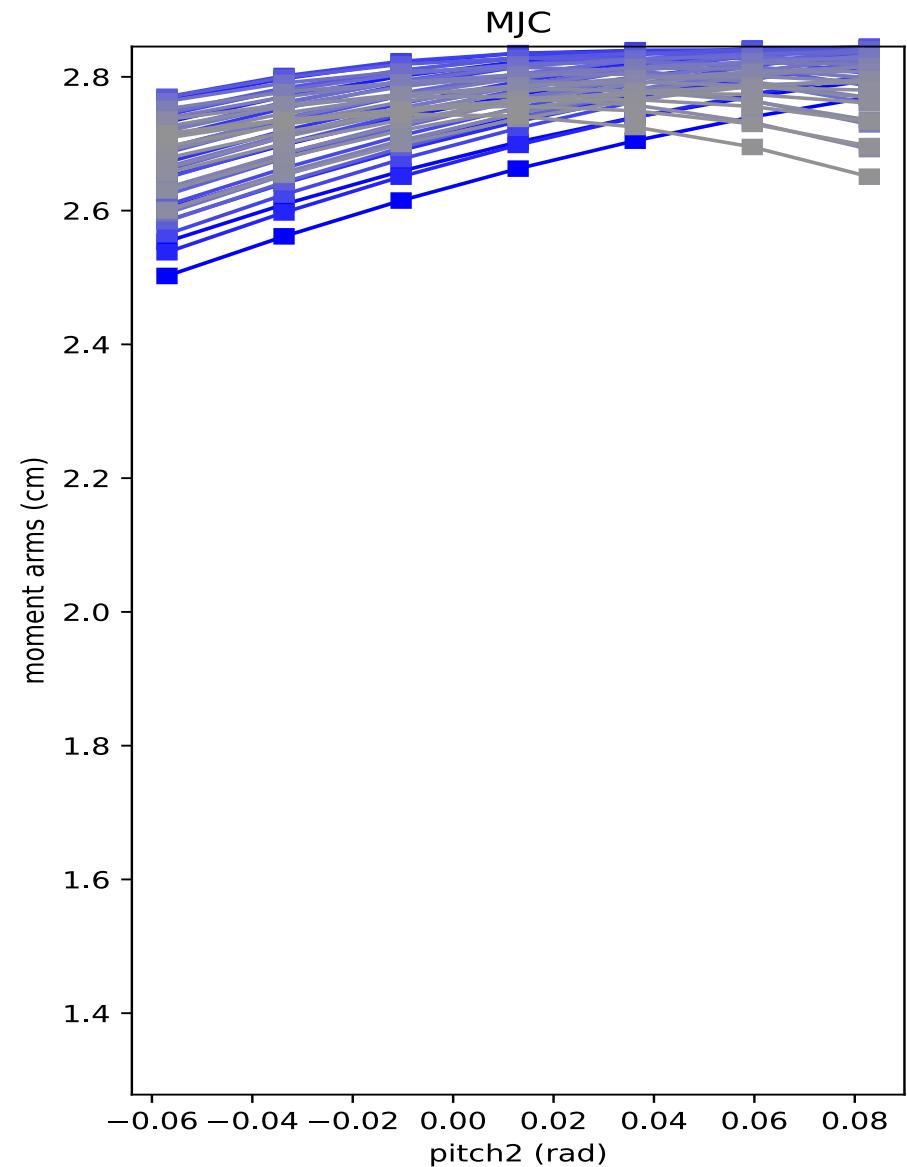
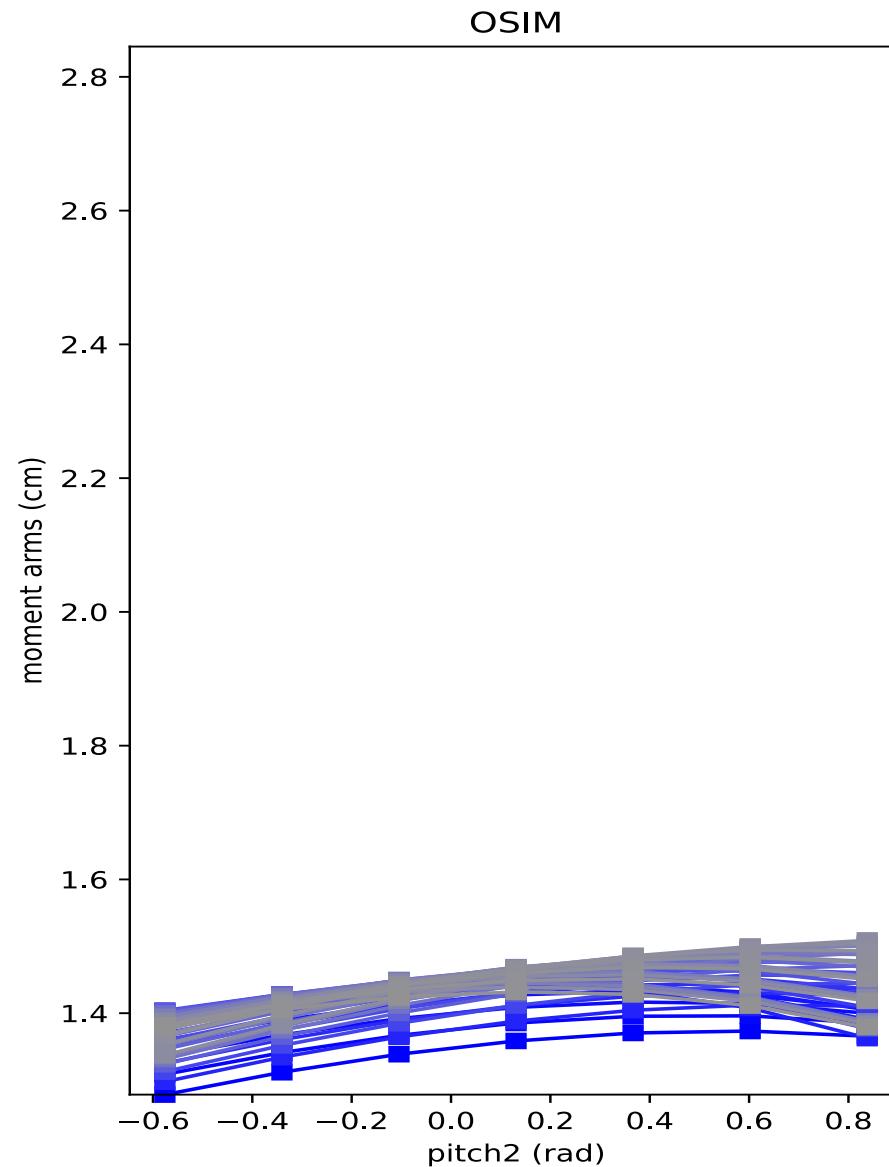
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant_L - pitch1 - roll1 - yaw1



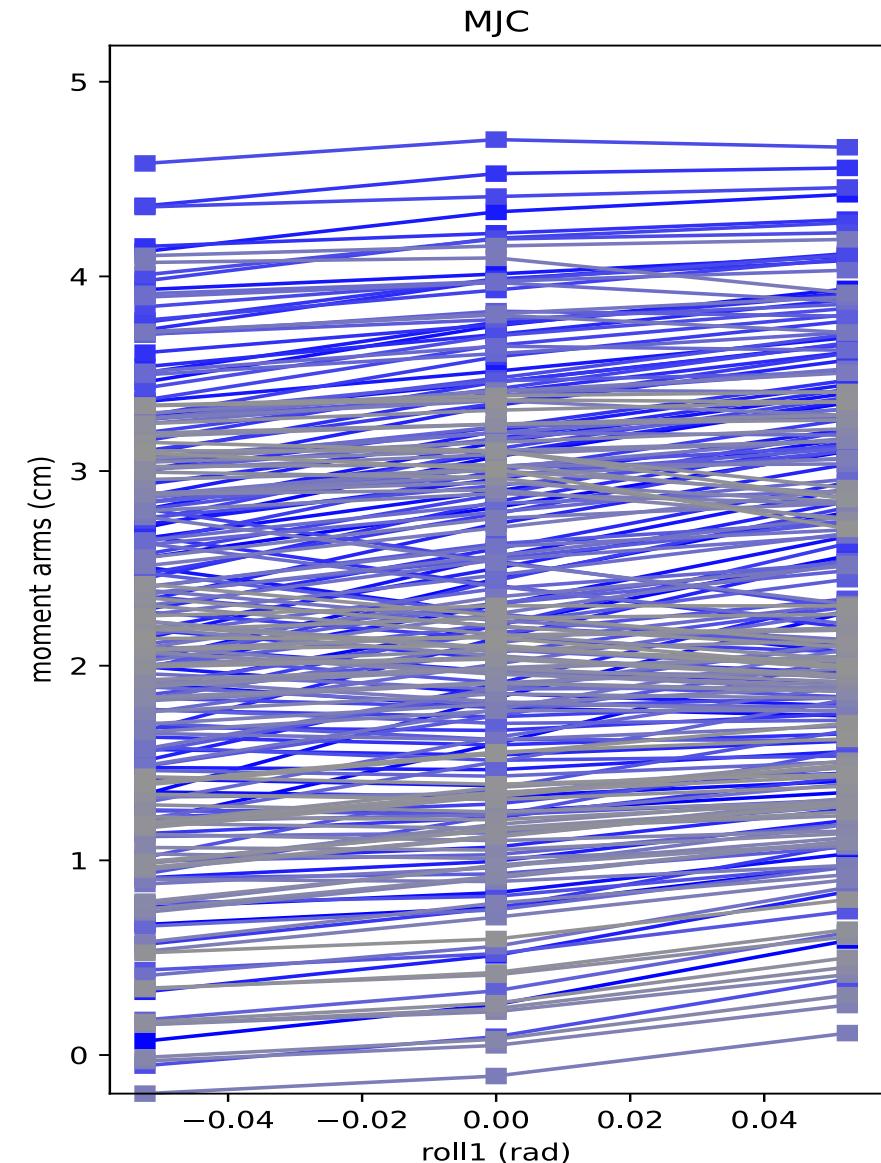
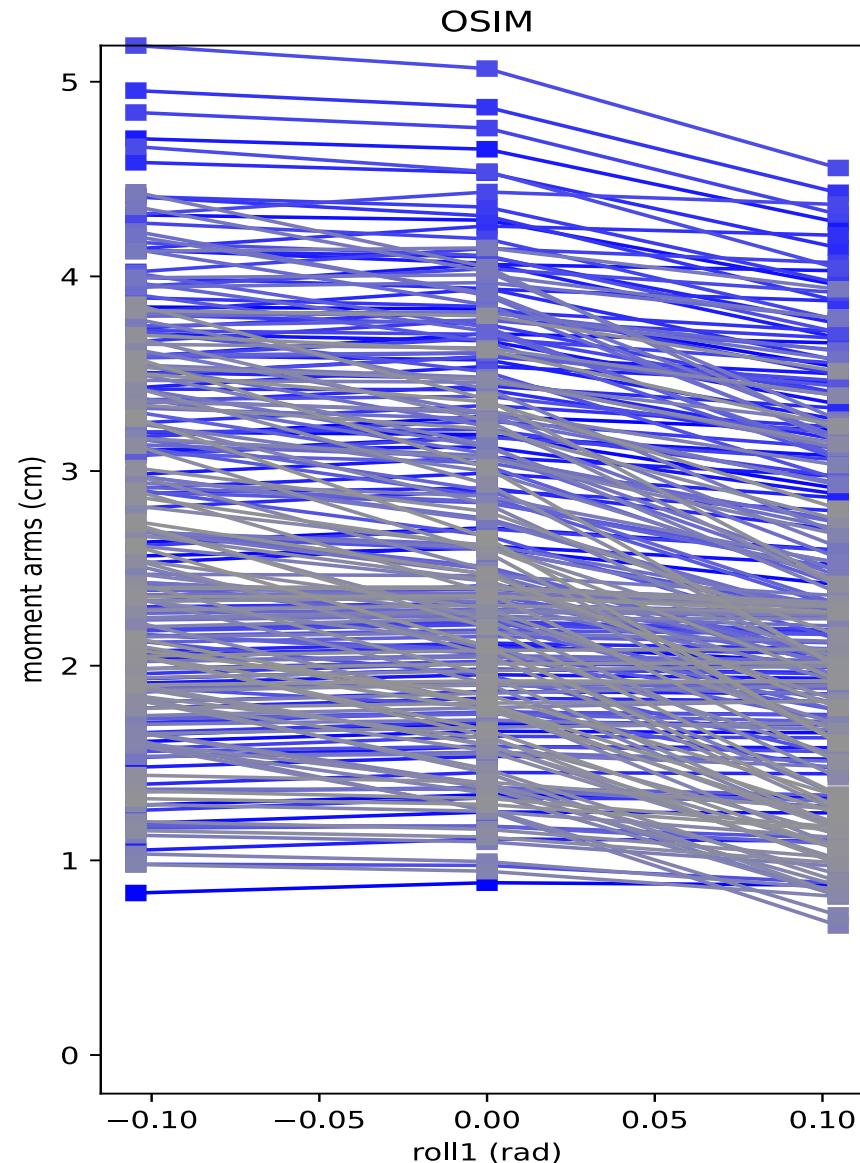
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib_L - pitch2 - roll2 - yaw2



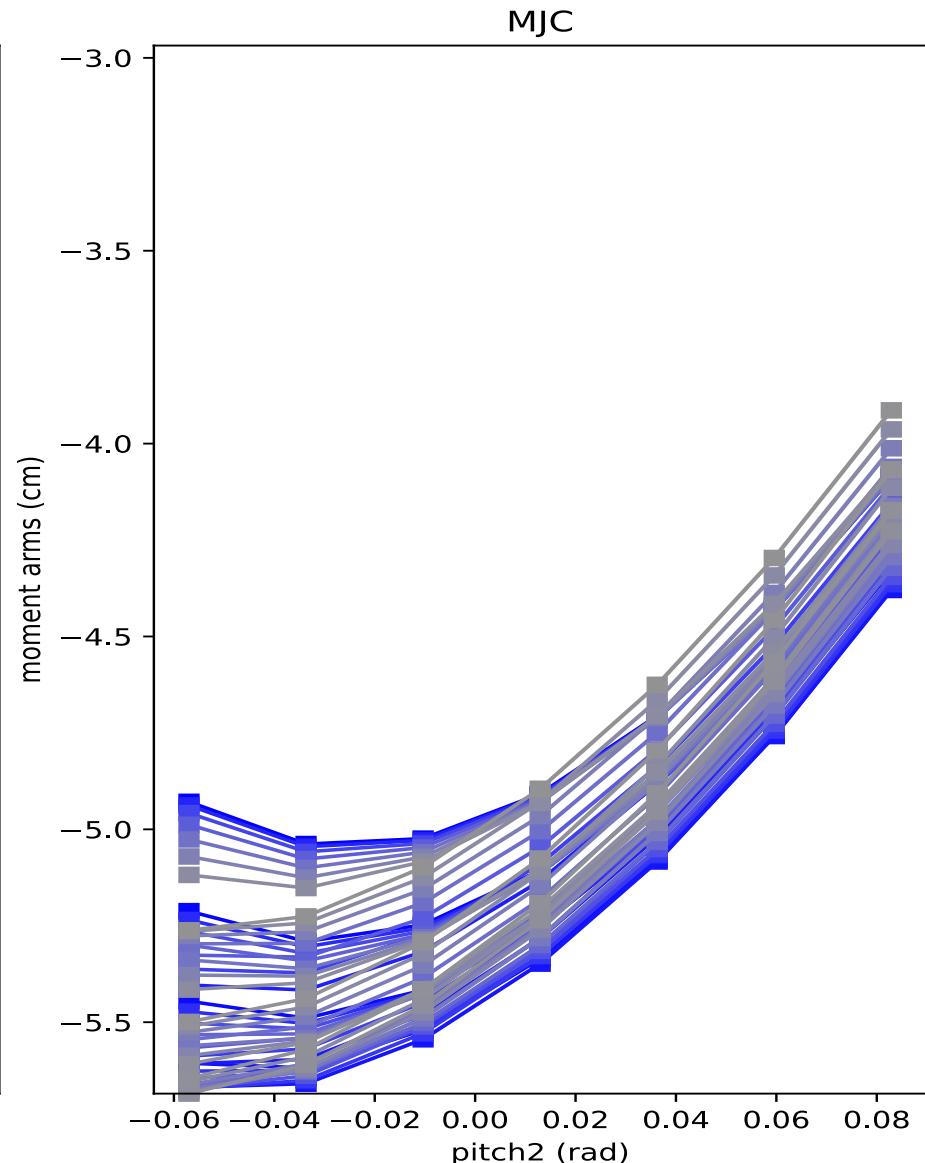
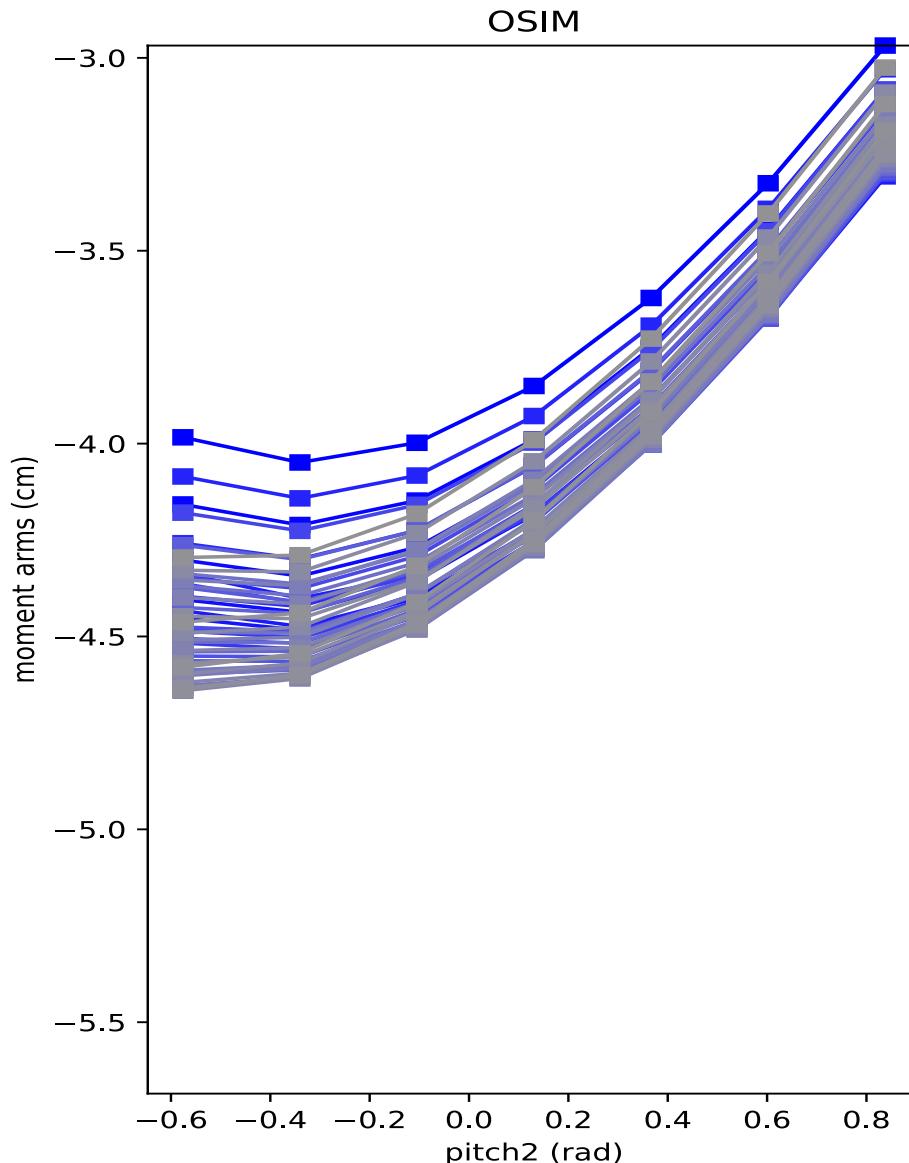
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



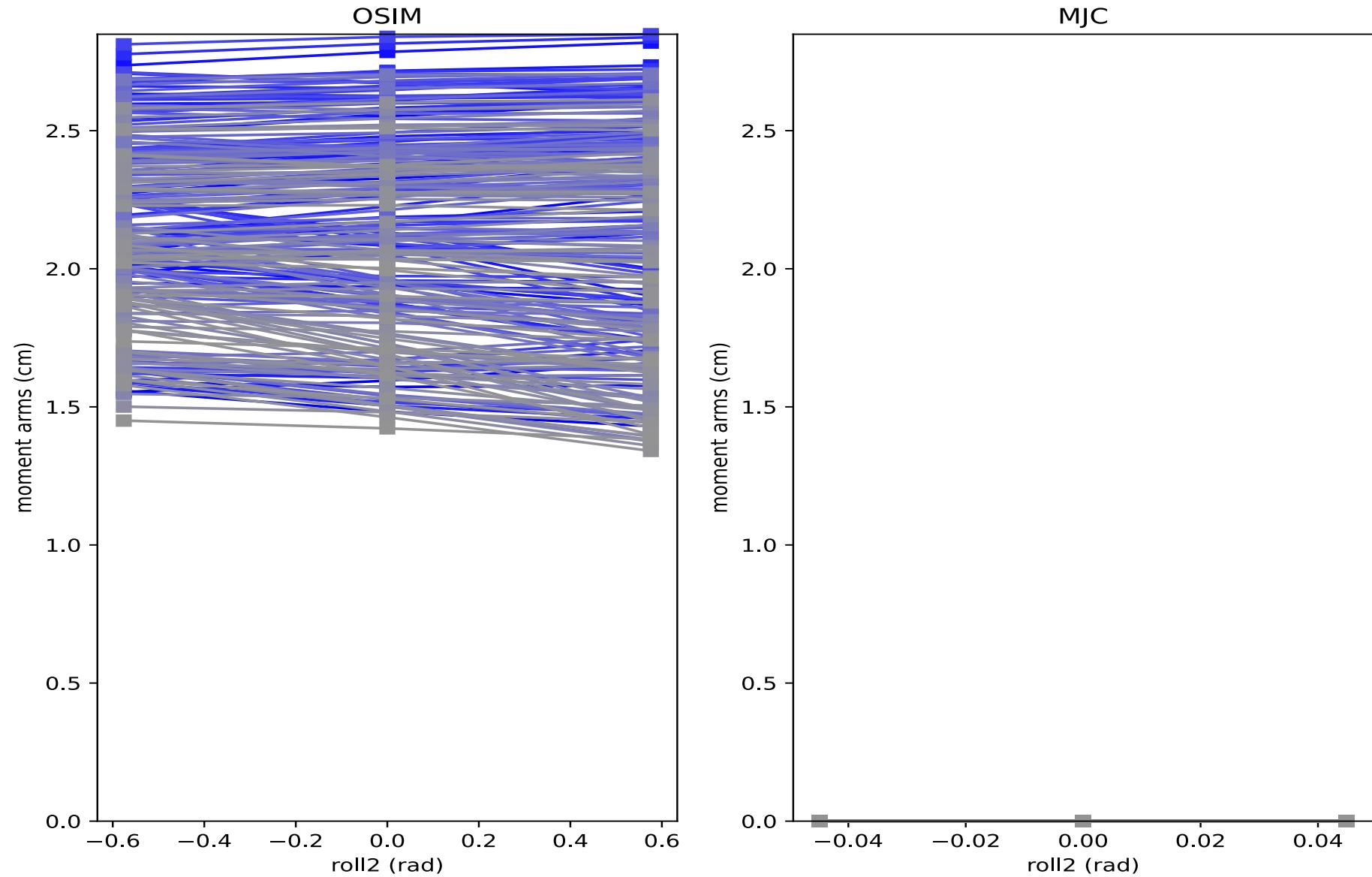
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid_L - pitch2 - roll2 - yaw2



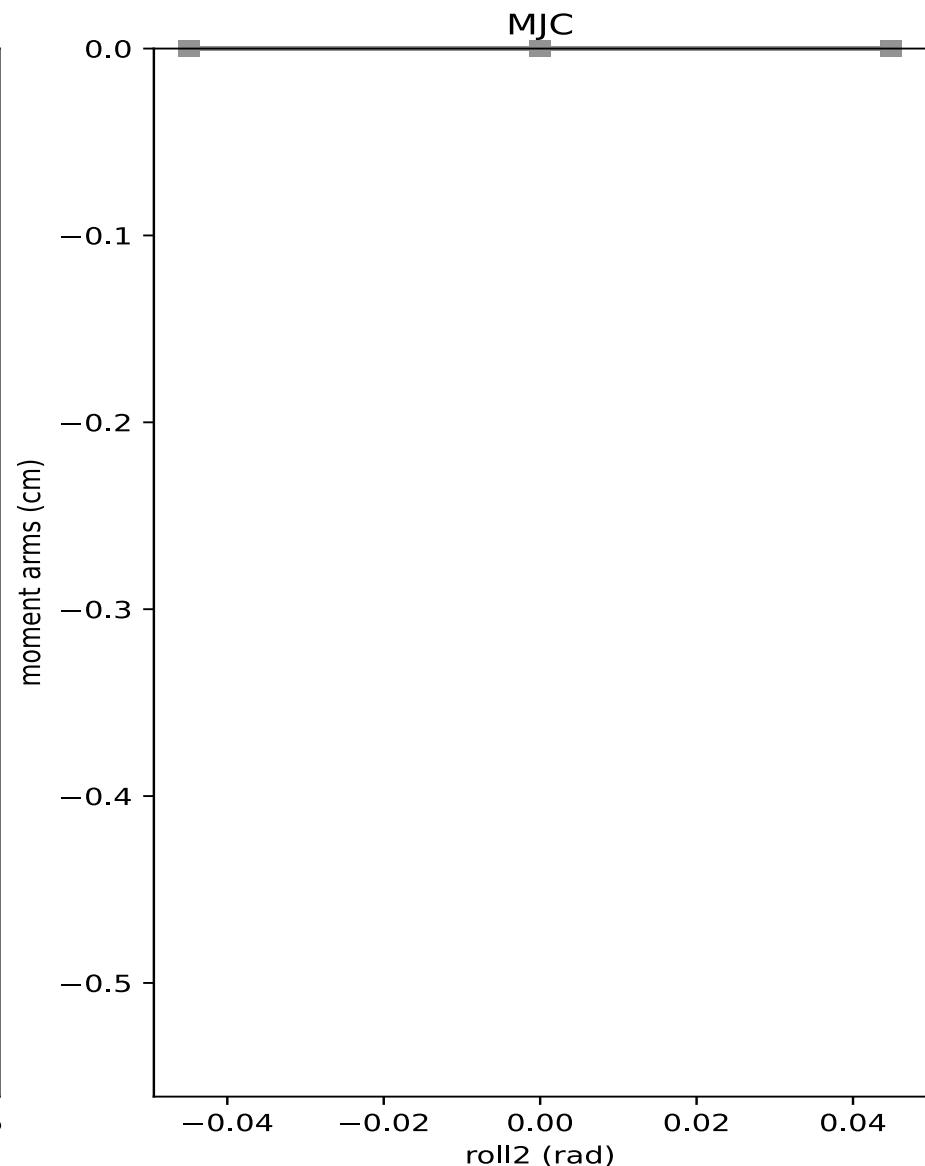
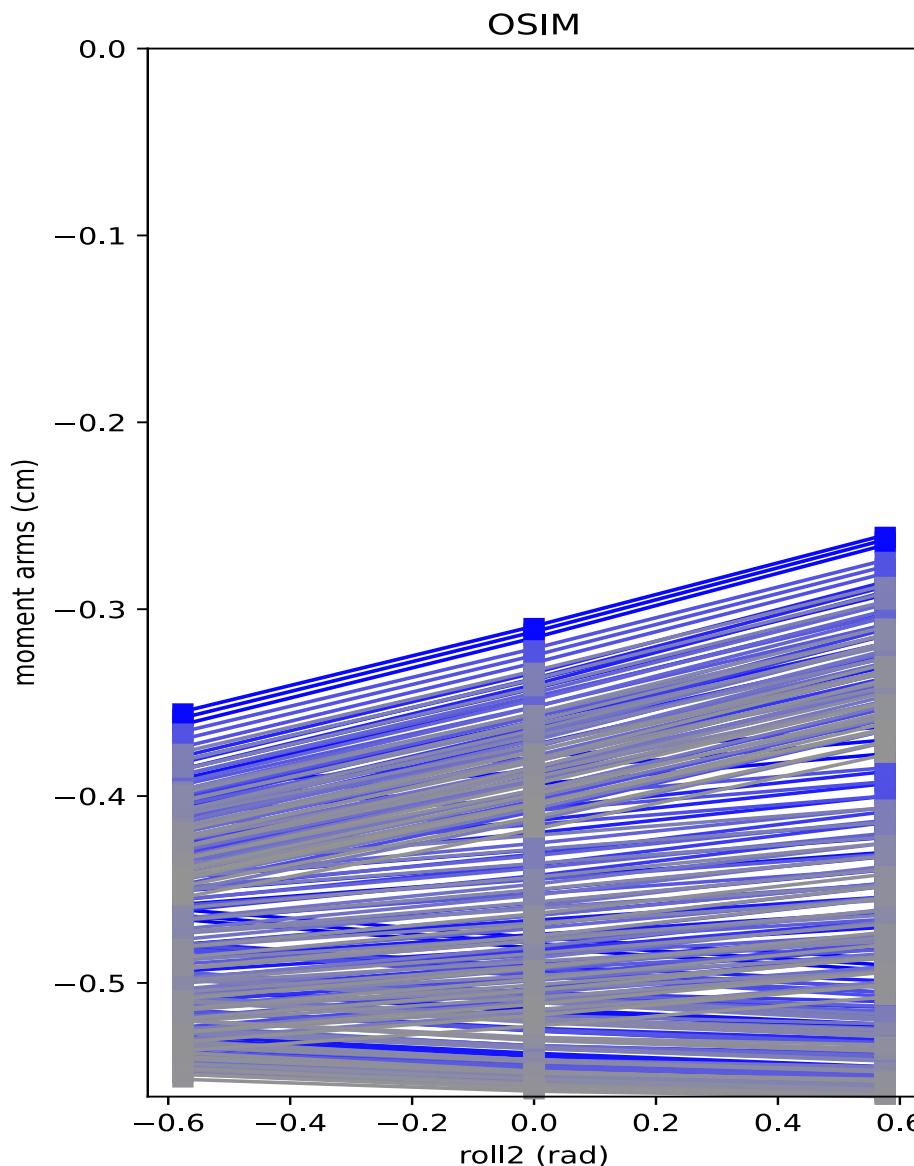
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



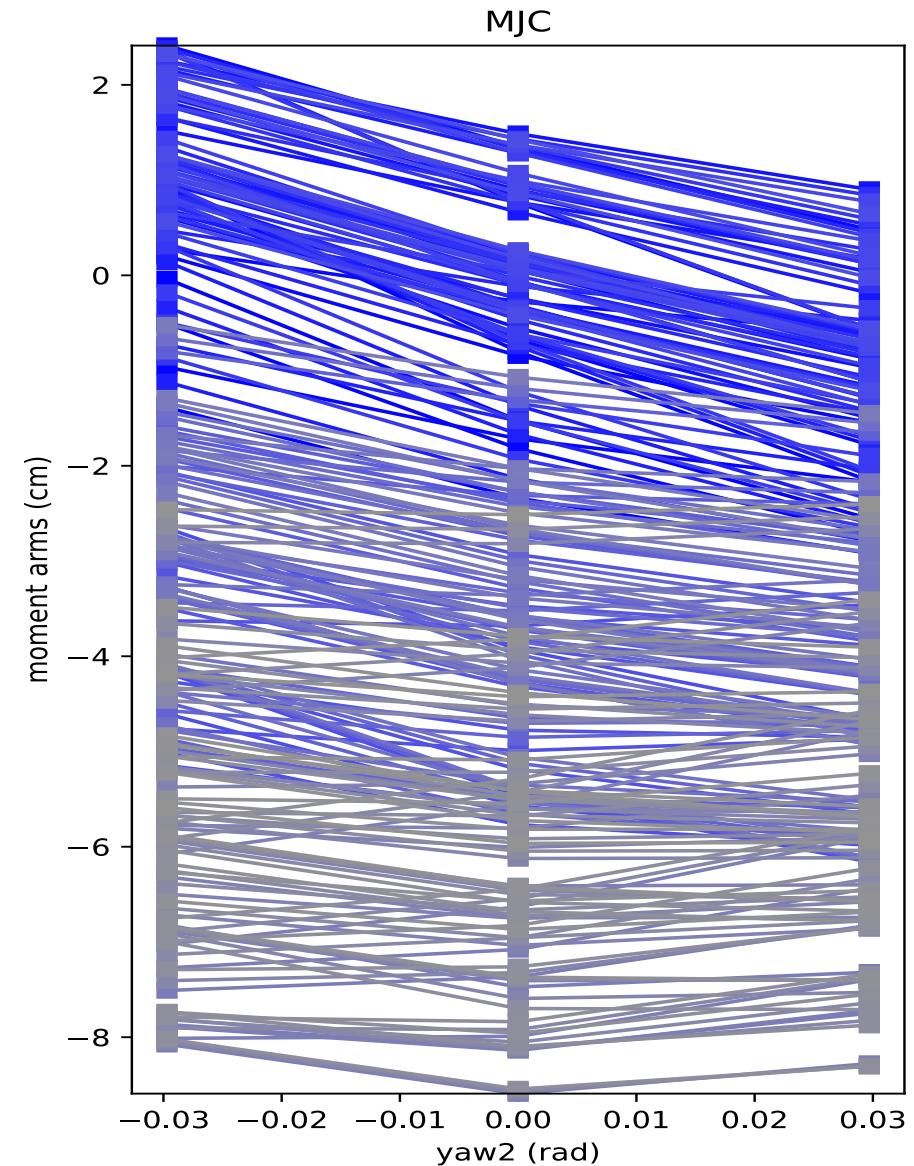
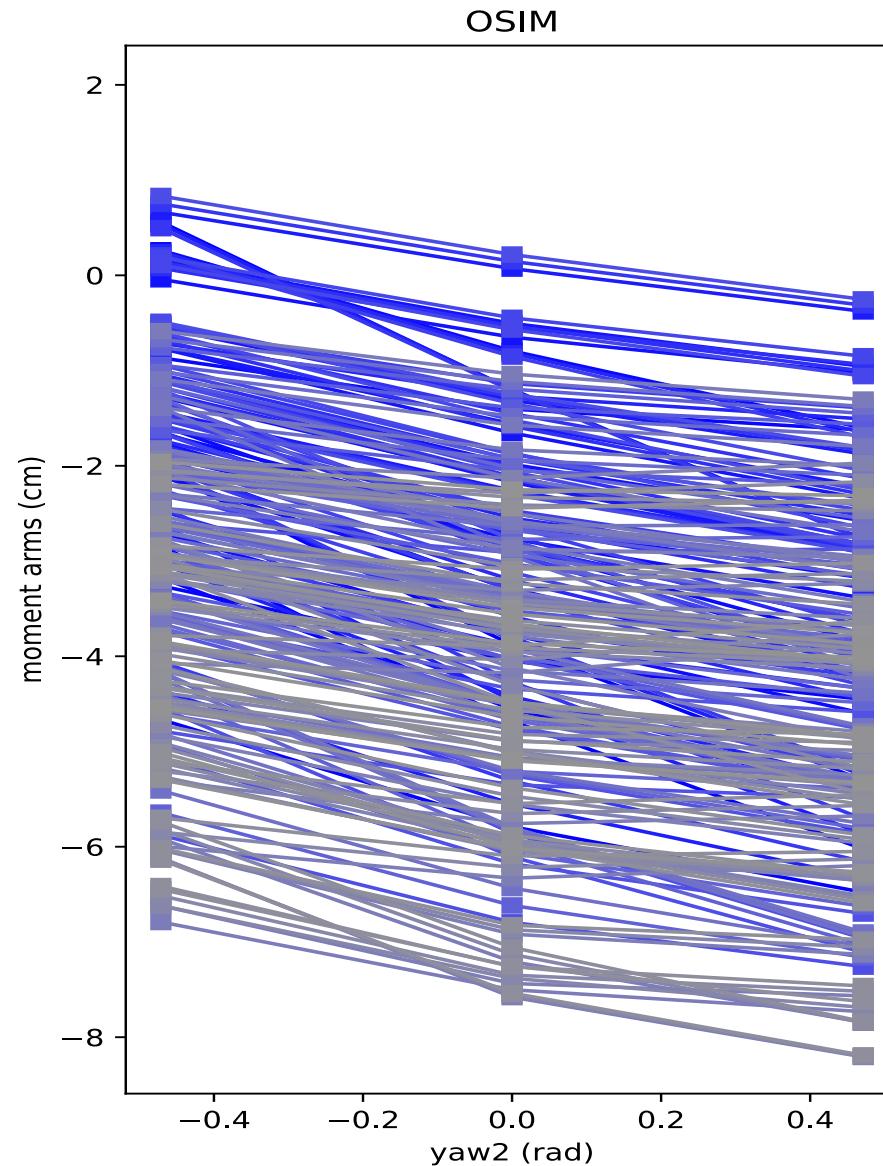
Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



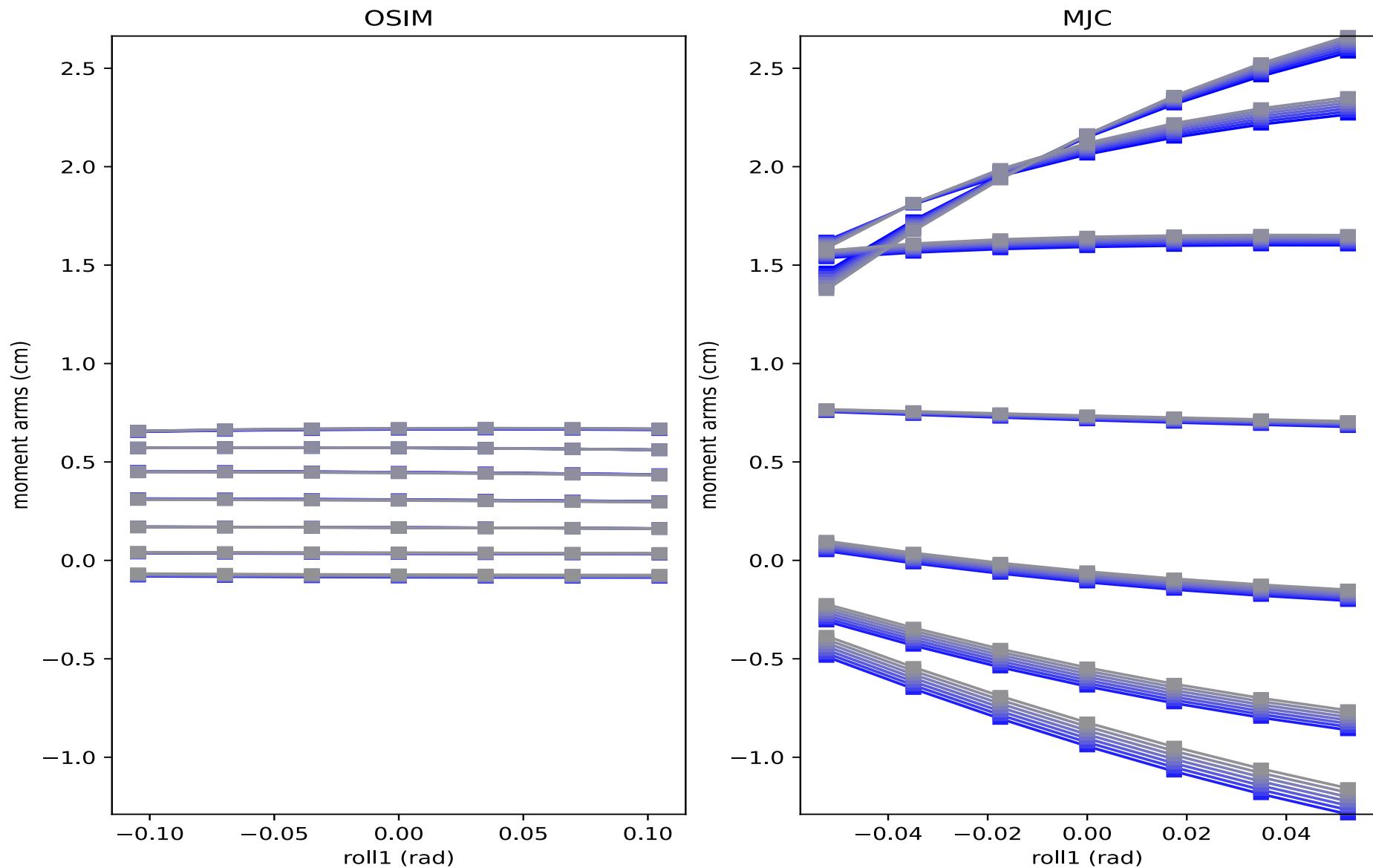
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



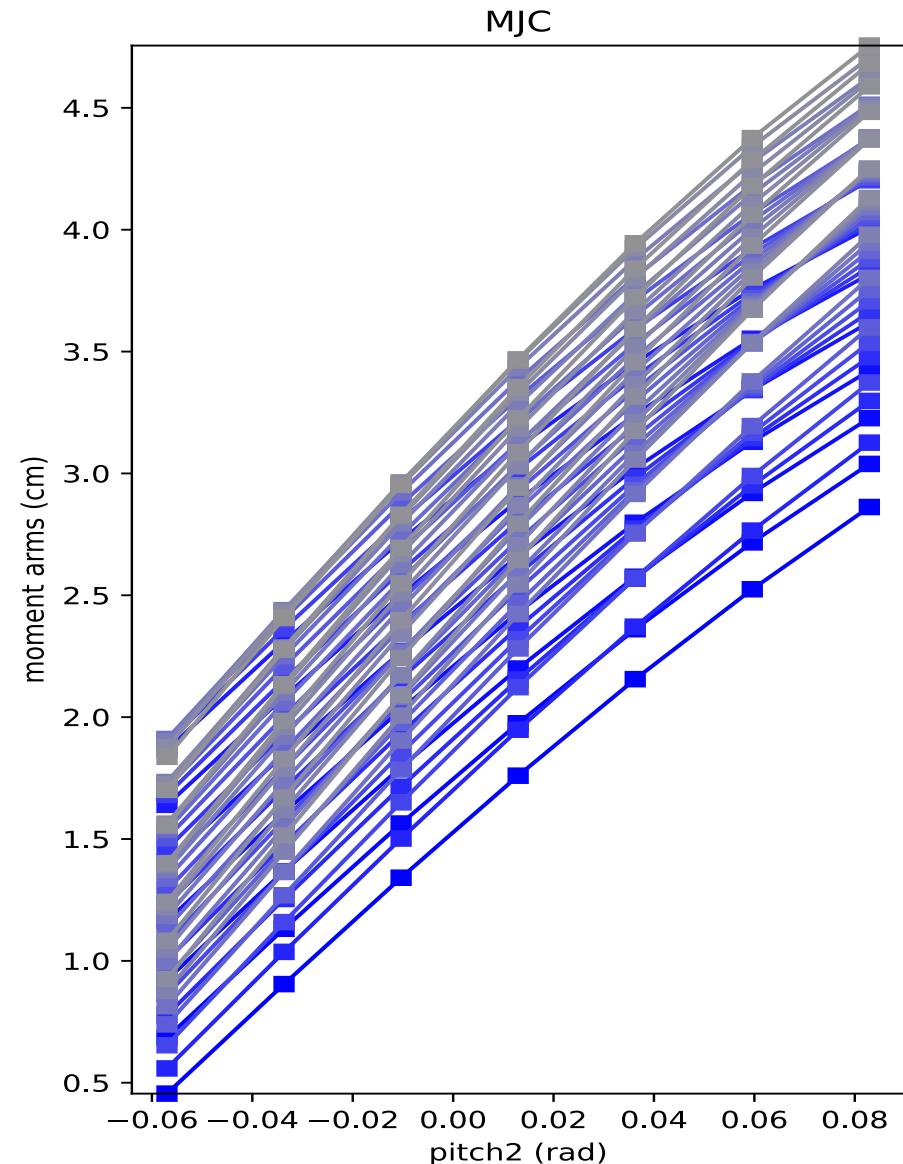
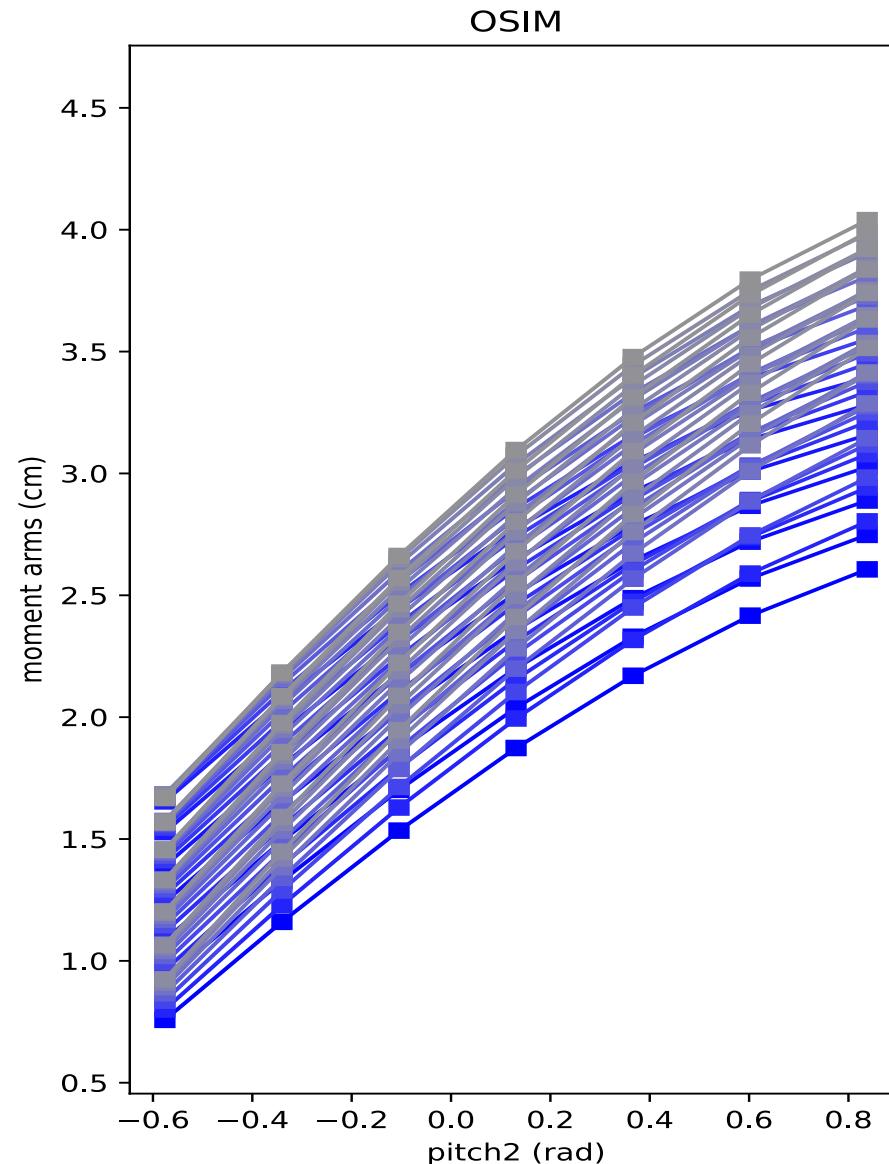
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch1 - roll1 - yaw1



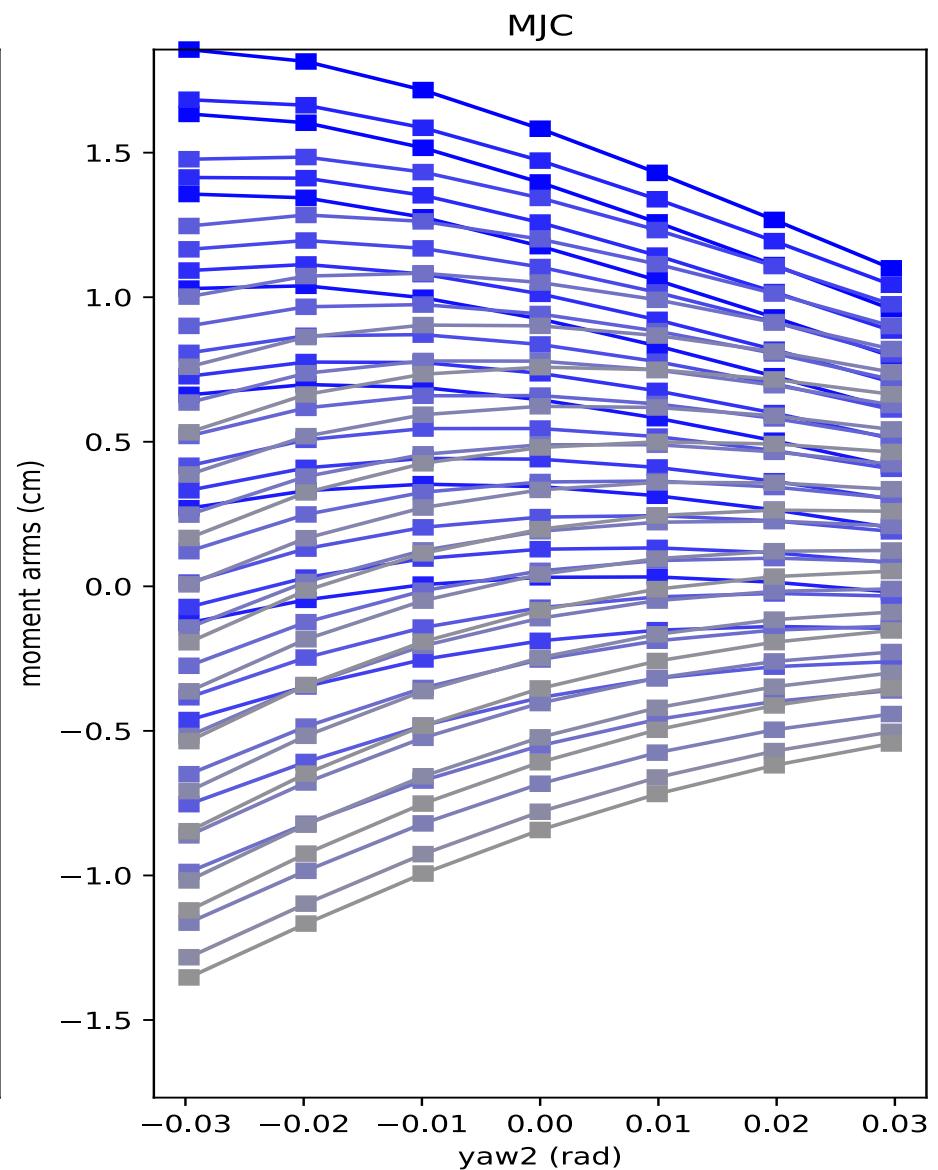
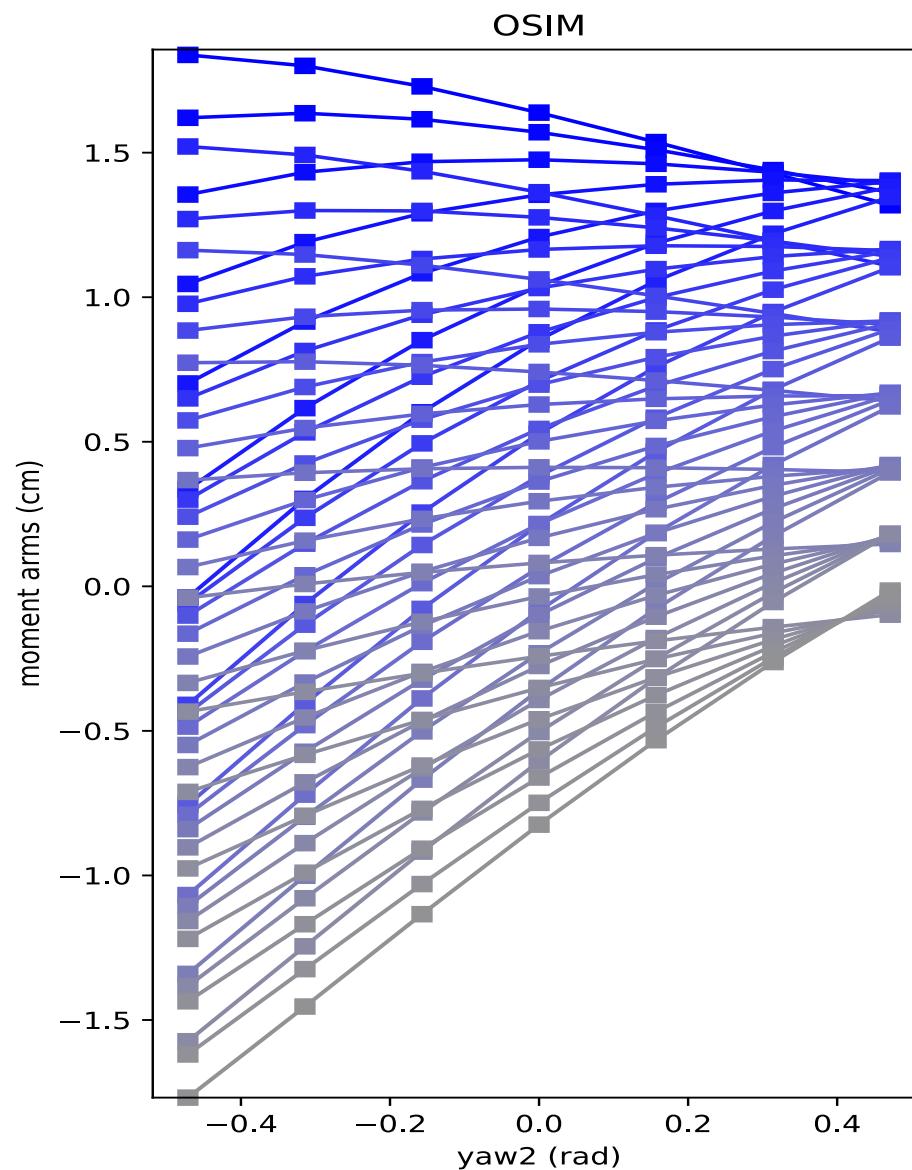
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx_L - pitch2 - roll2 - yaw2



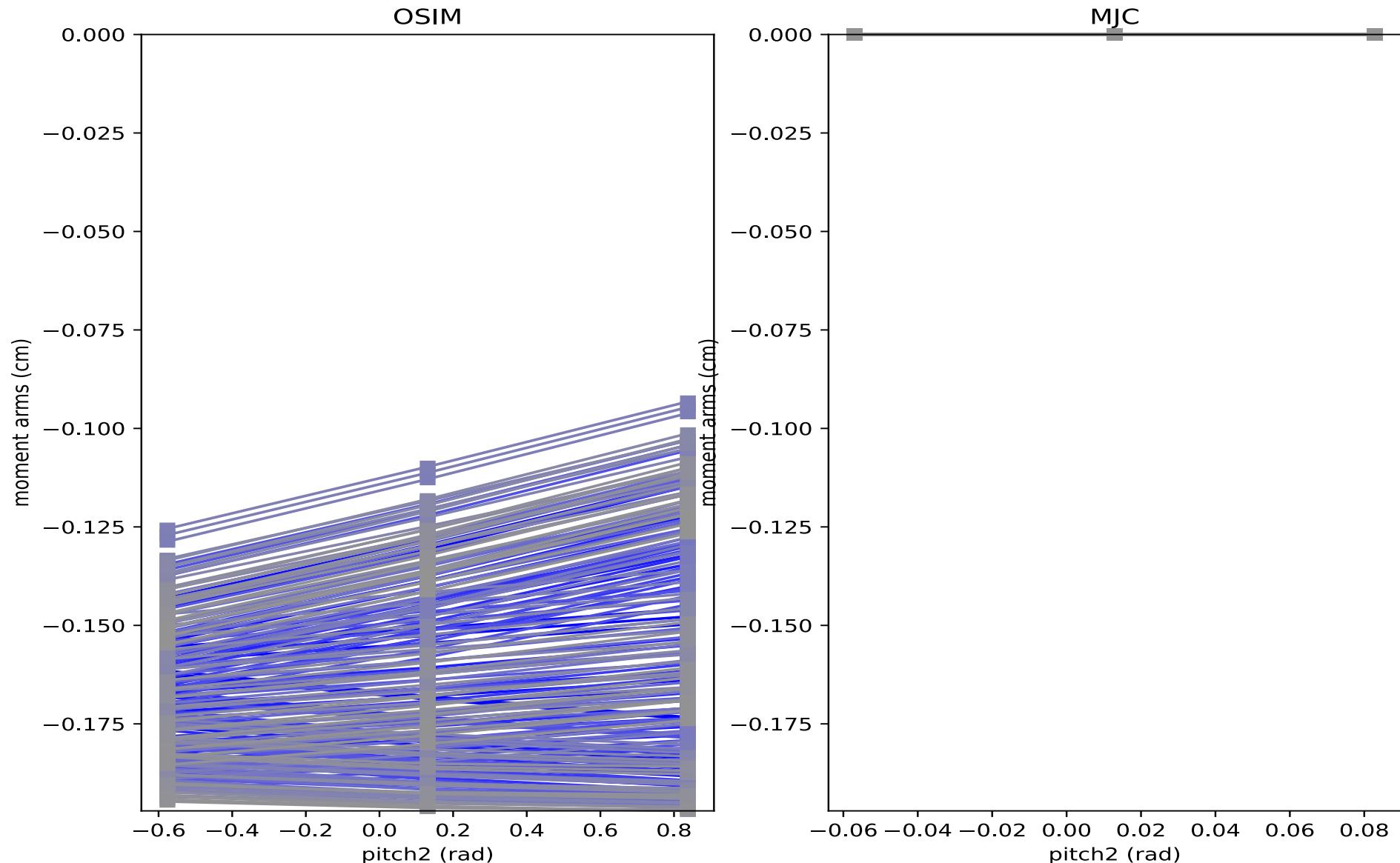
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid_L - pitch2 - roll2 - yaw2



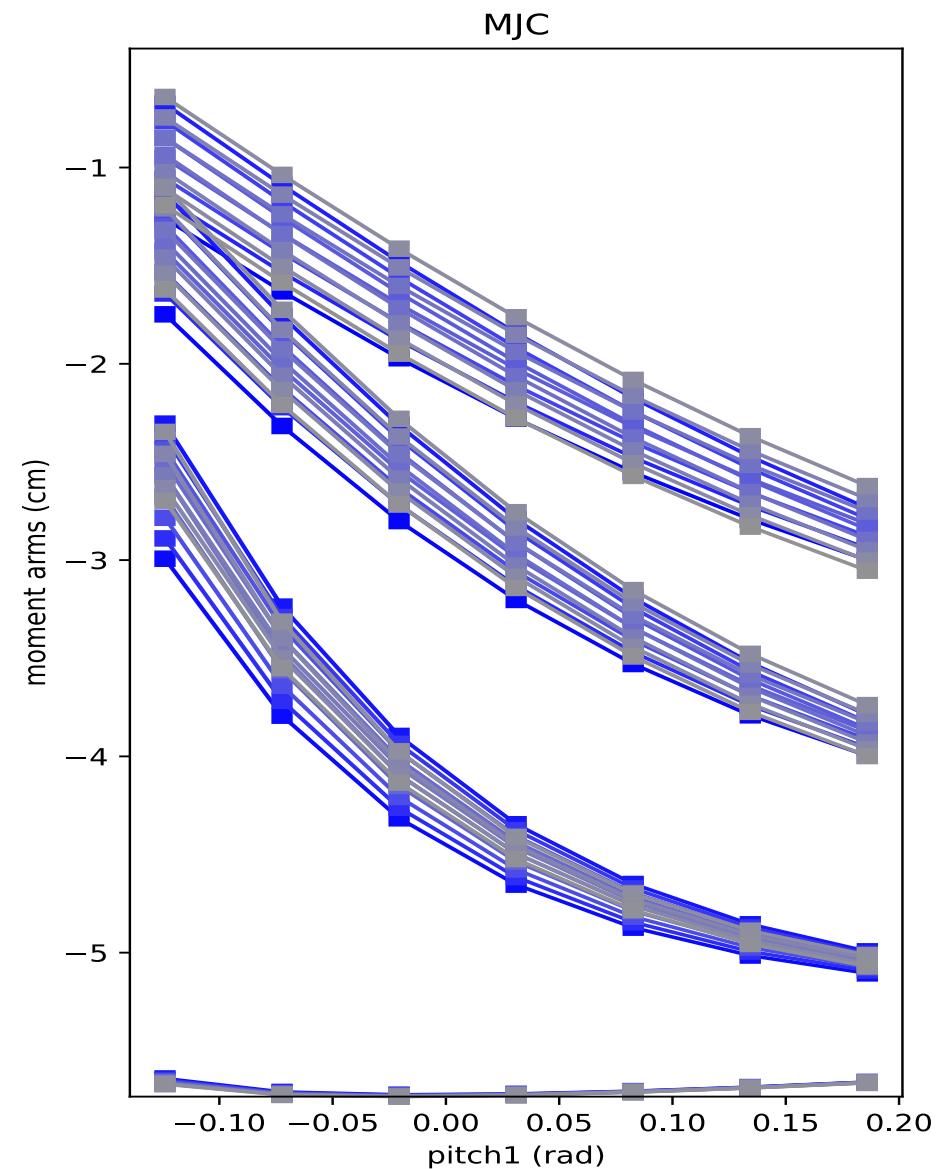
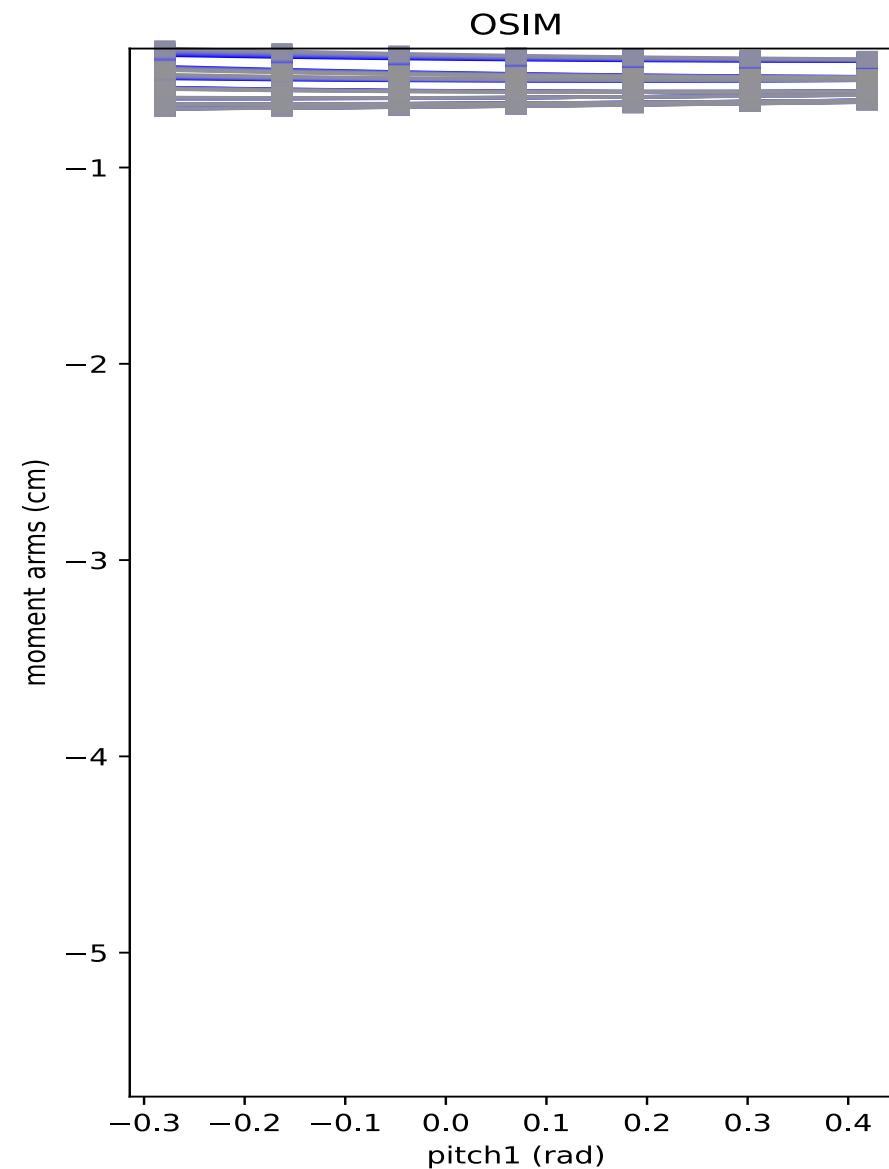
Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



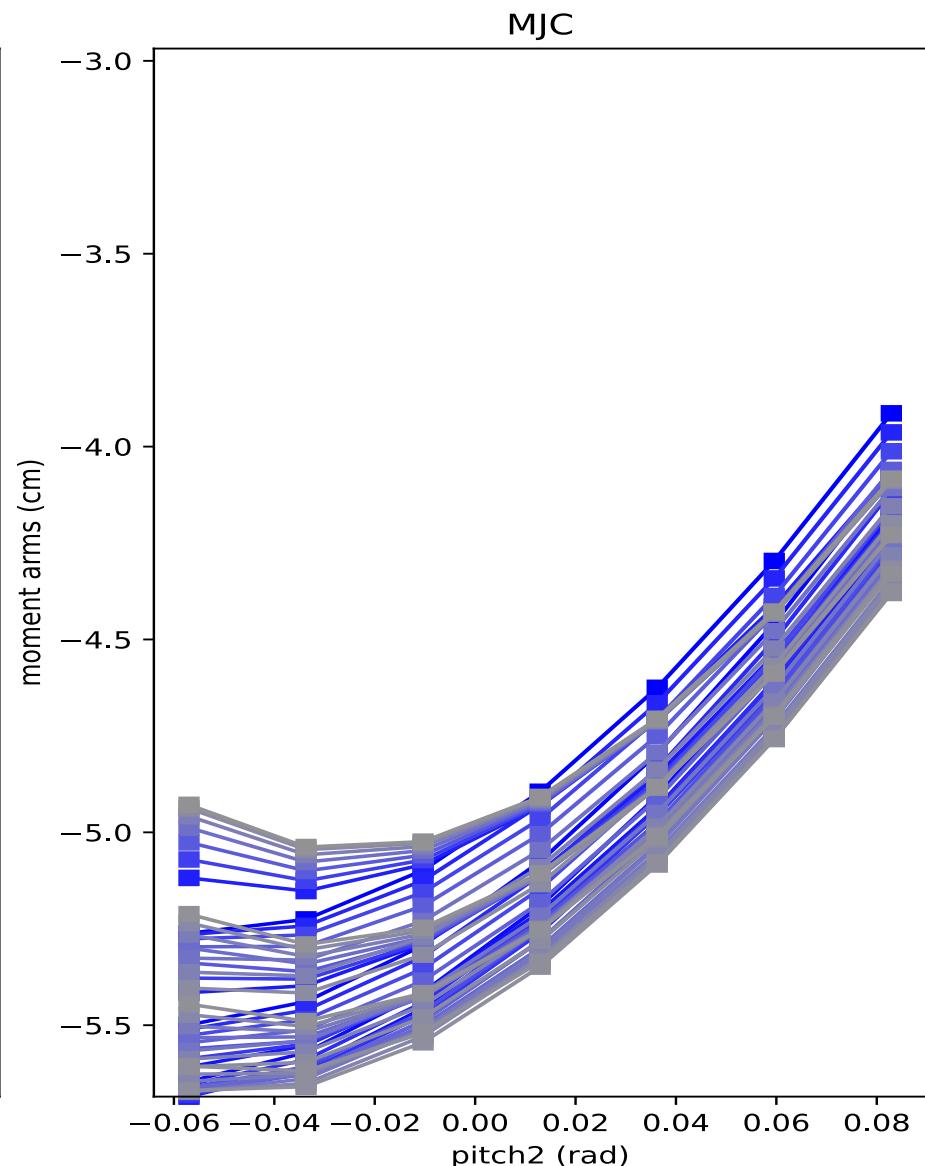
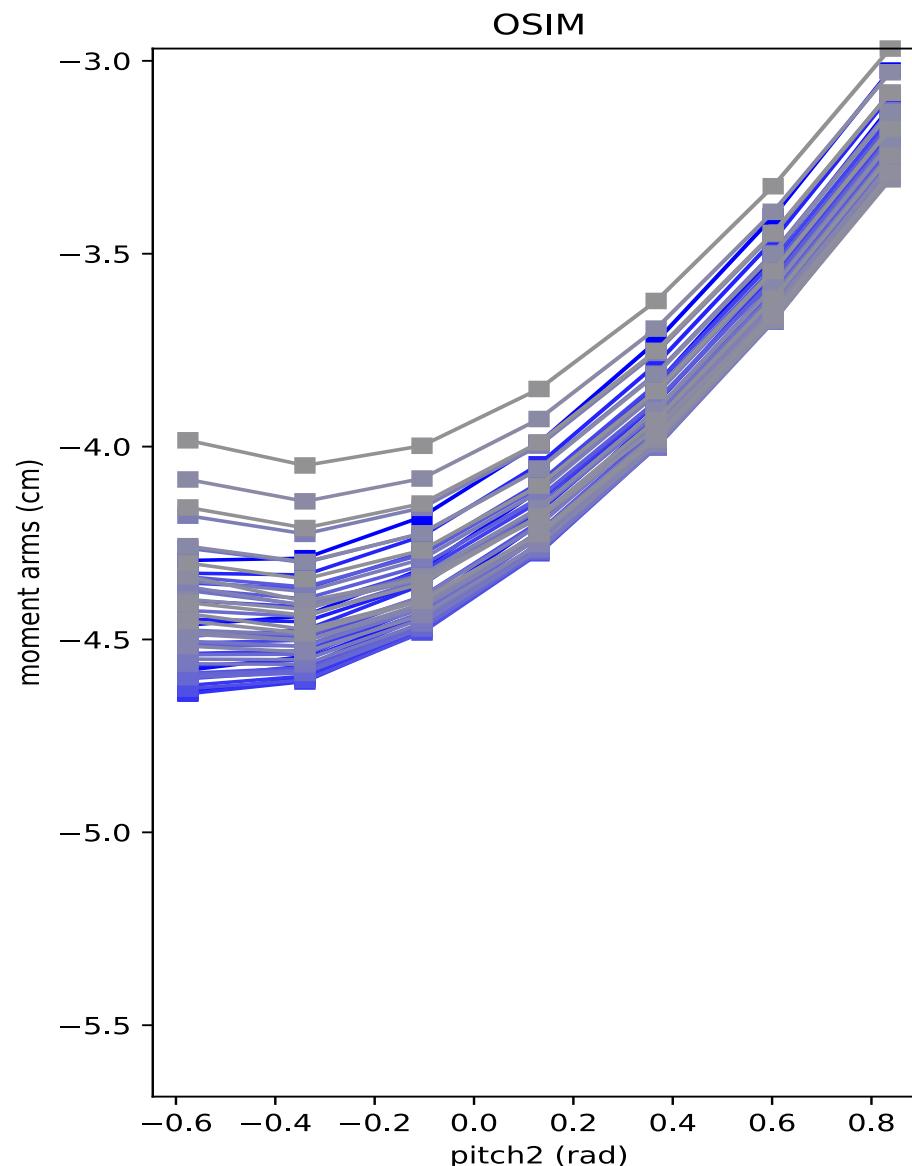
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch1 - roll1 - yaw1



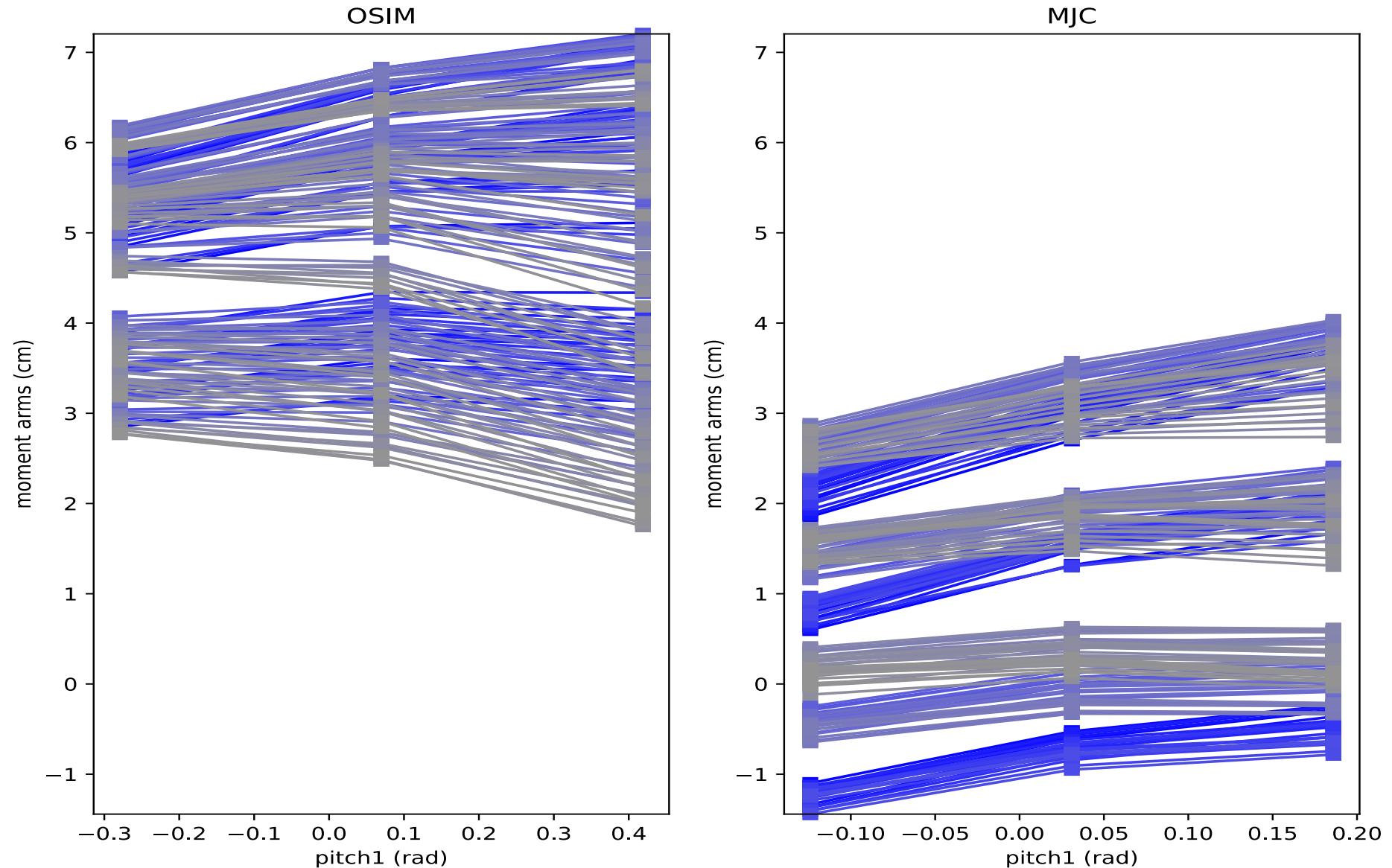
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid - pitch2 - roll2 - yaw2



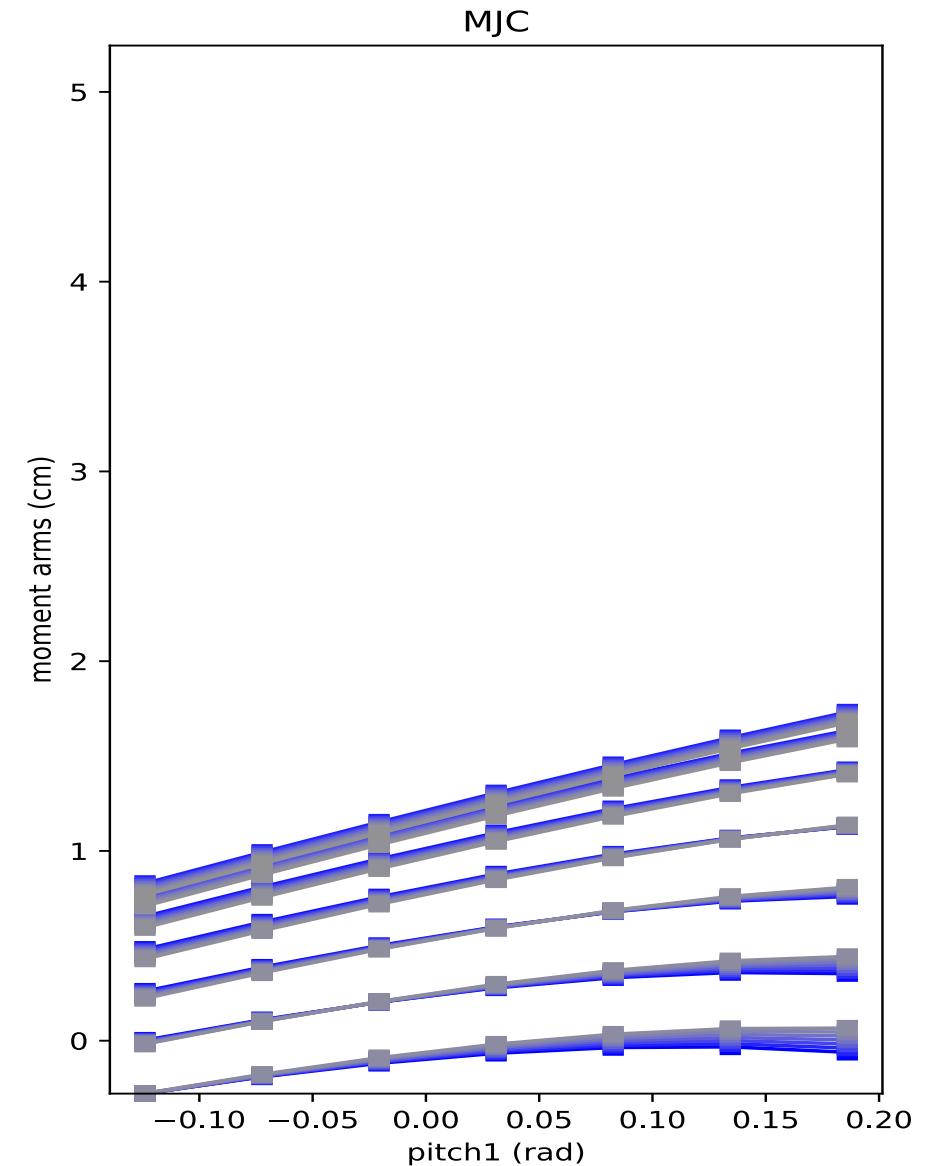
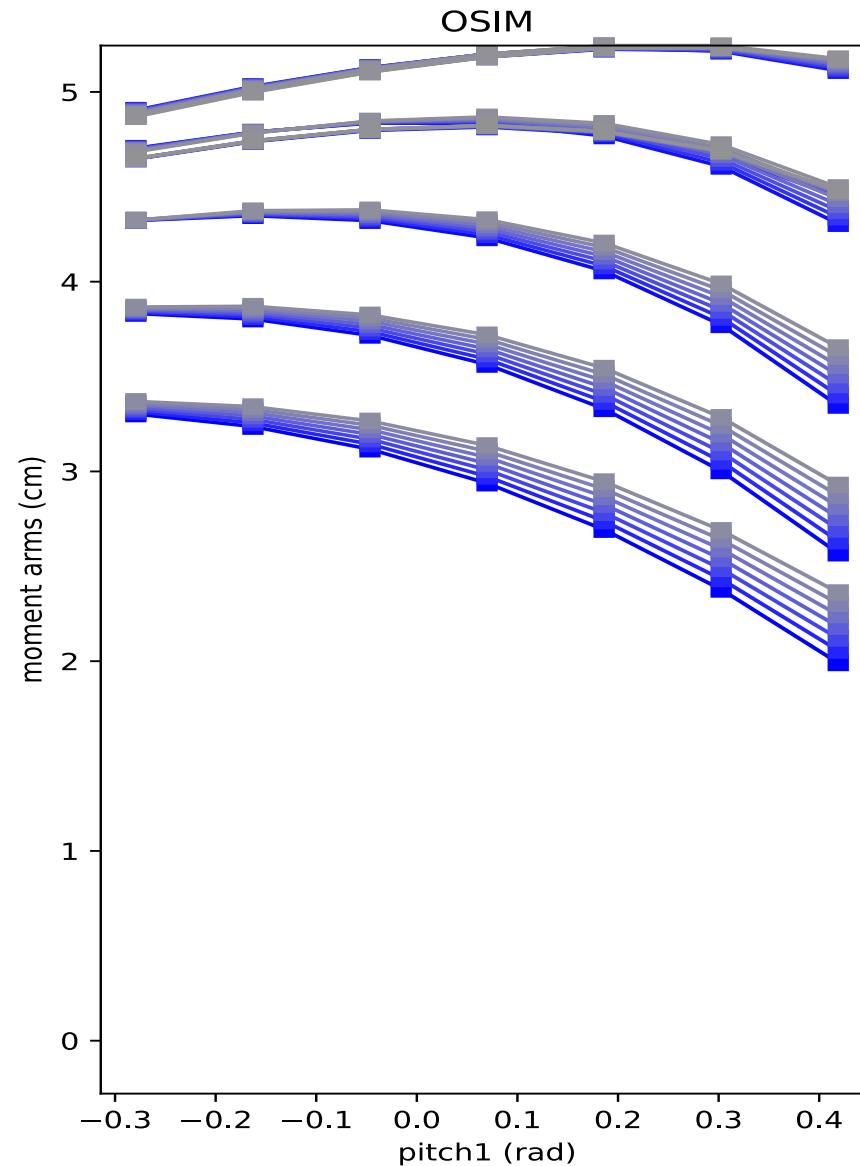
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



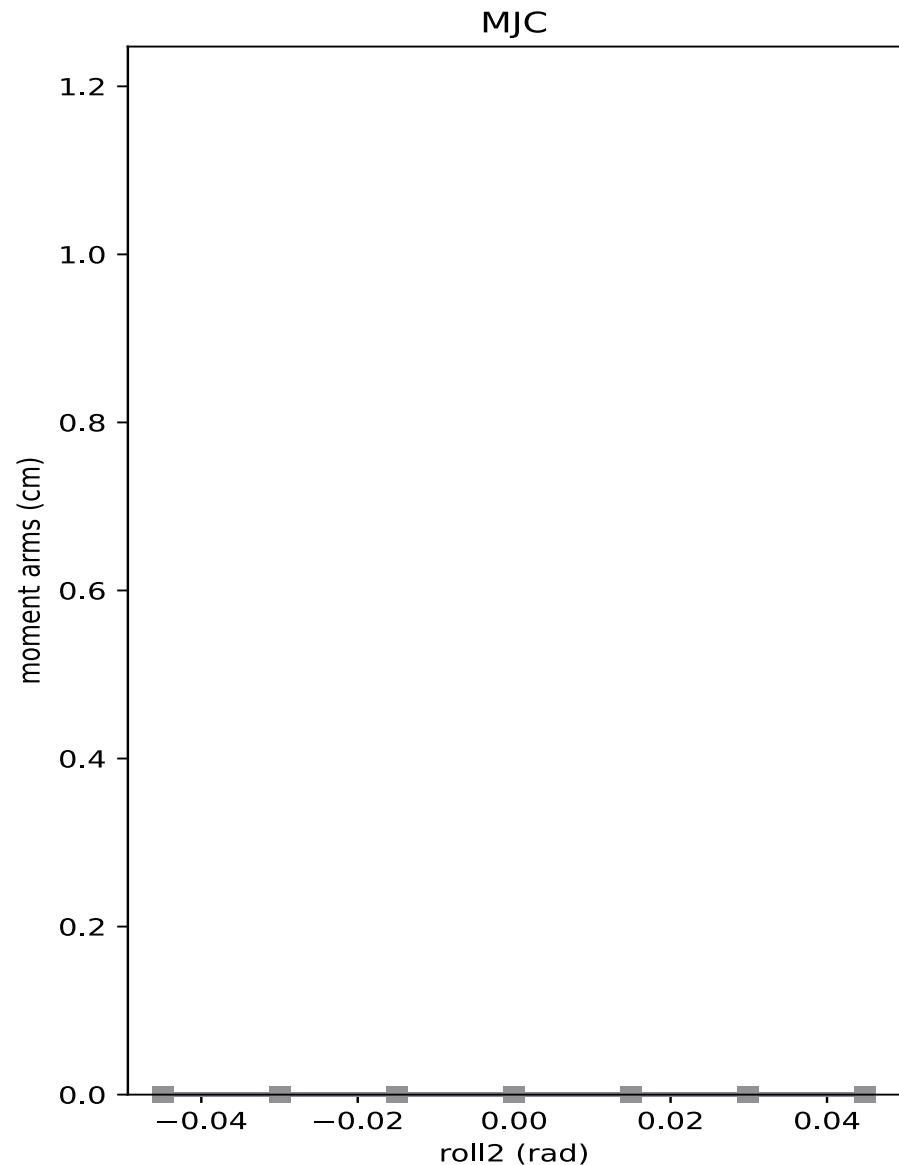
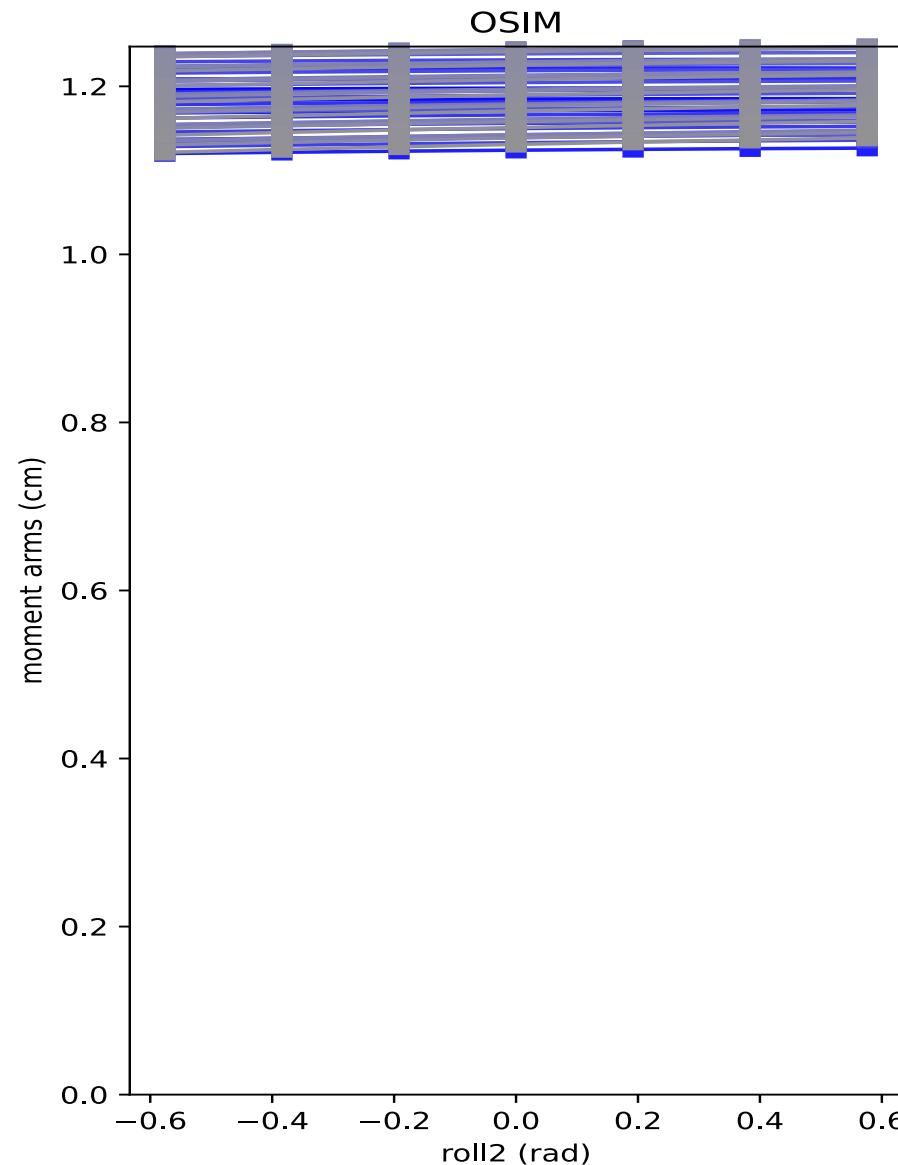
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj_L - pitch1 - roll1 - yaw1



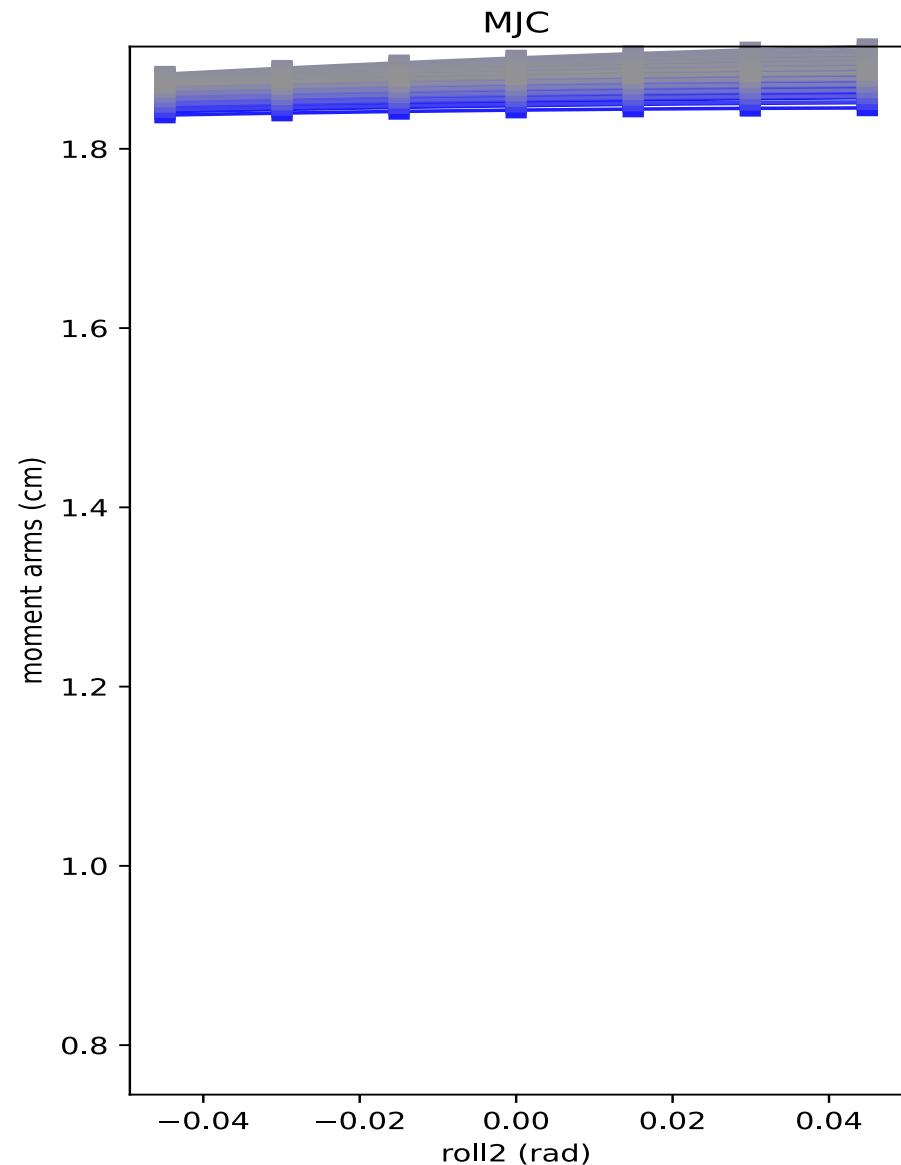
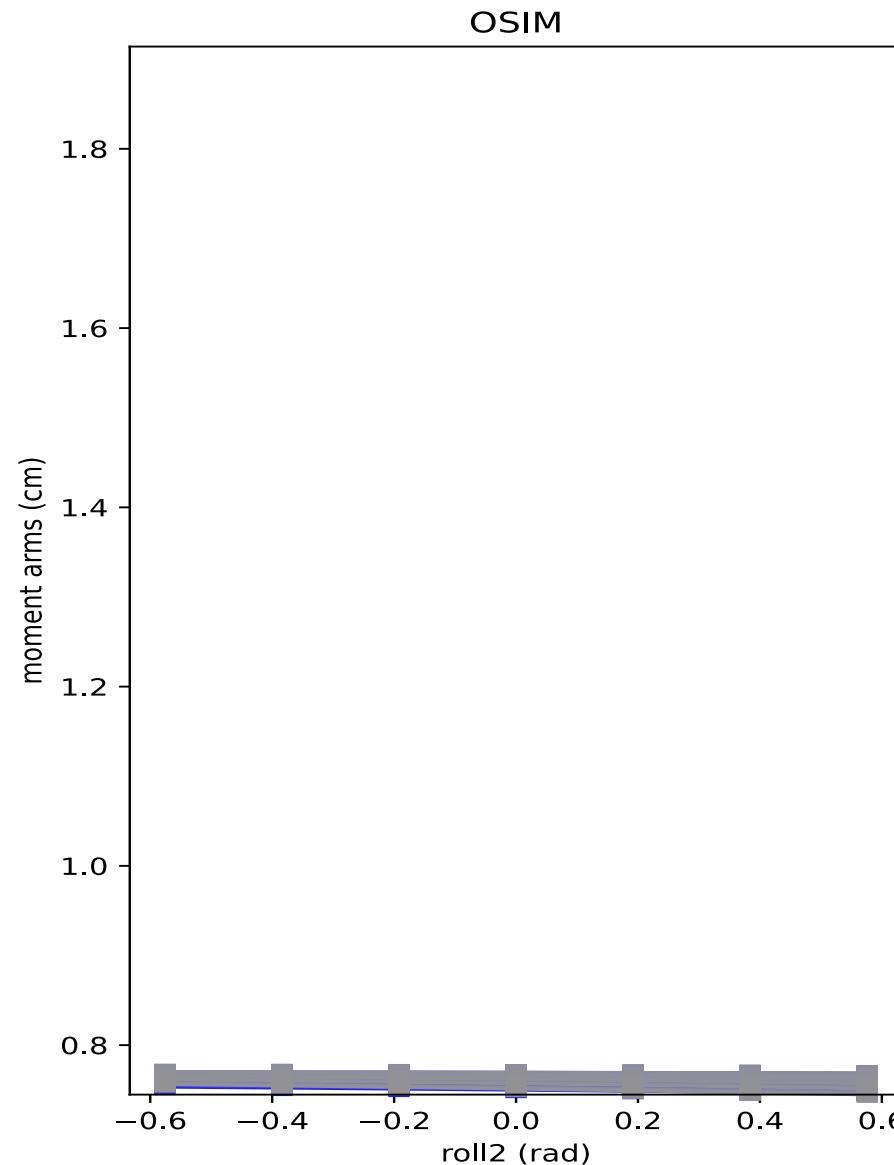
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch2 - roll2 - yaw2



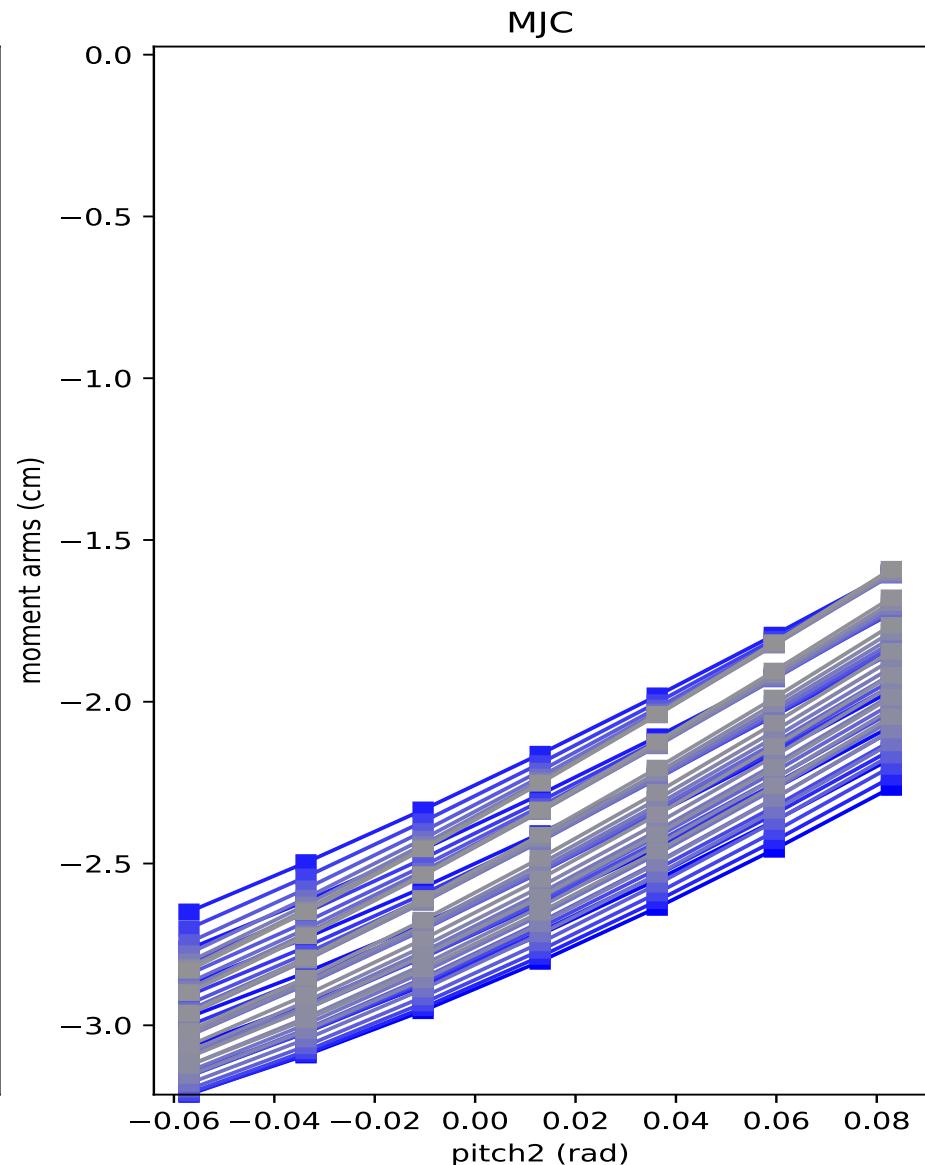
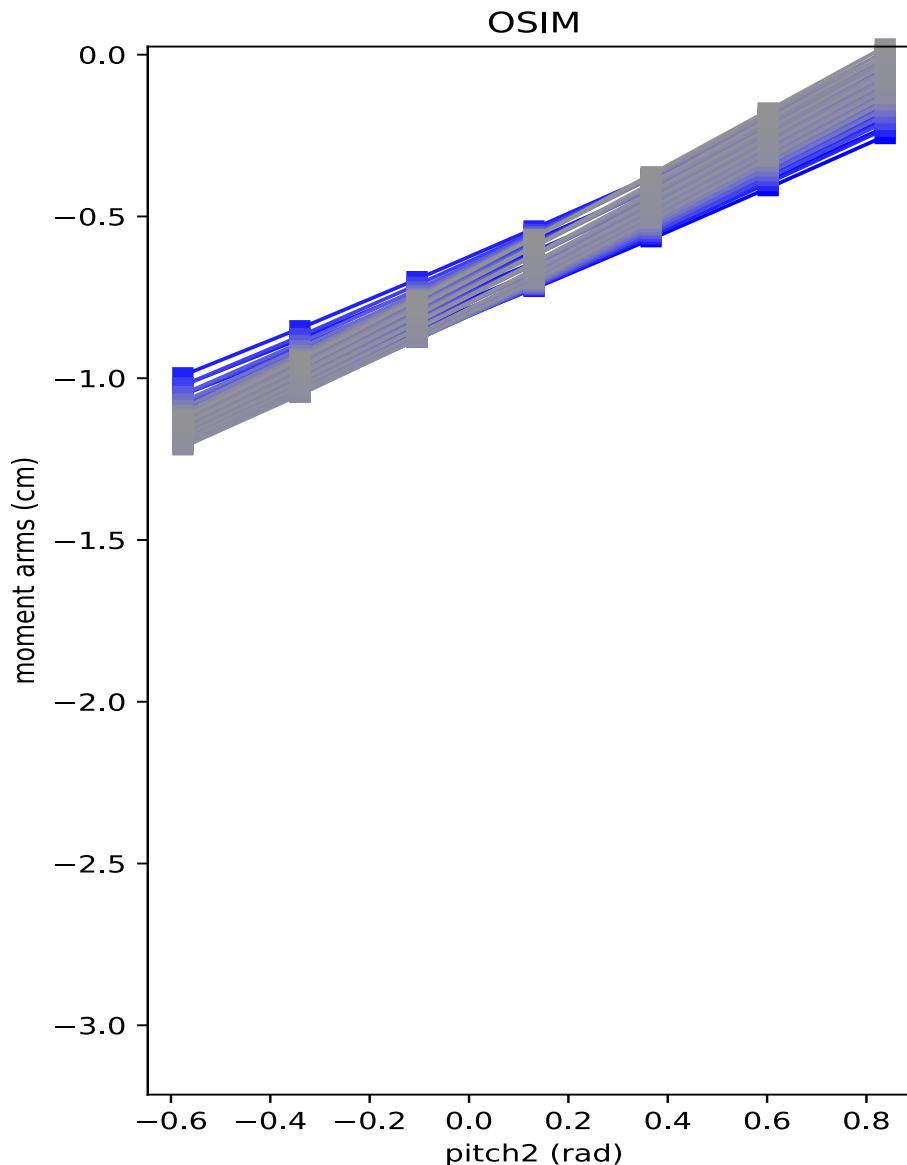
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx - pitch2 - roll2 - yaw2



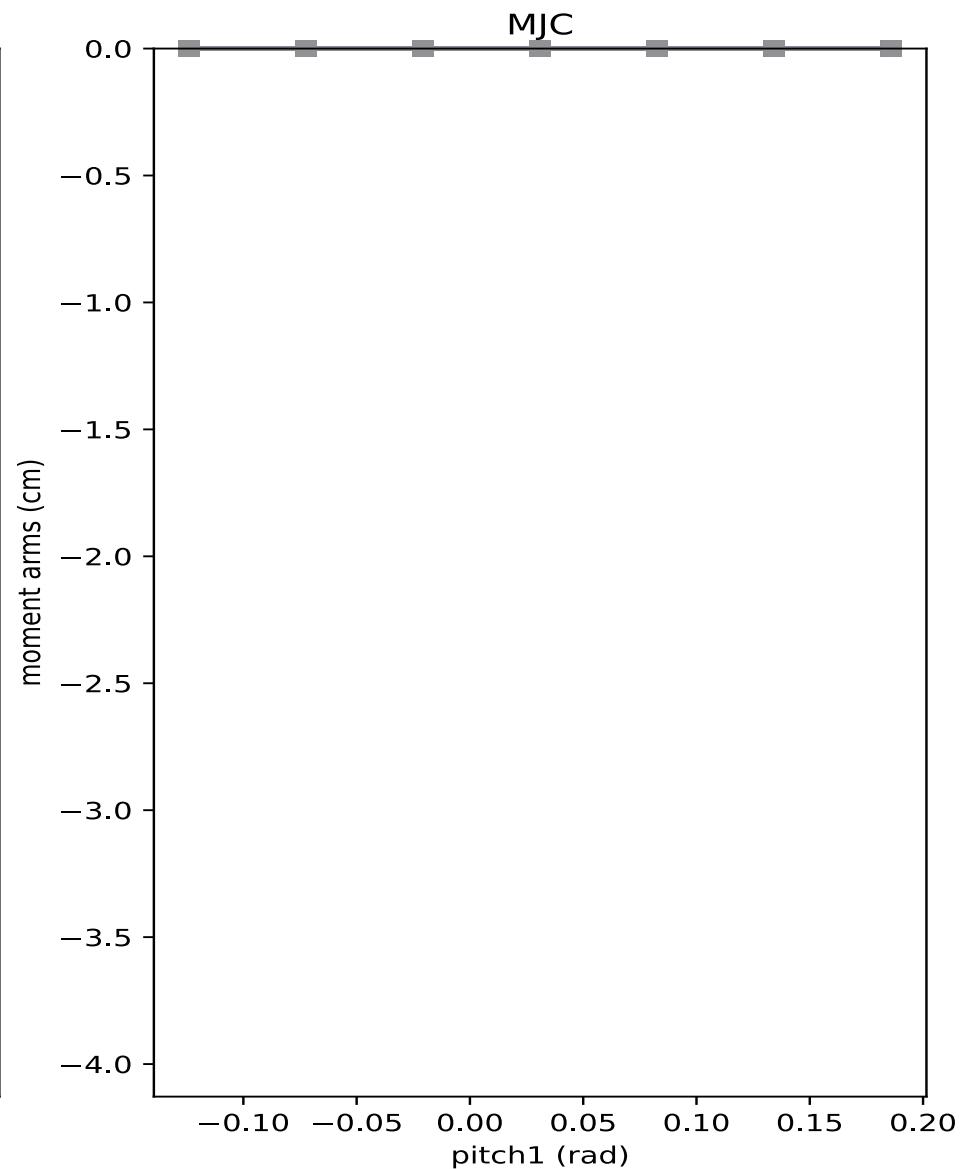
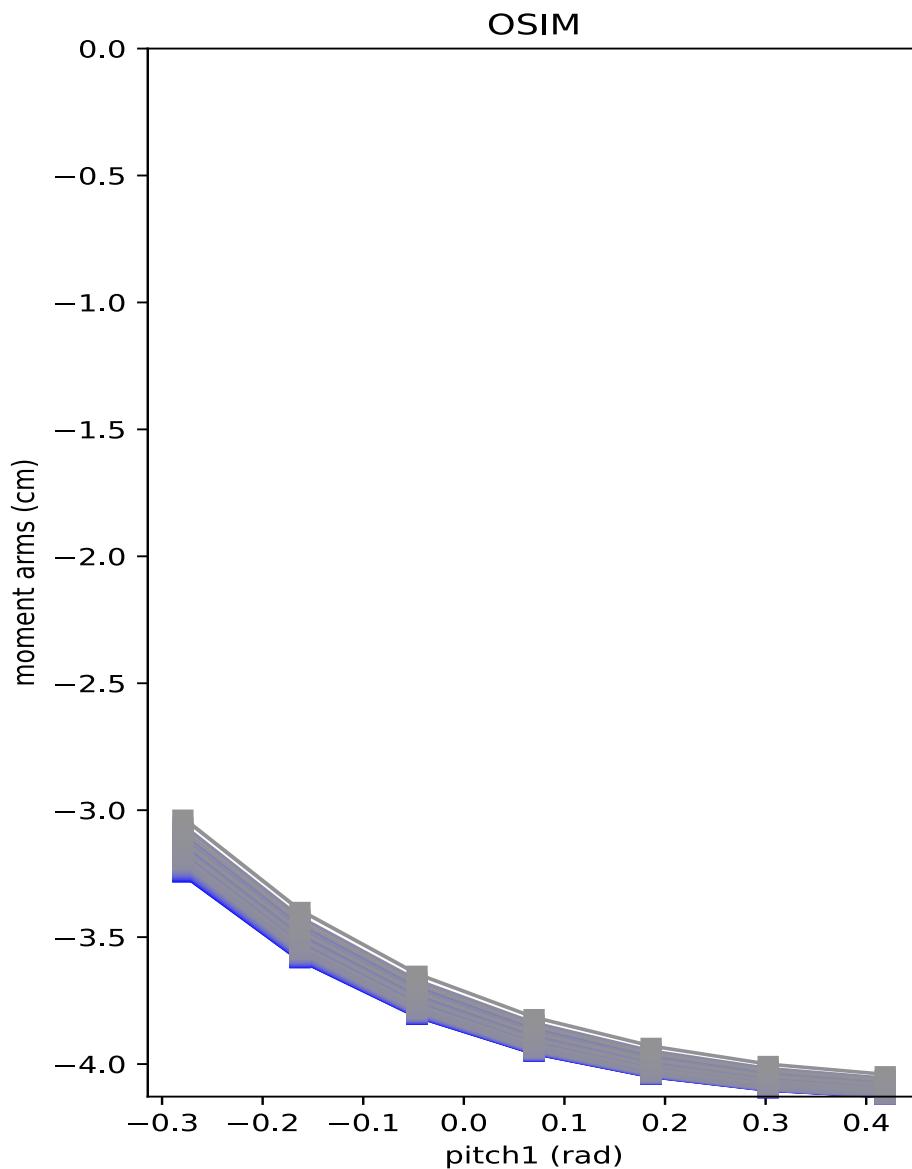
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant_L - pitch2 - roll2 - yaw2



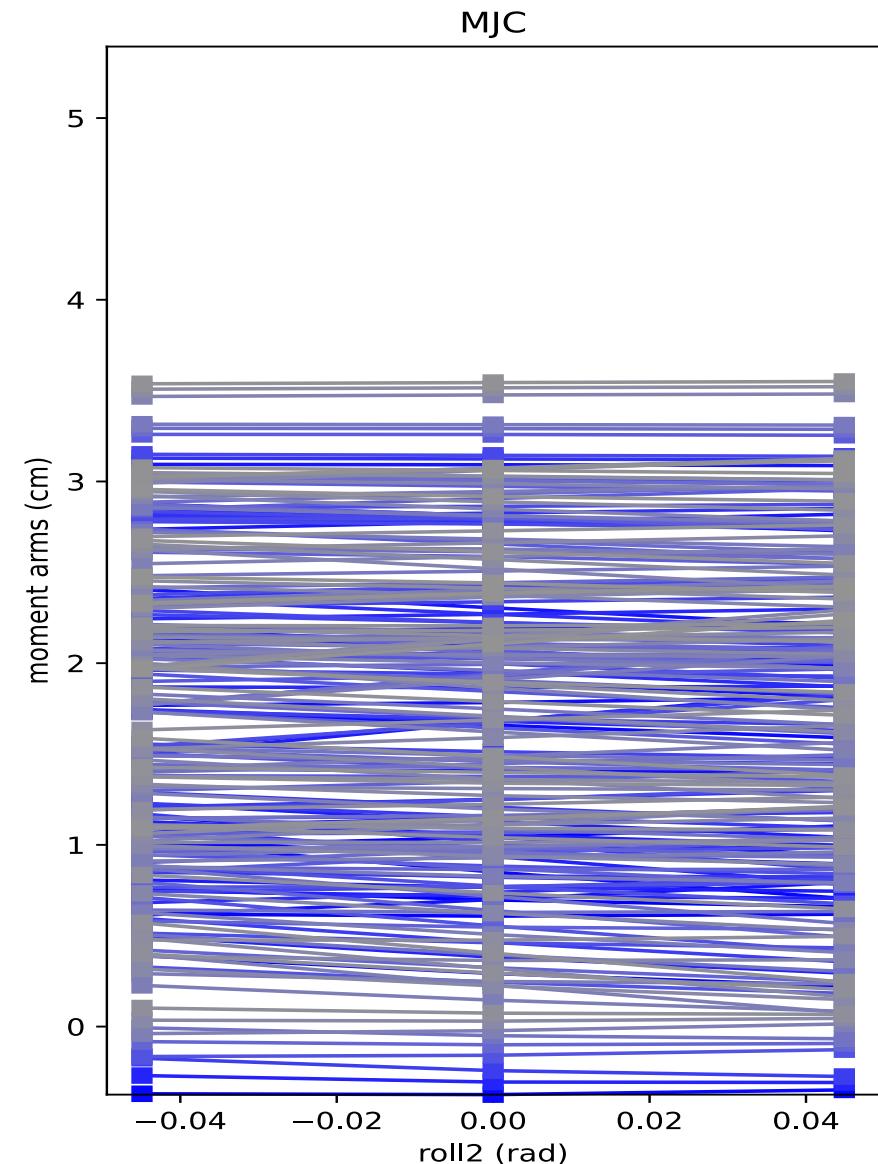
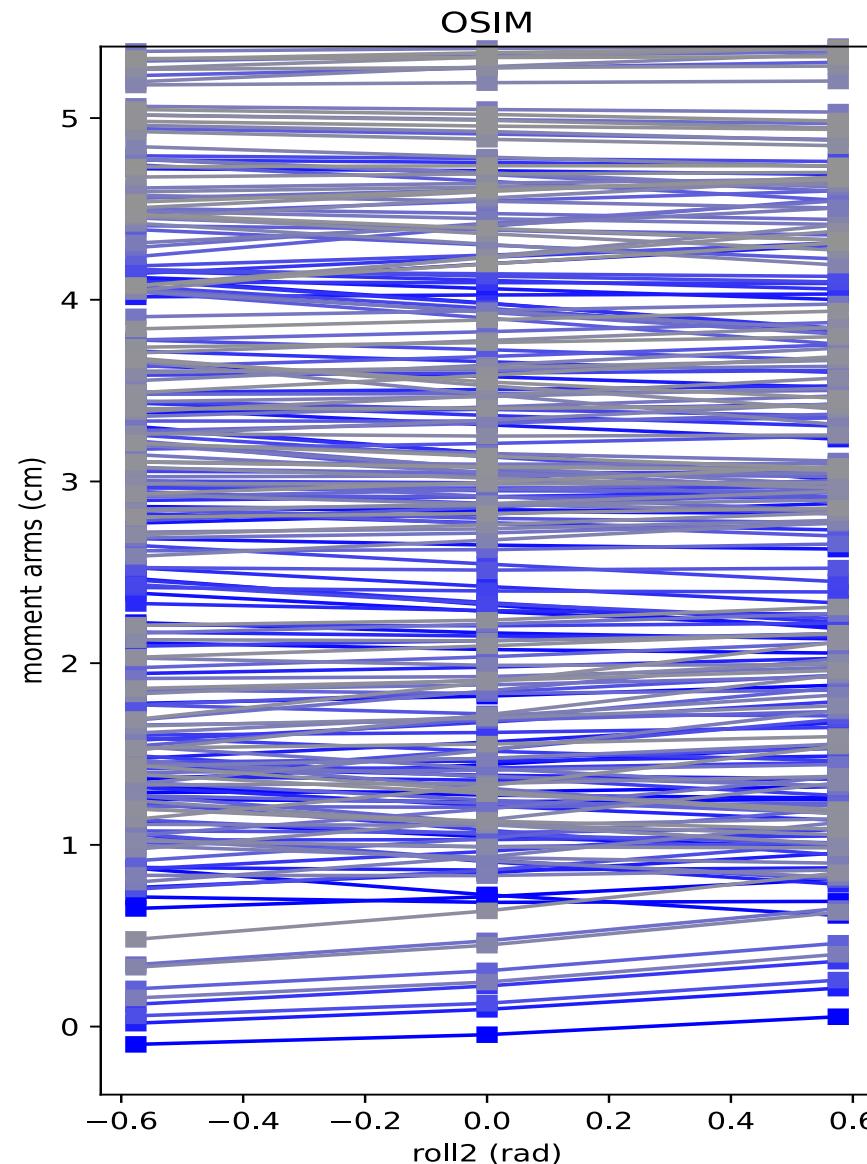
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid - pitch1 - roll1 - yaw1



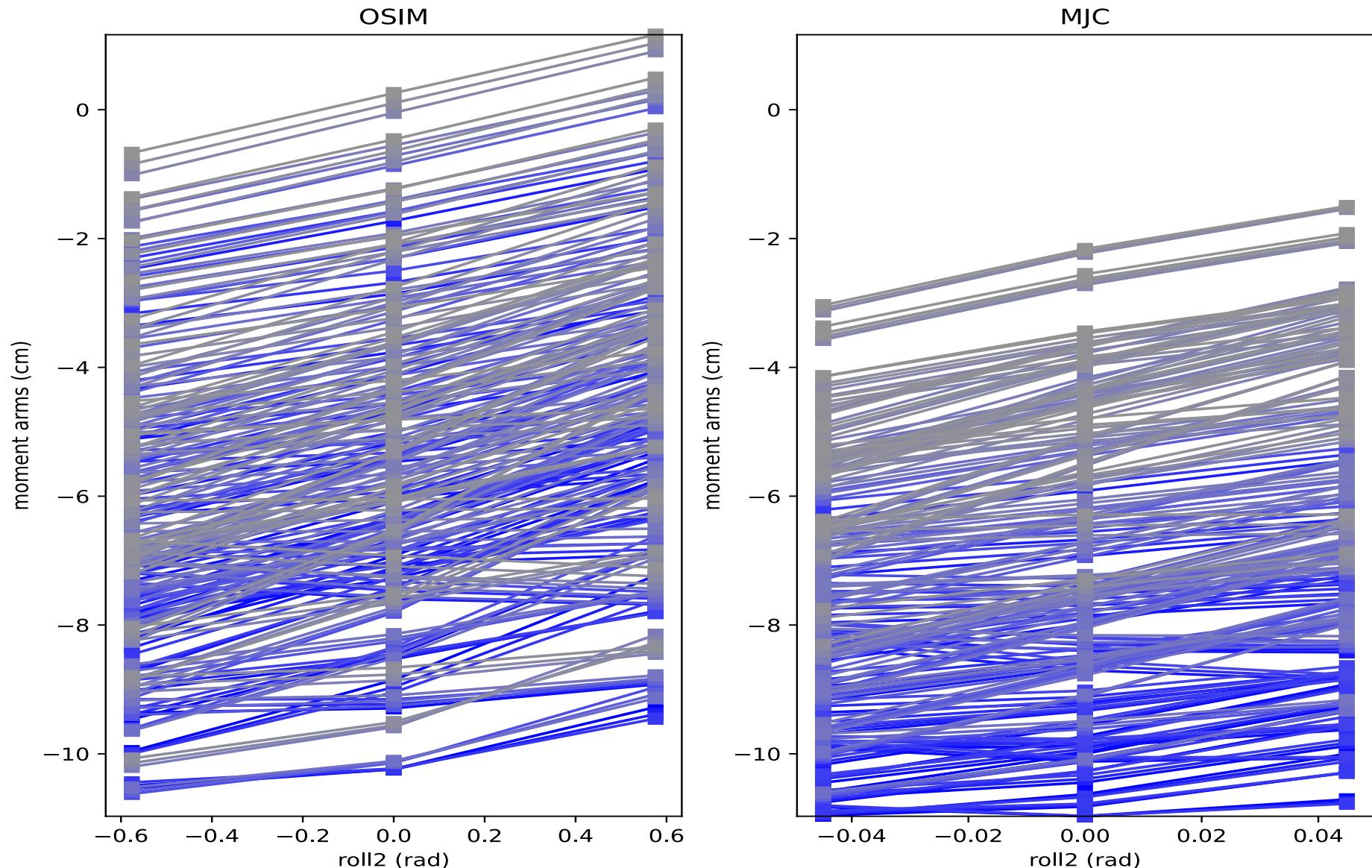
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



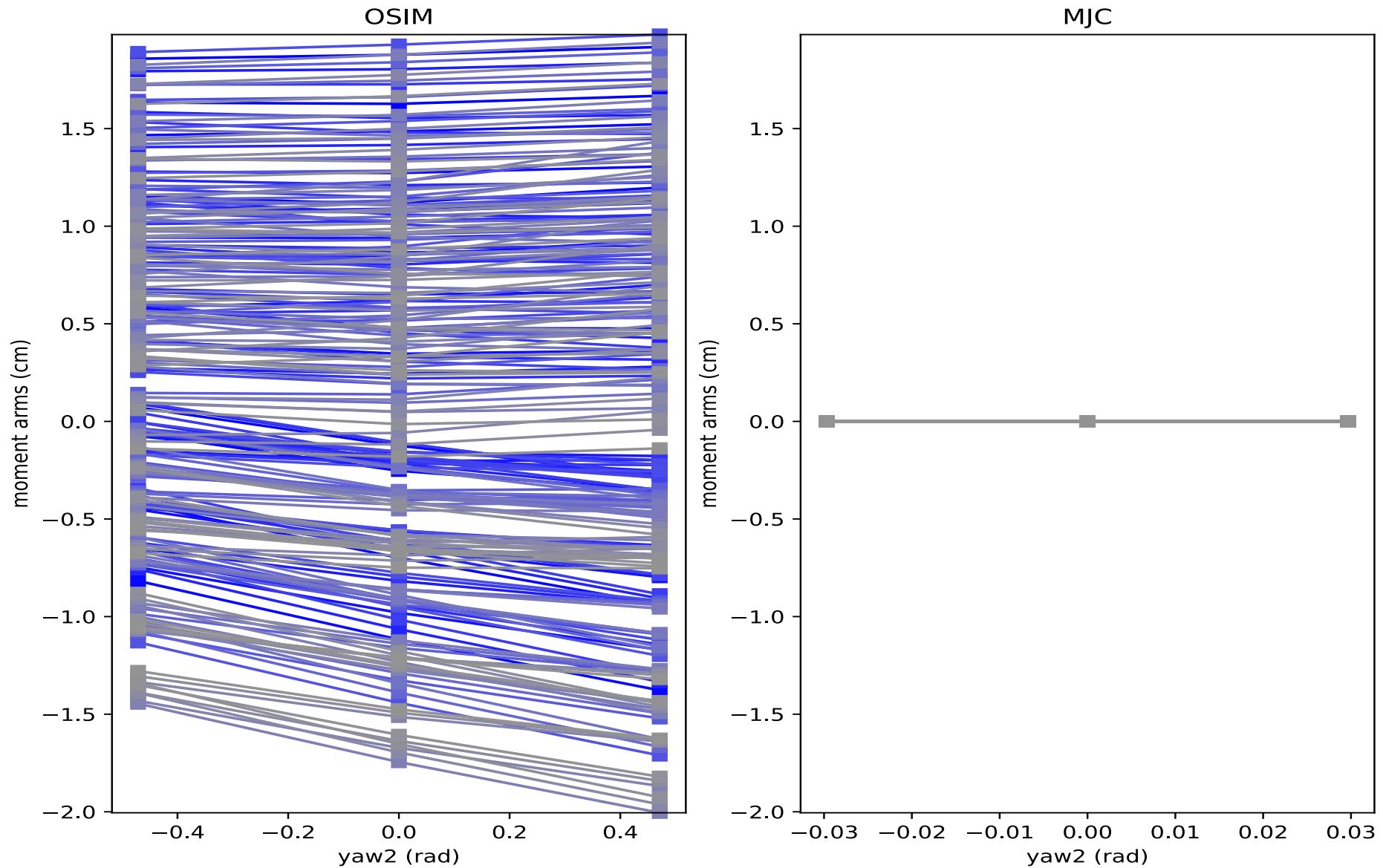
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



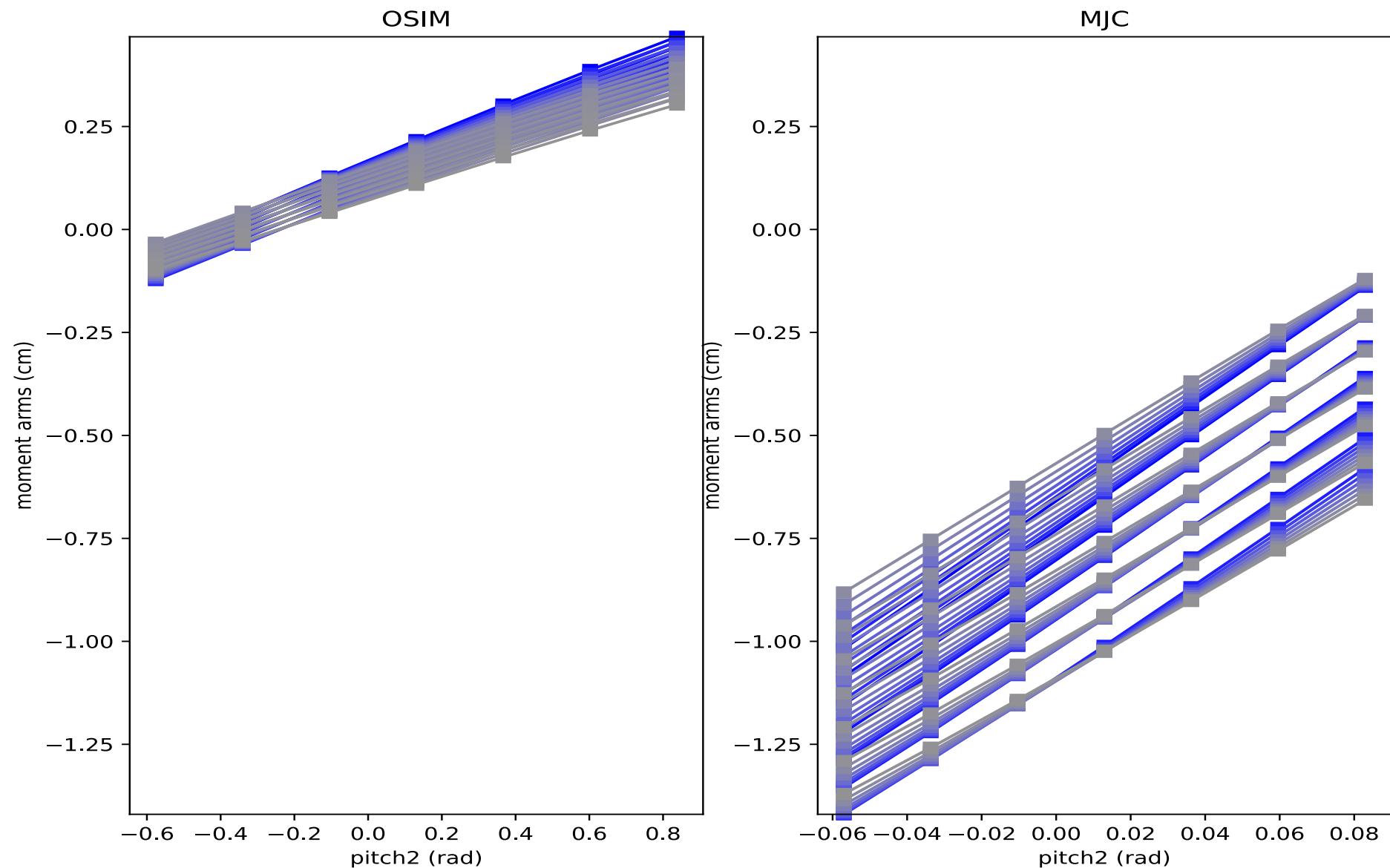
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



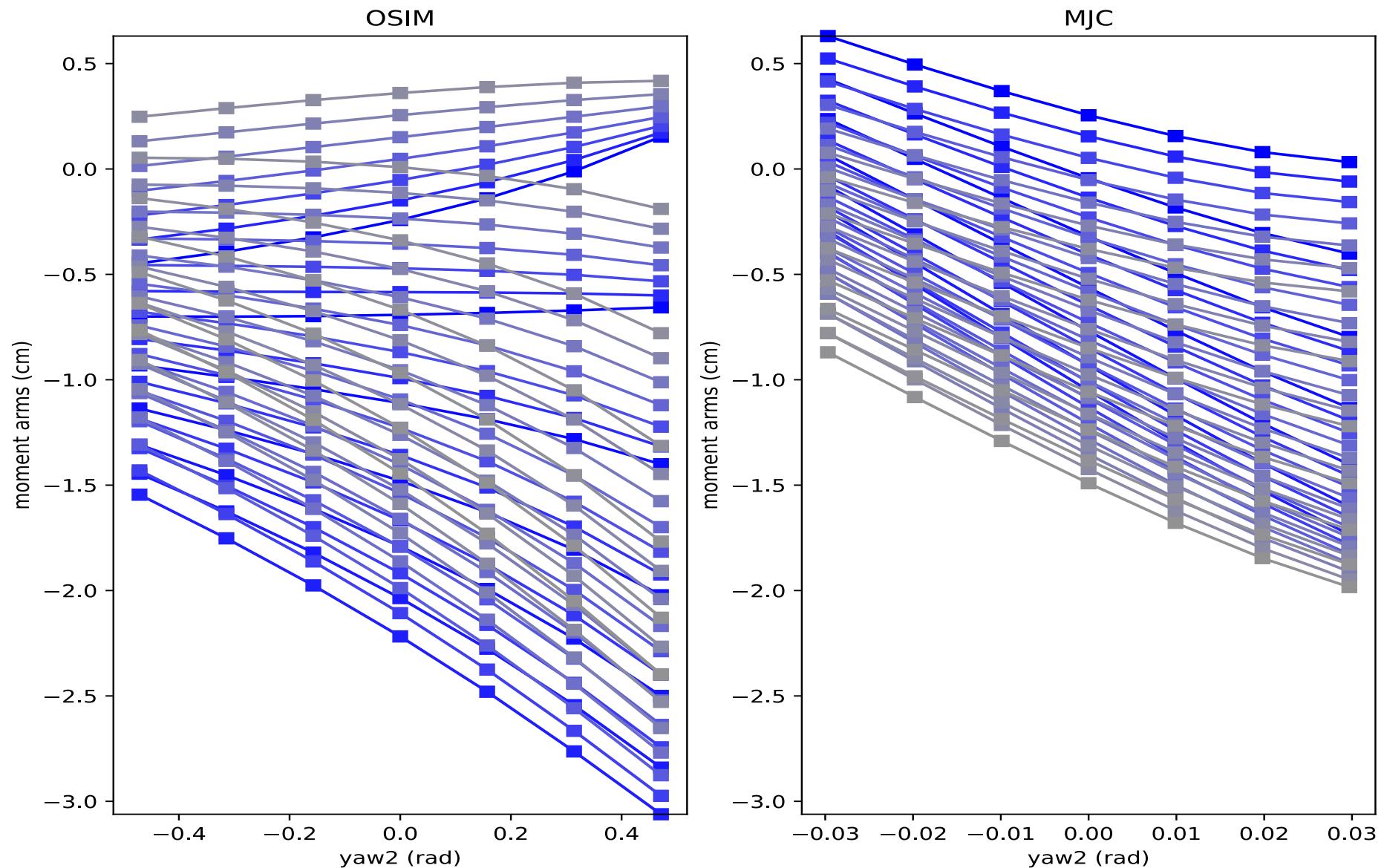
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post - pitch2 - roll2 - yaw2



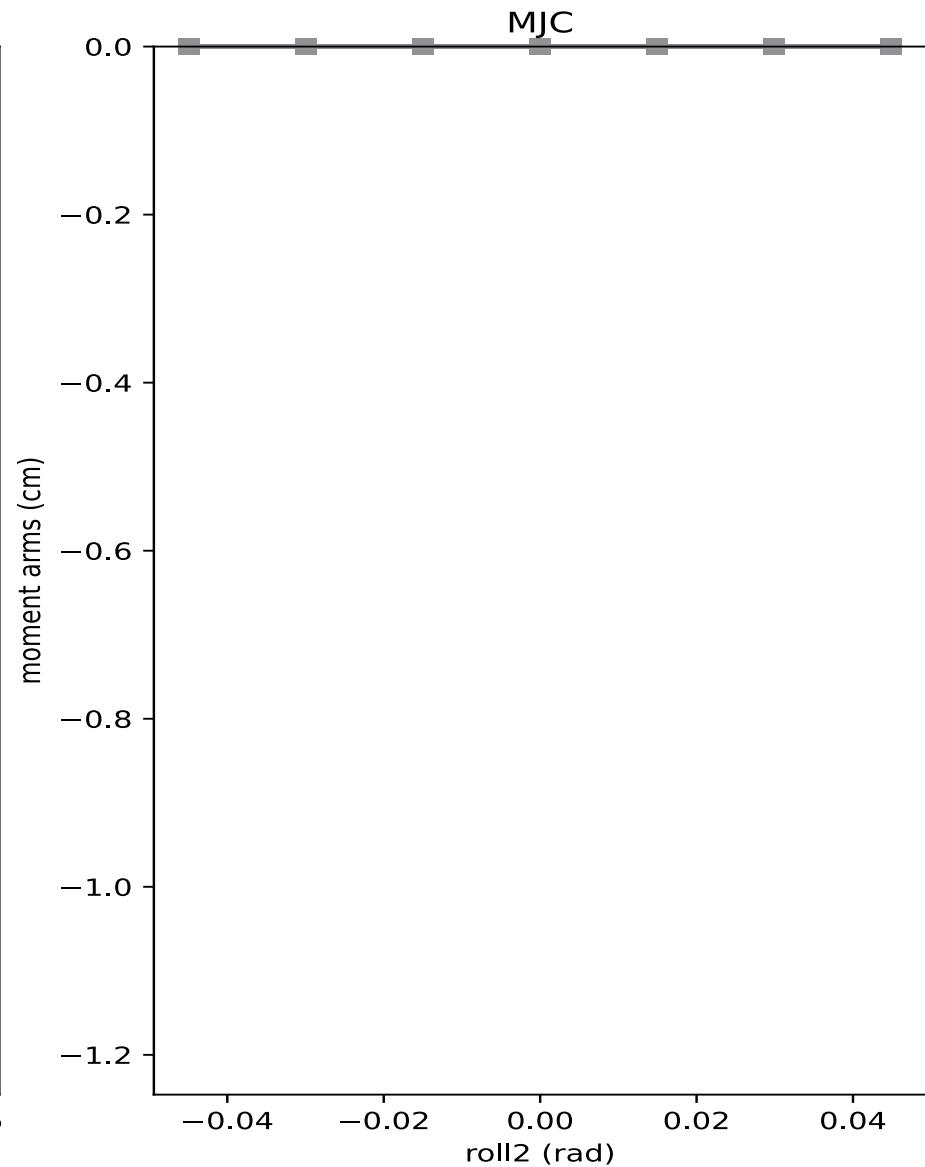
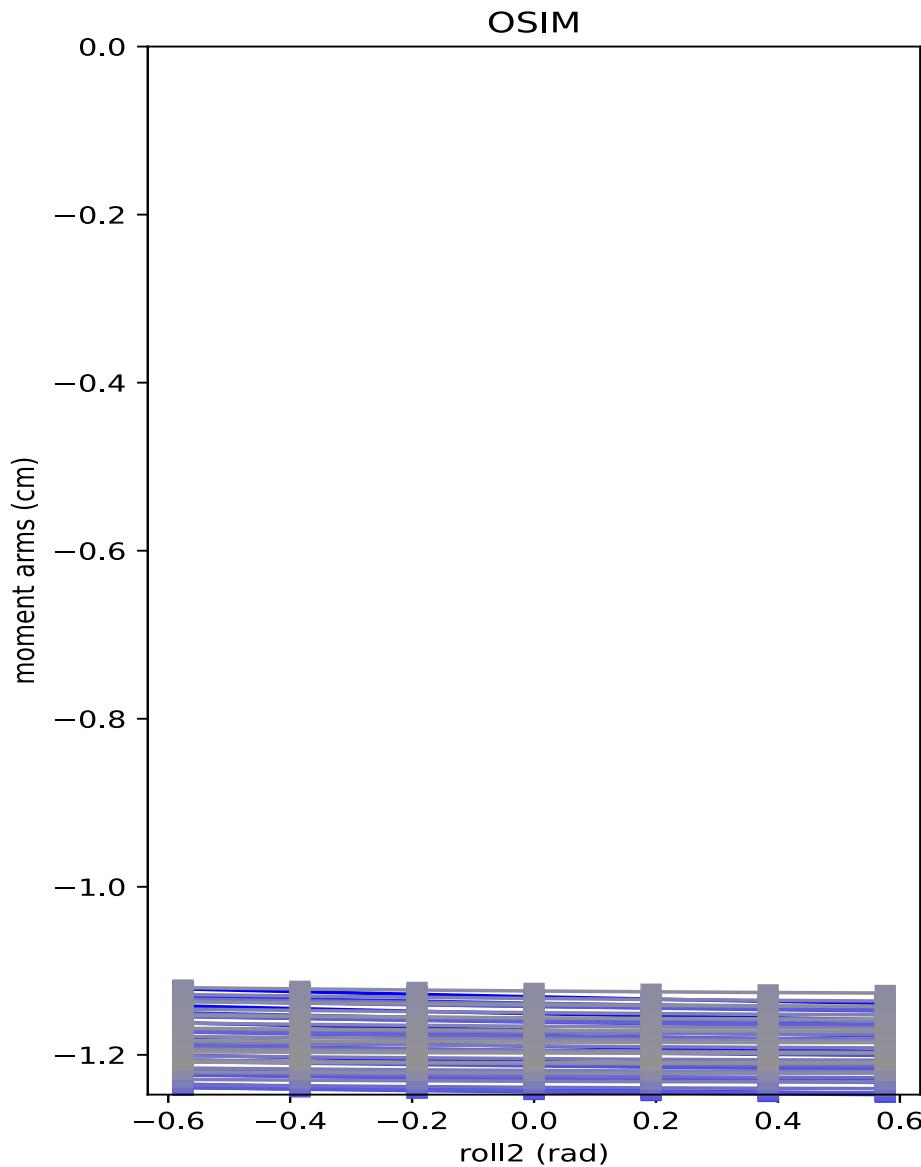
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx_L - pitch2 - roll2 - yaw2



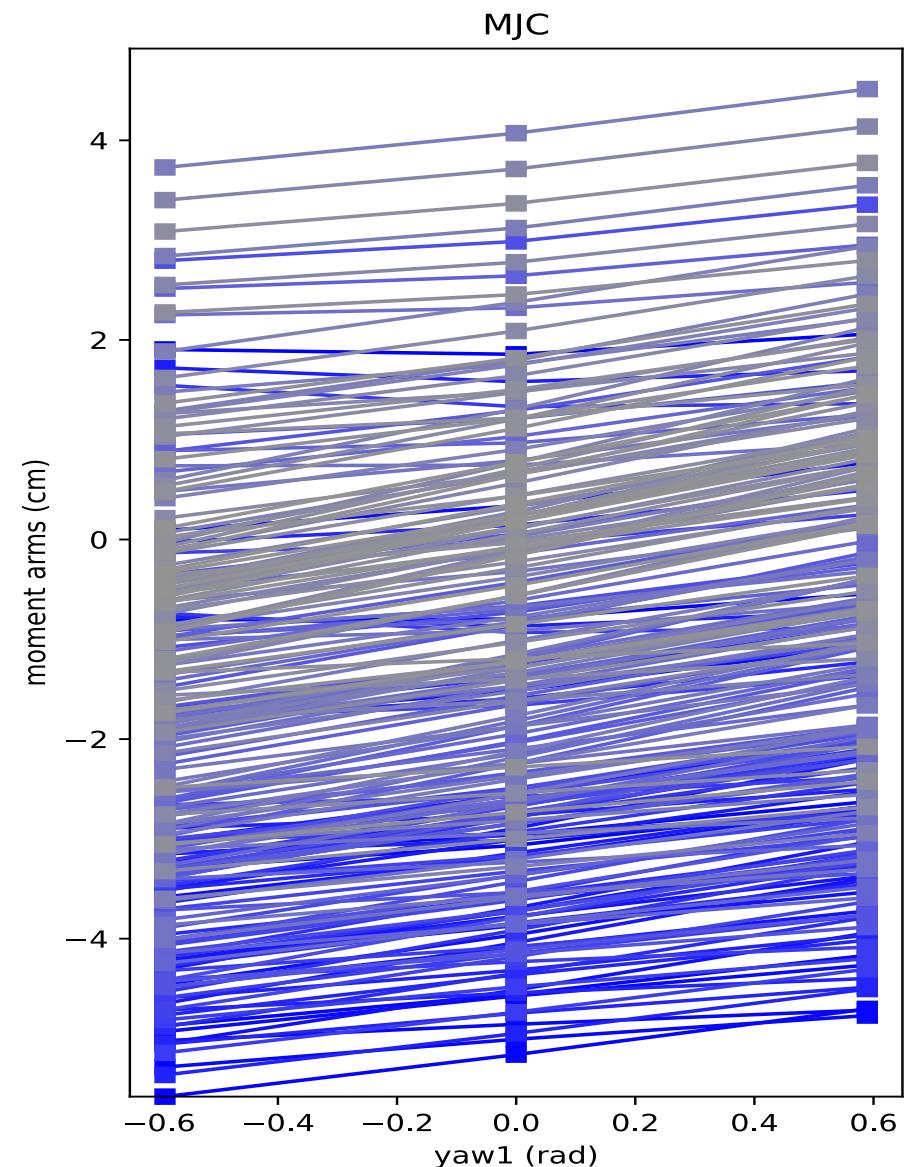
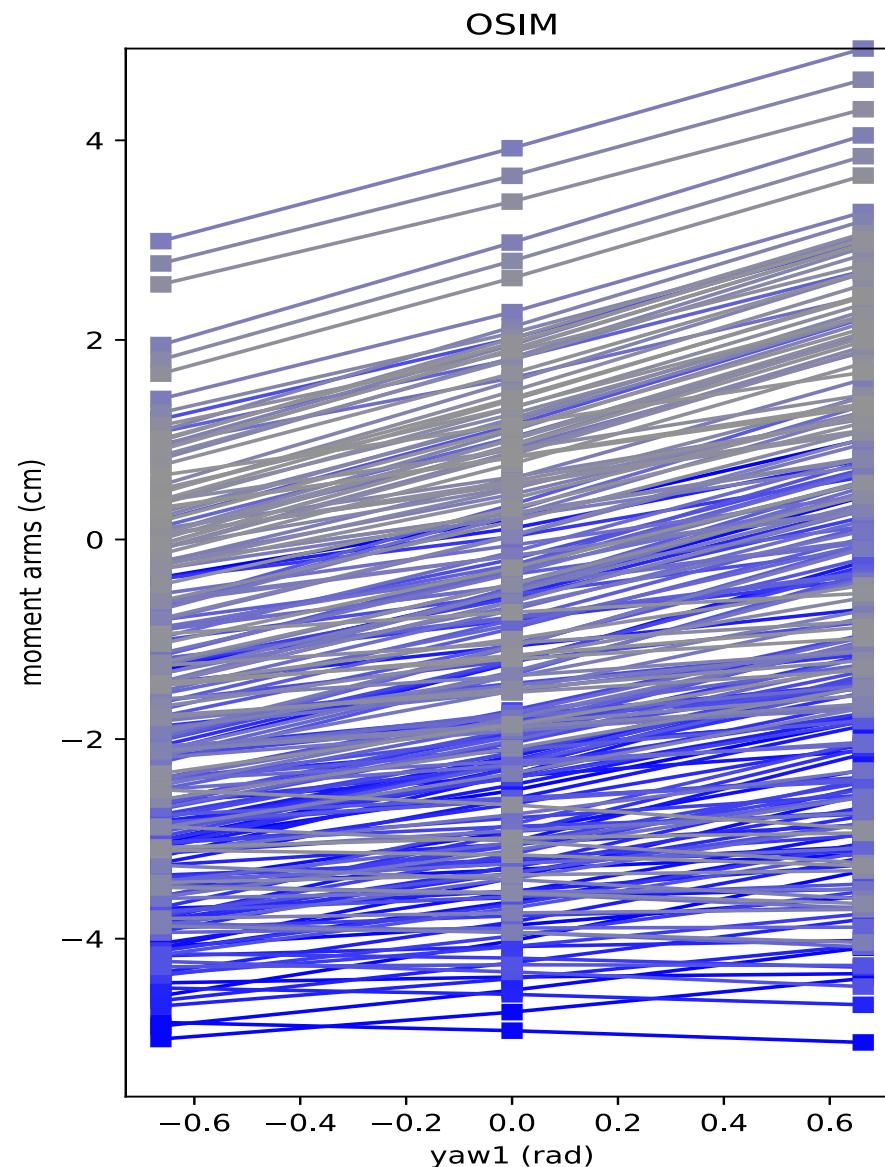
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch2 - roll2 - yaw2



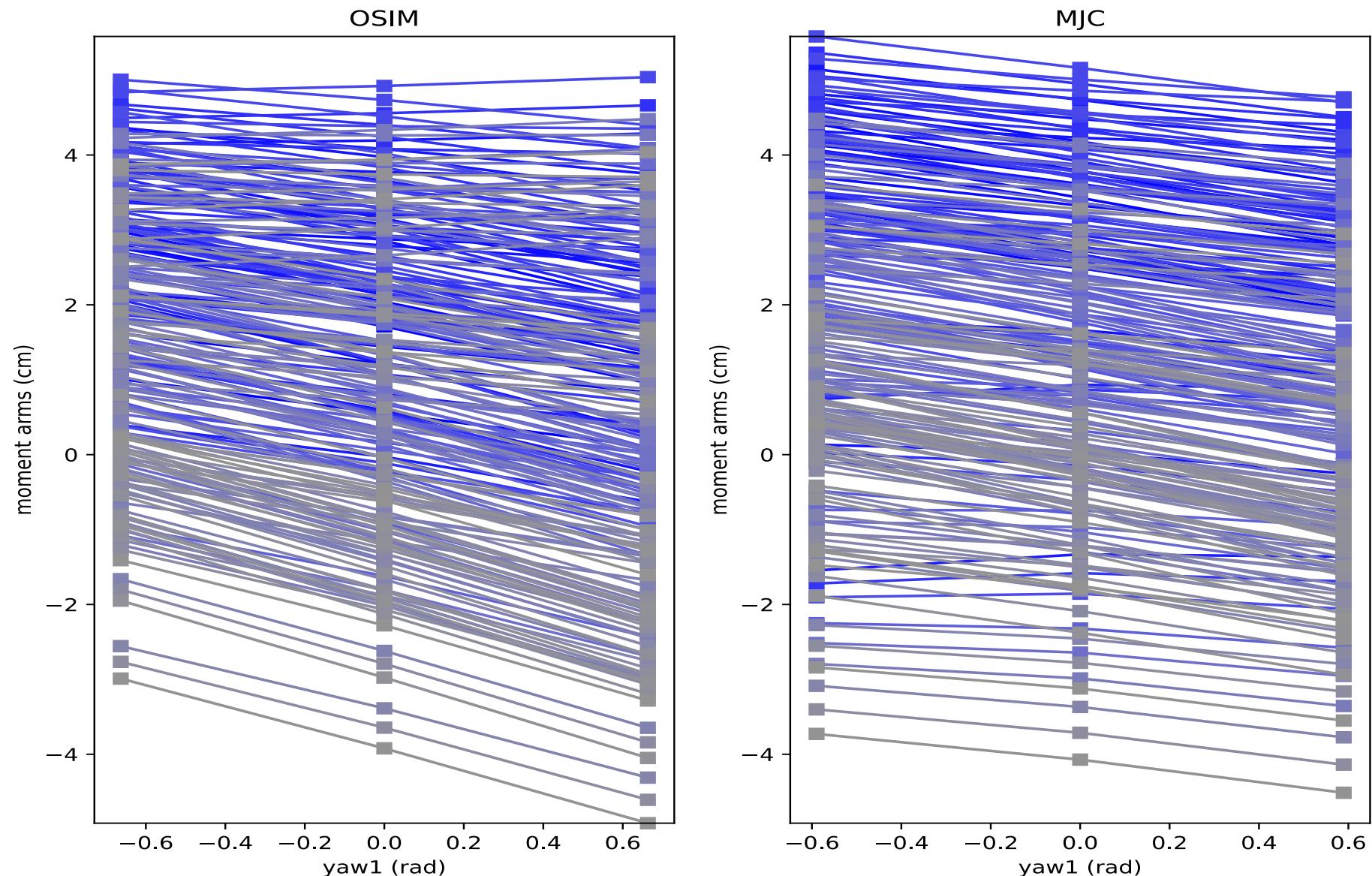
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



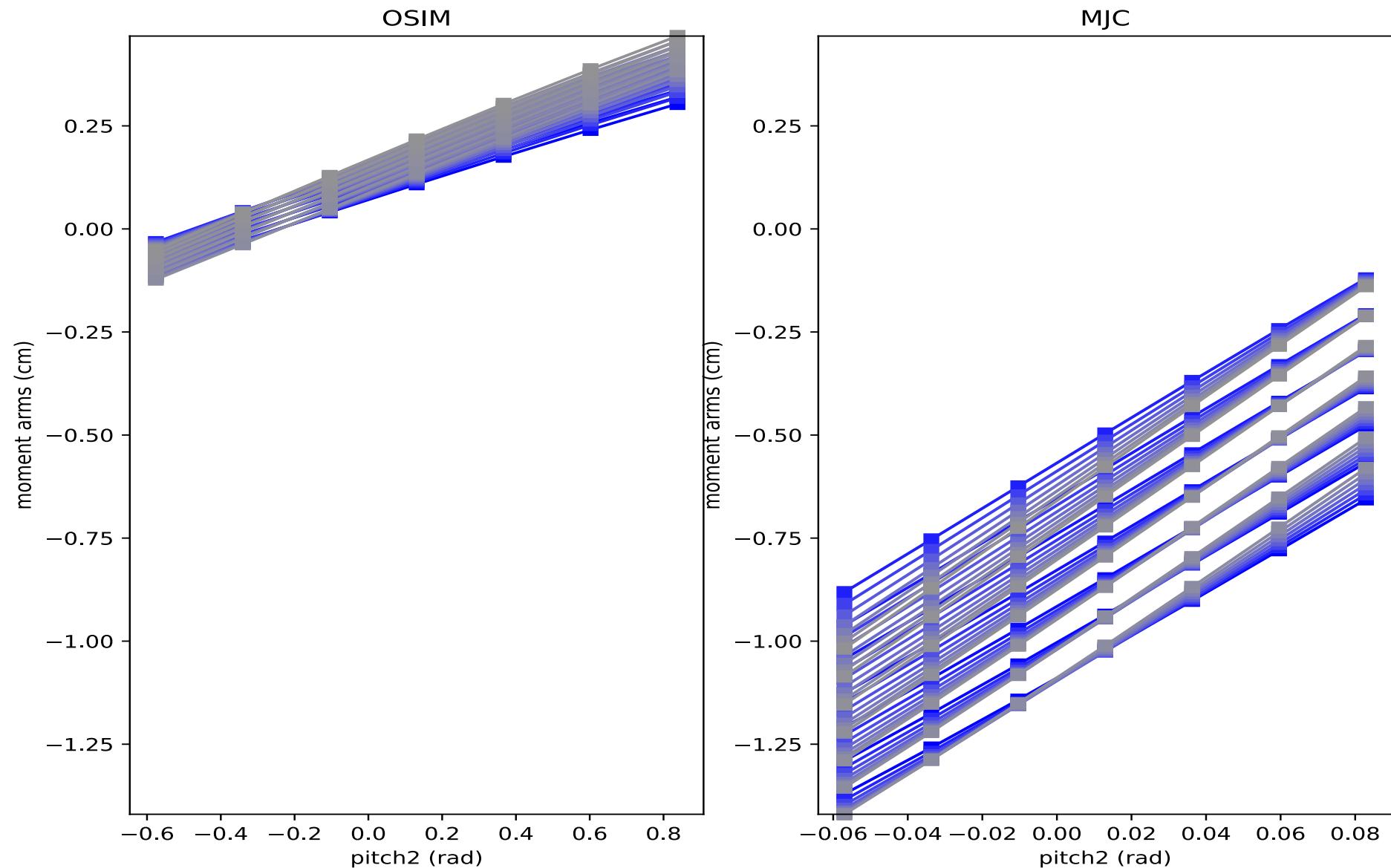
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



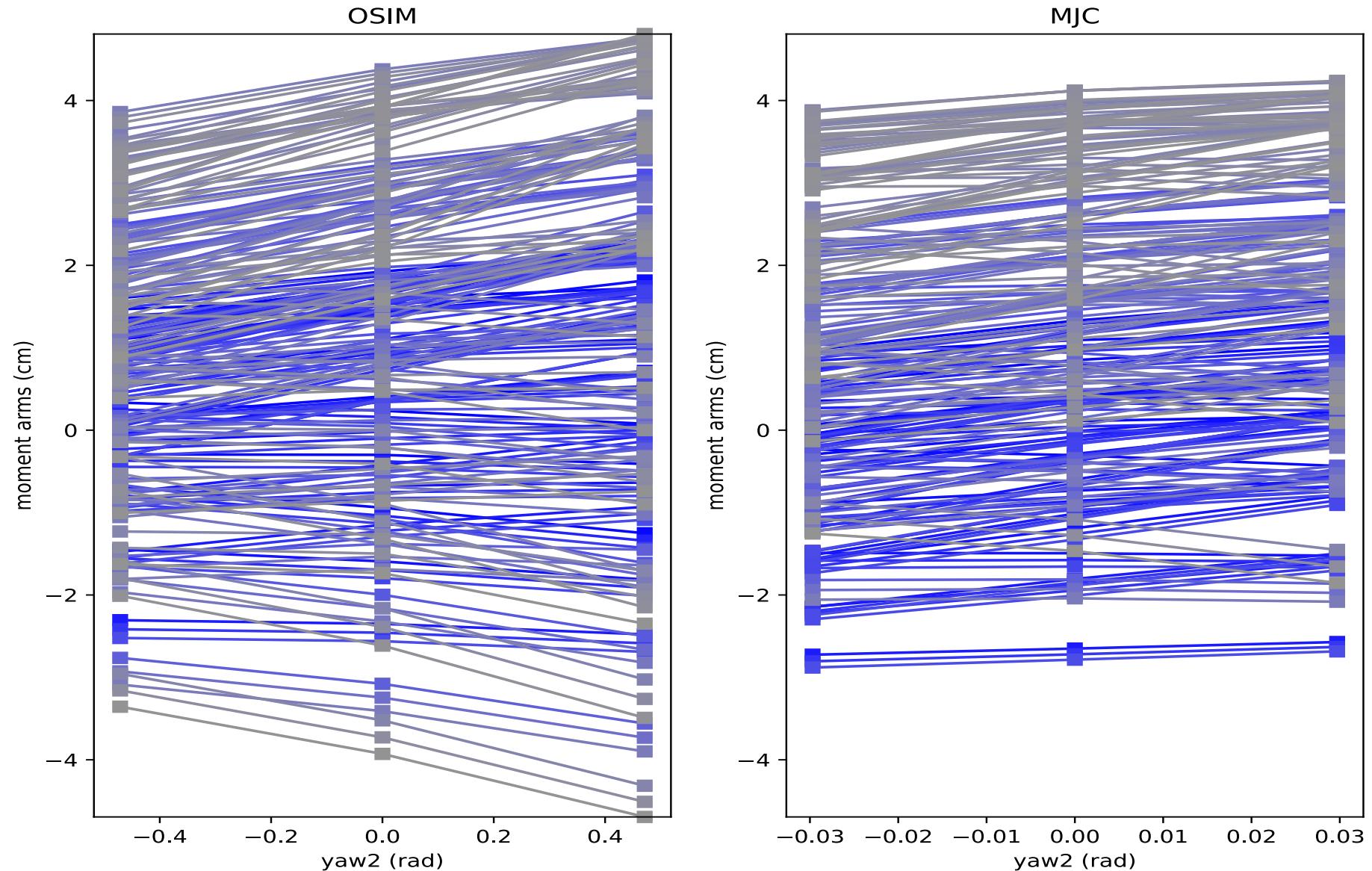
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post_L - pitch2 - roll2 - yaw2



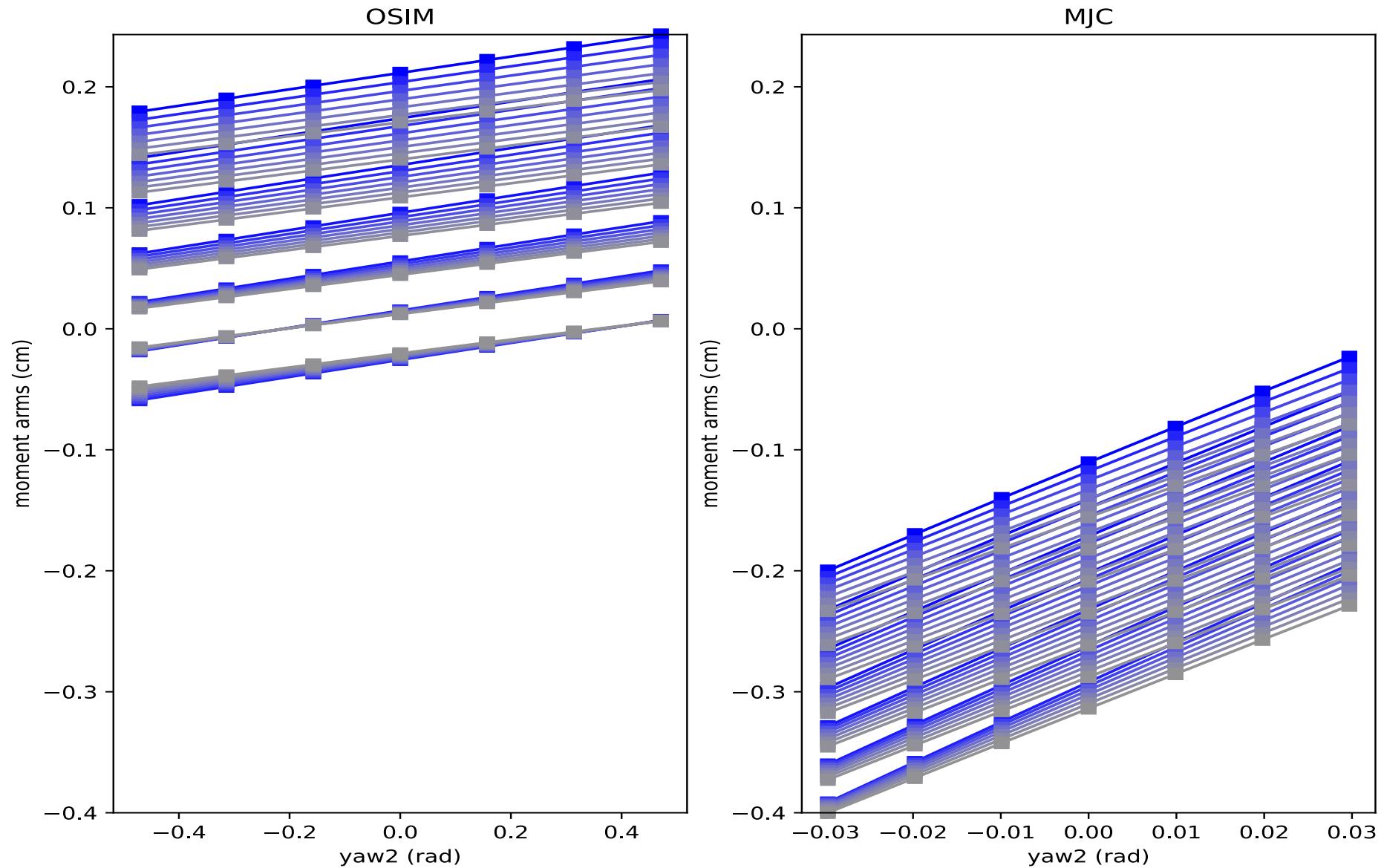
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



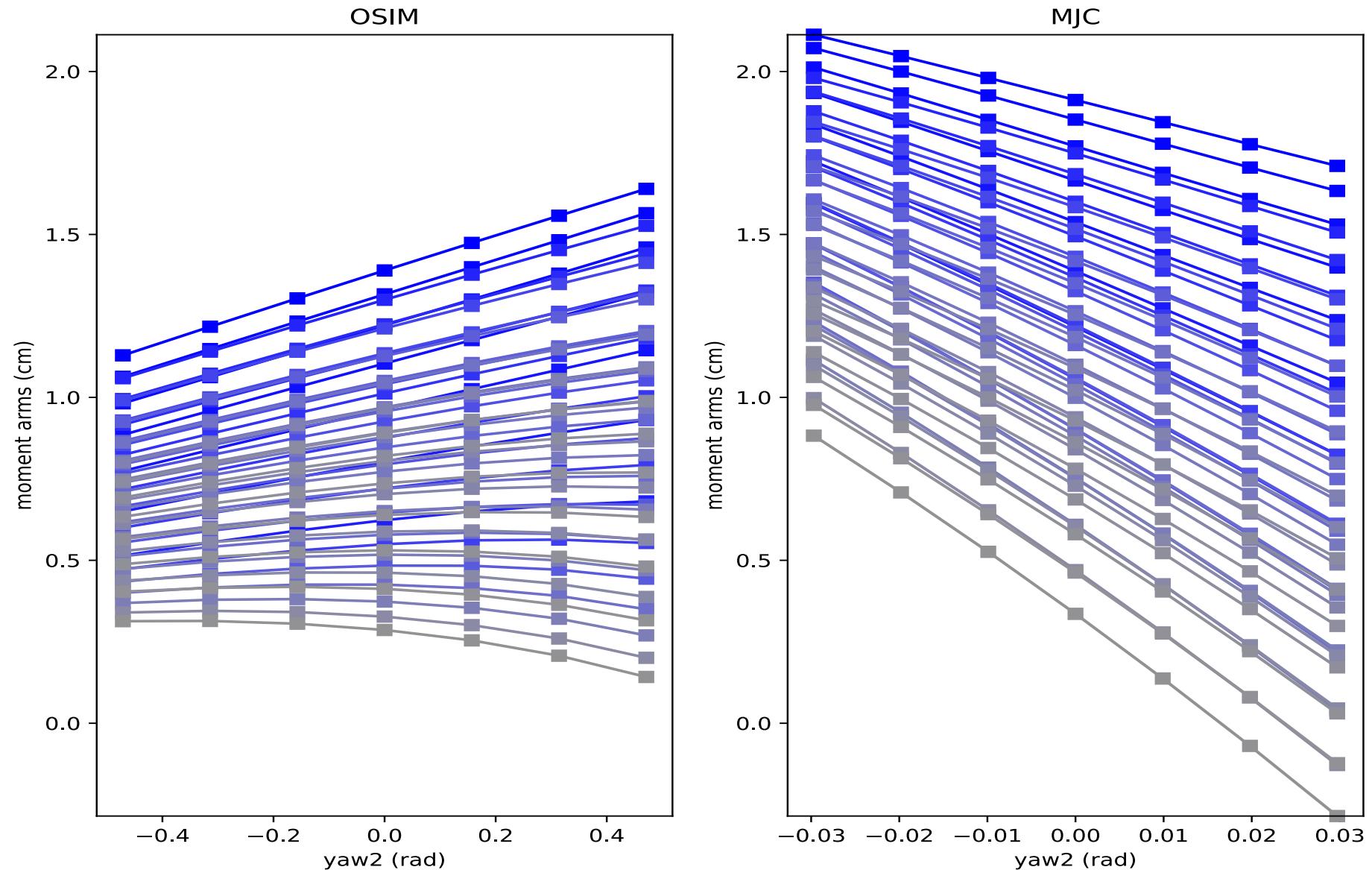
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx_L - pitch2 - roll2 - yaw2



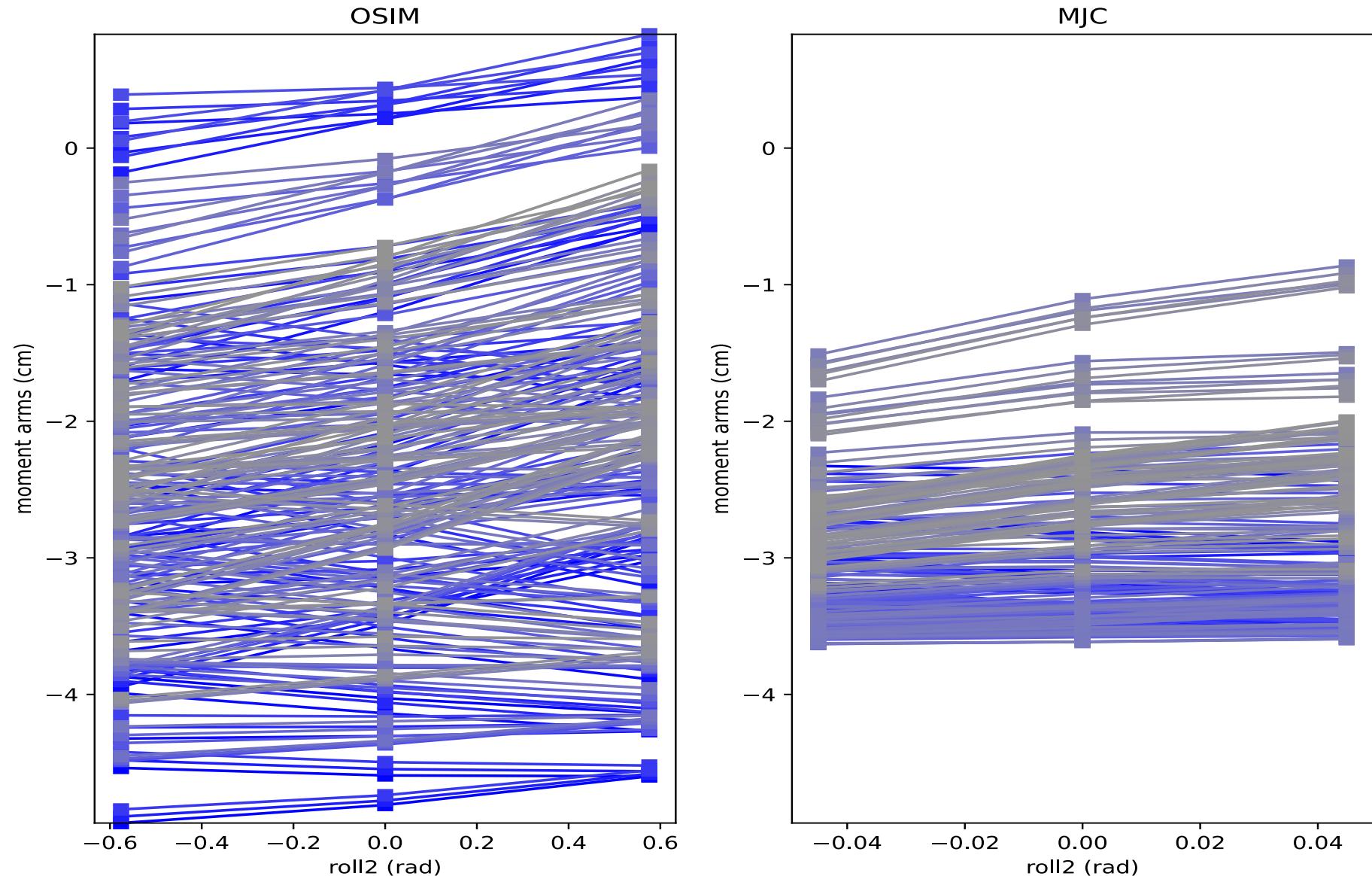
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx_L - pitch2 - roll2 - yaw2



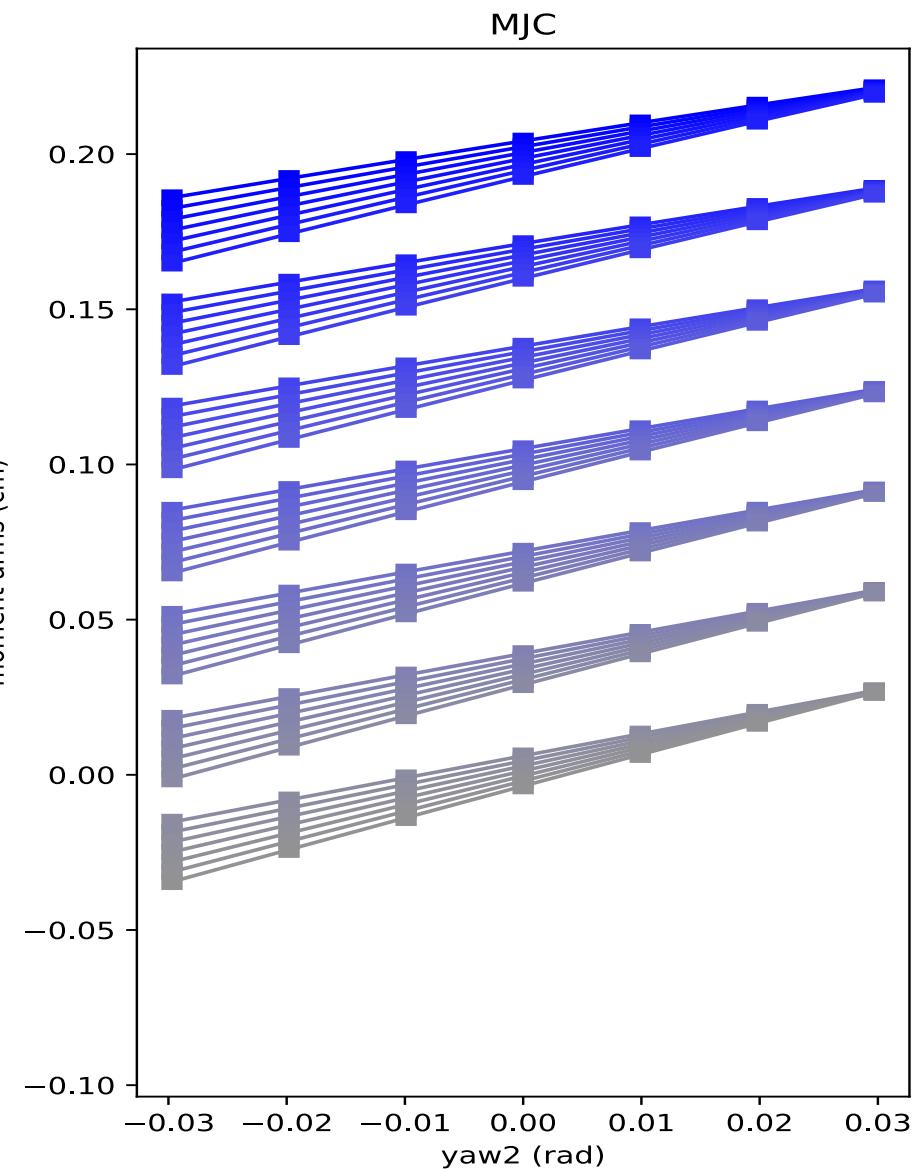
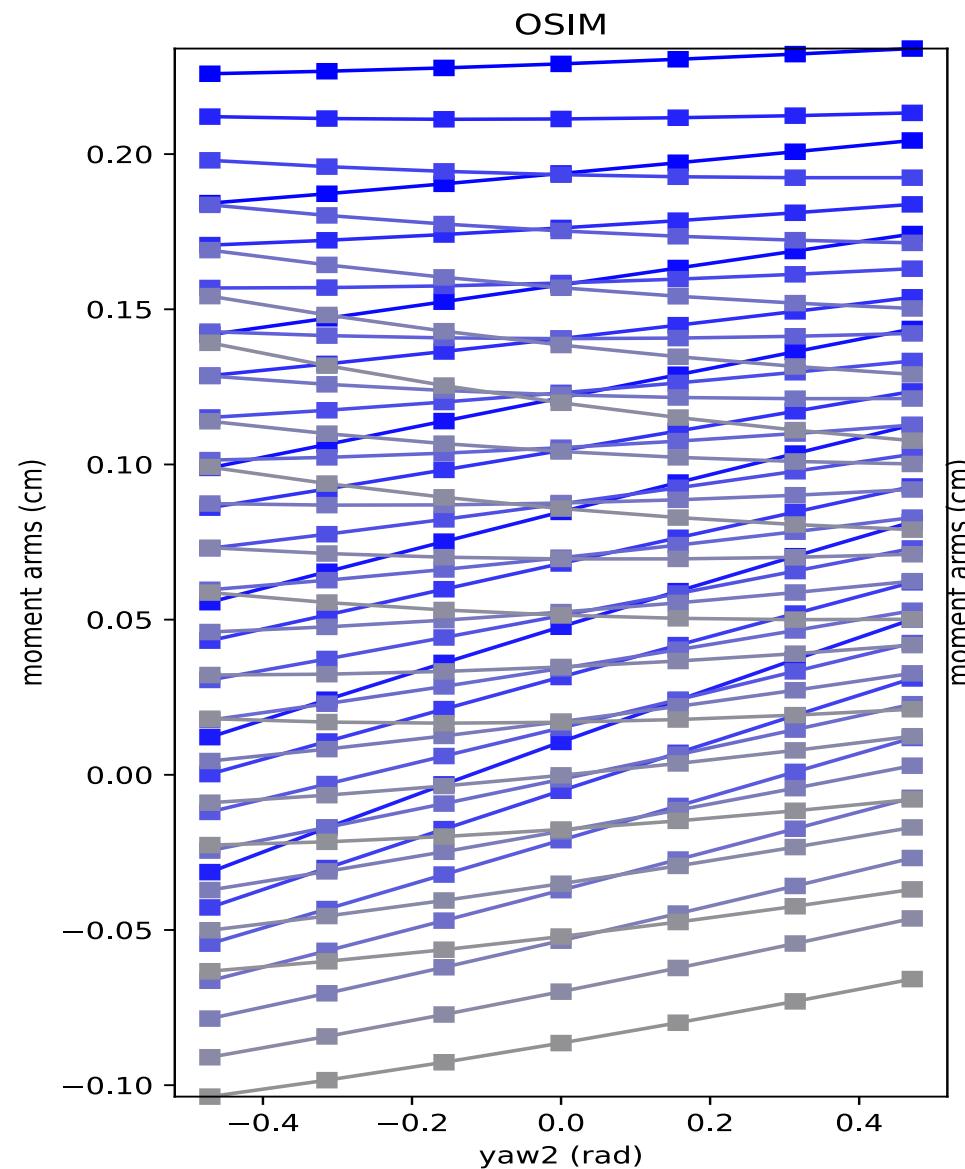
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



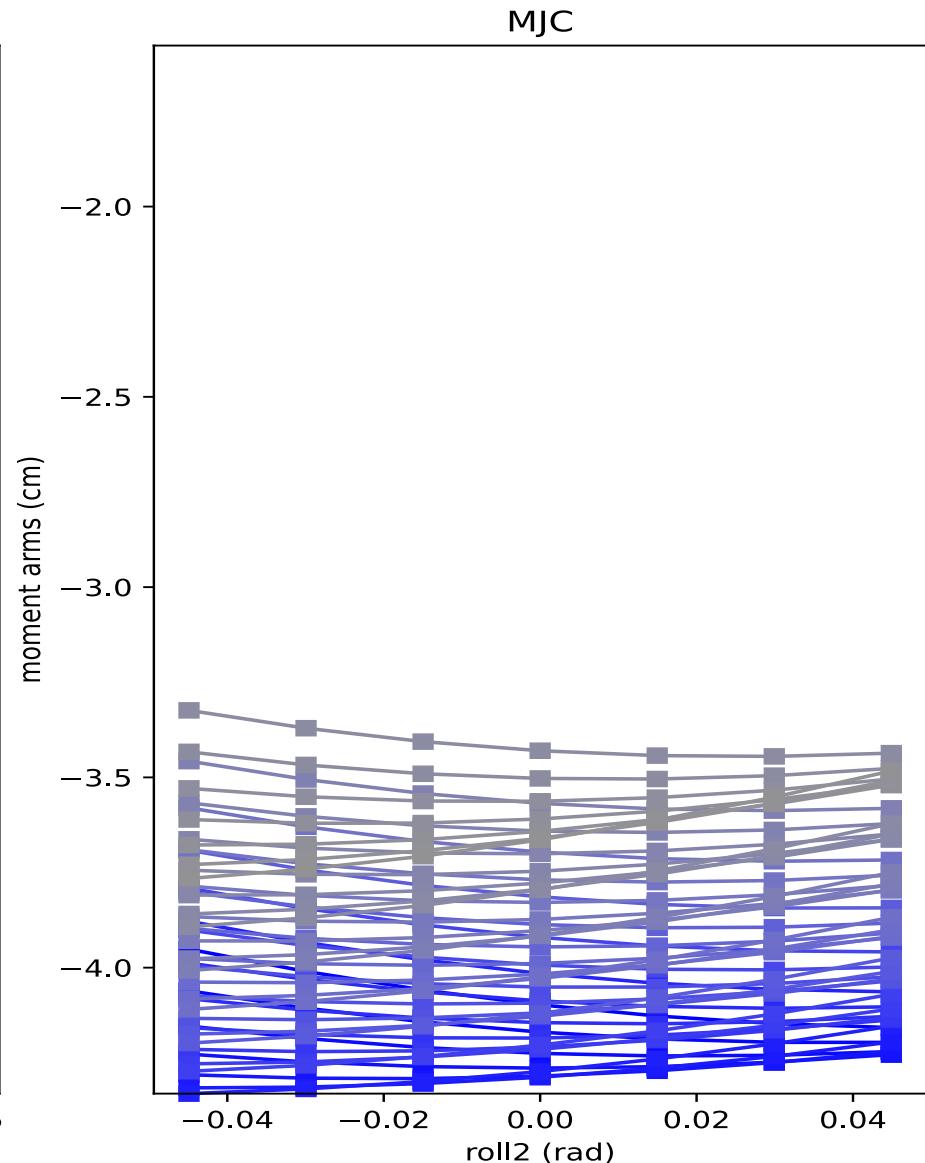
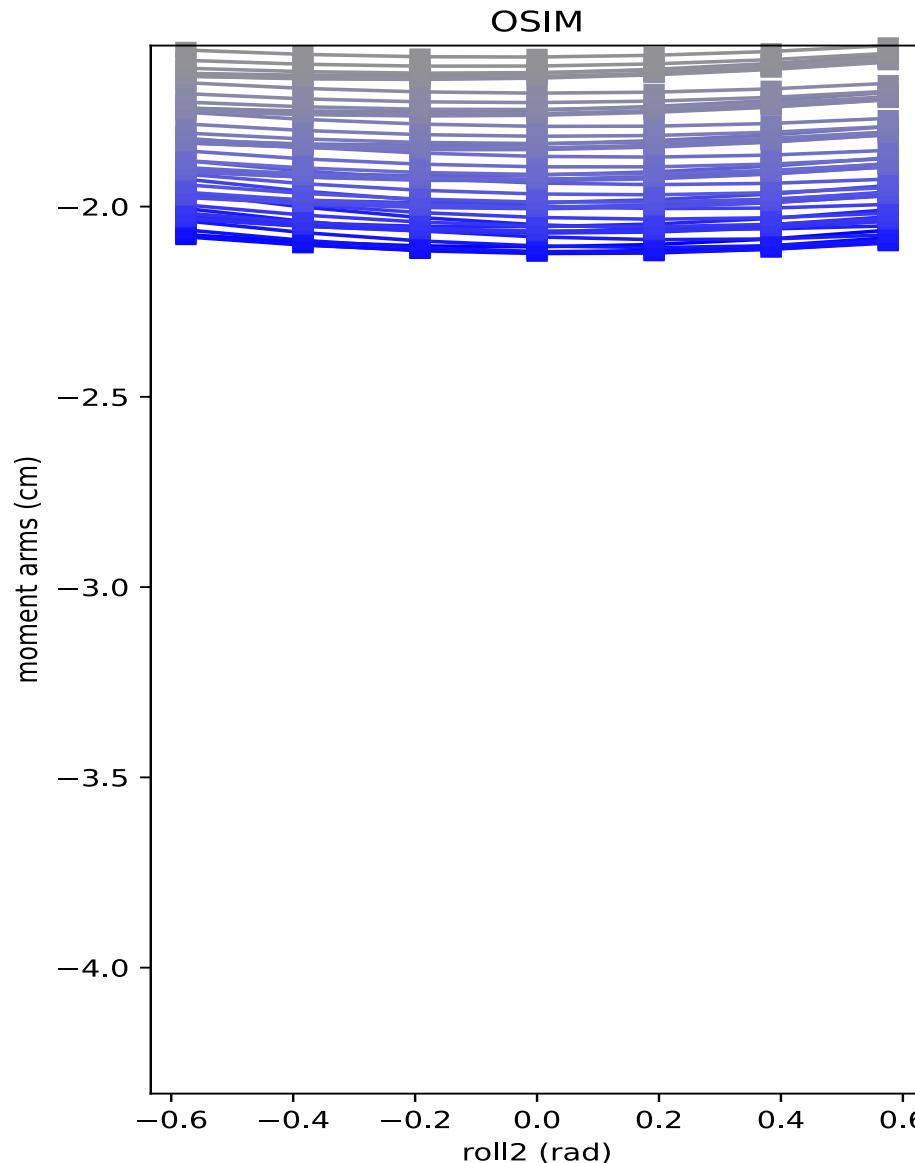
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch2 - roll2 - yaw2



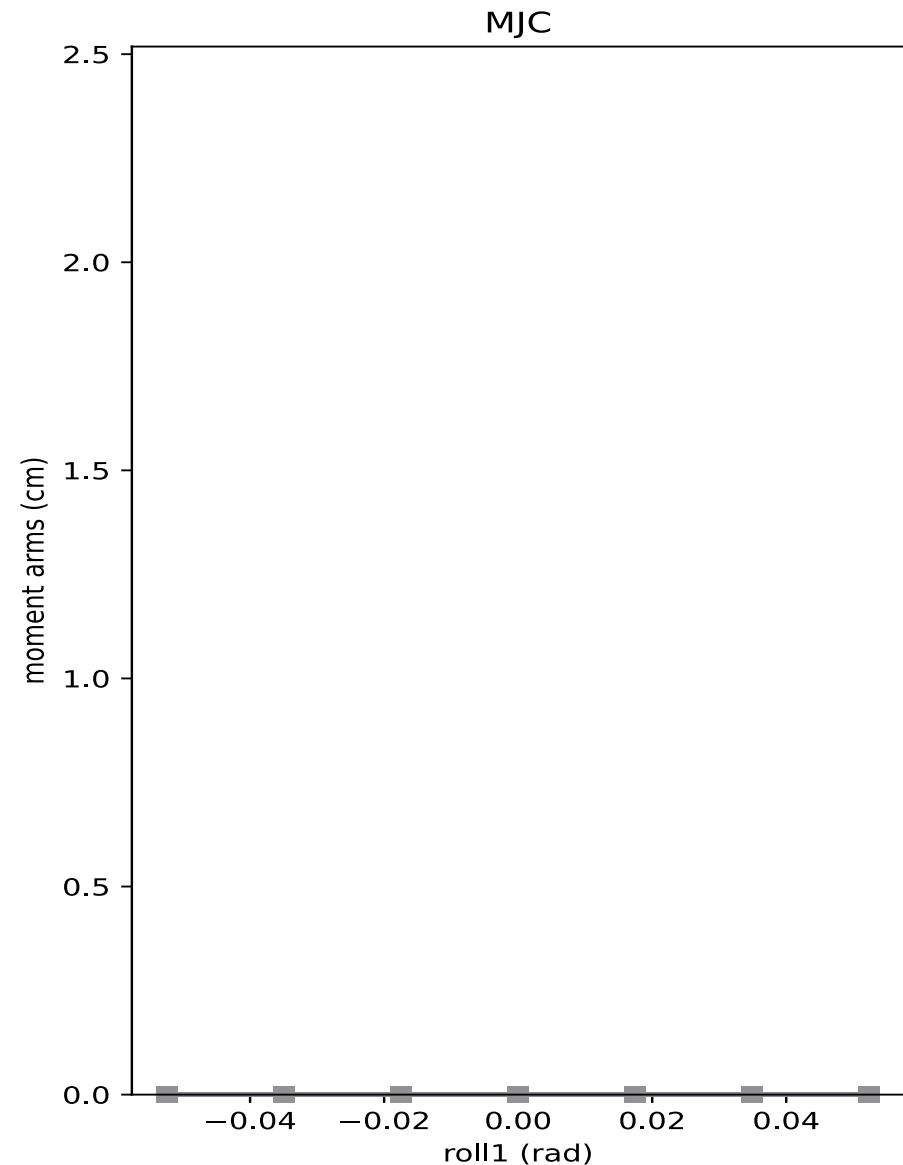
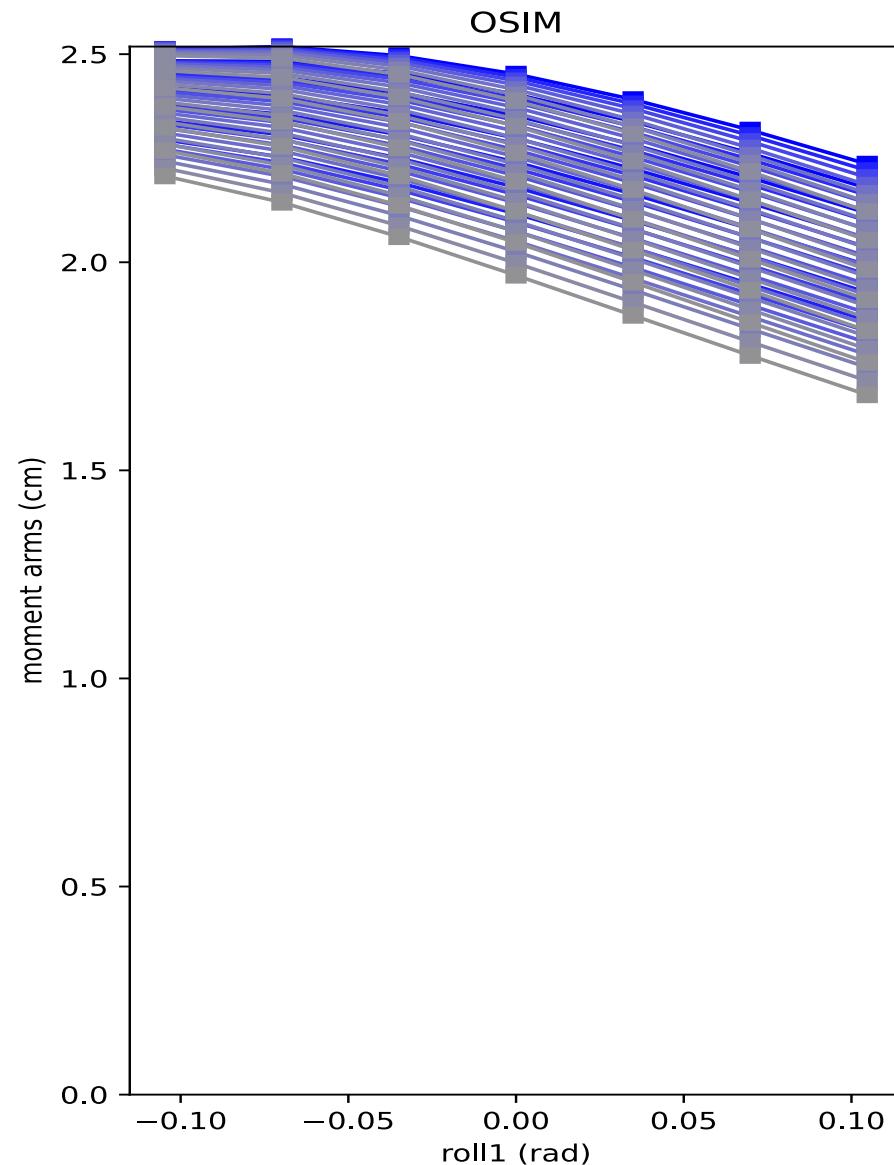
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant_L - pitch2 - roll2 - yaw2



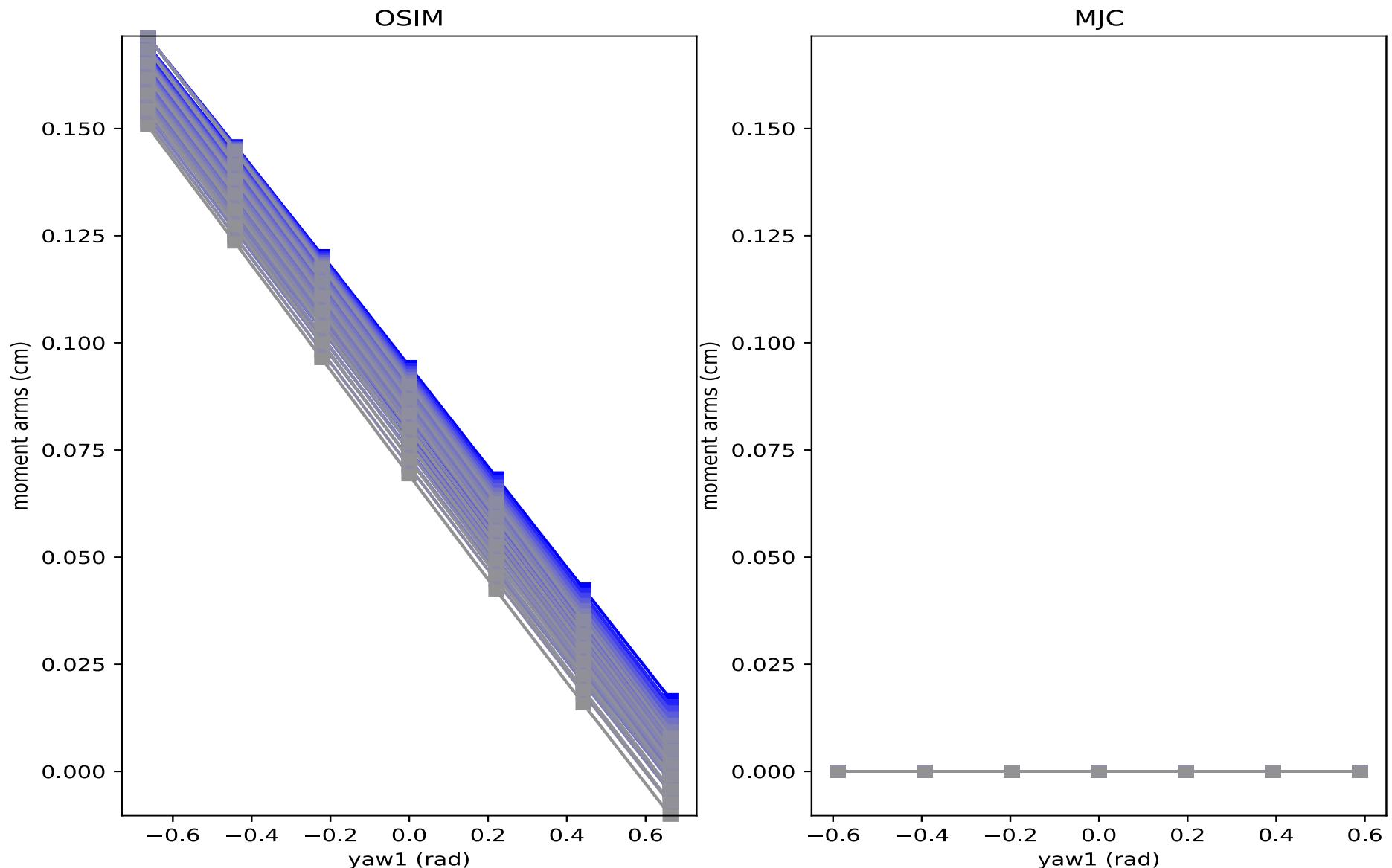
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post - pitch1 - roll1 - yaw1



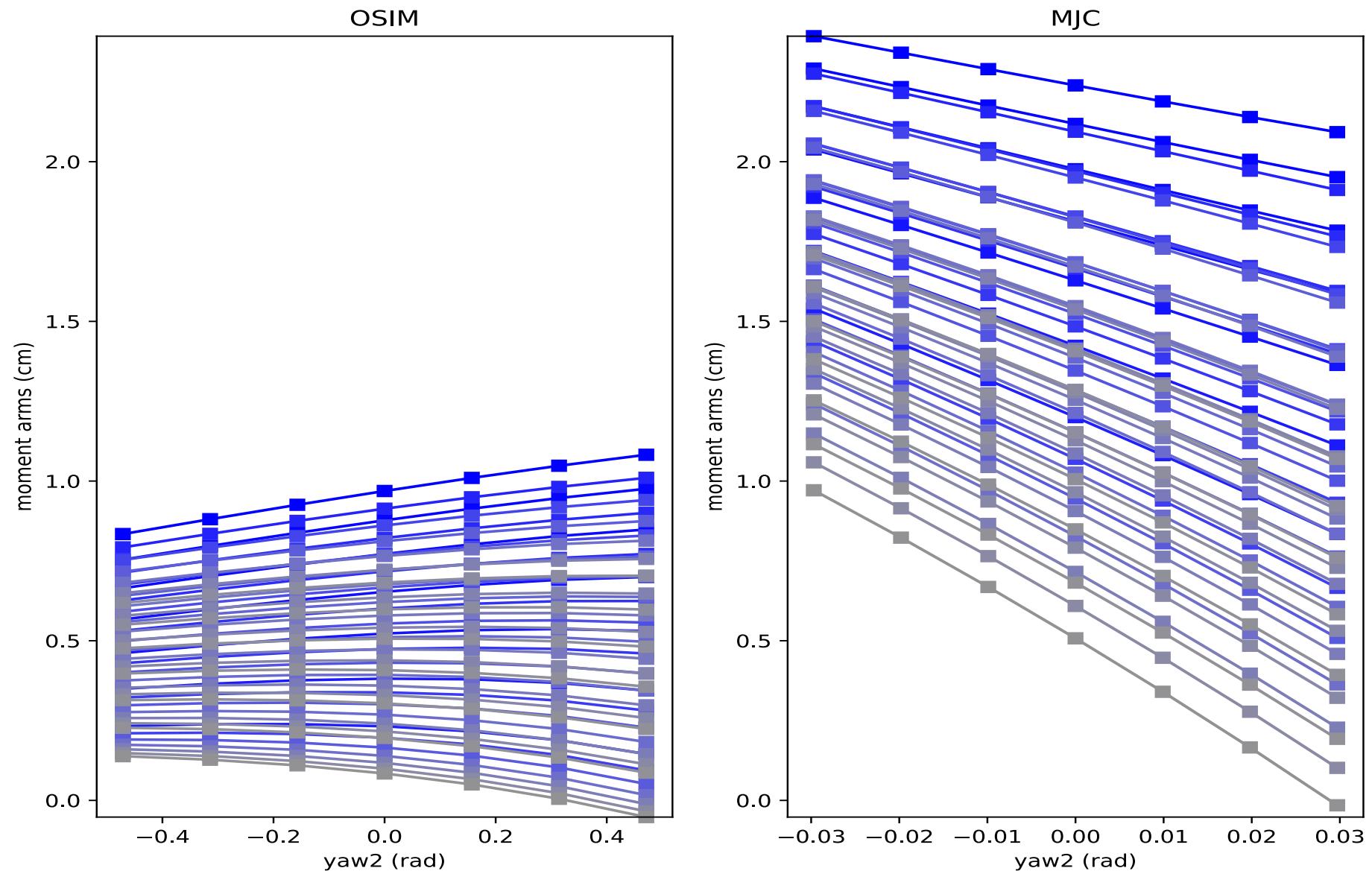
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat - pitch1 - roll1 - yaw1



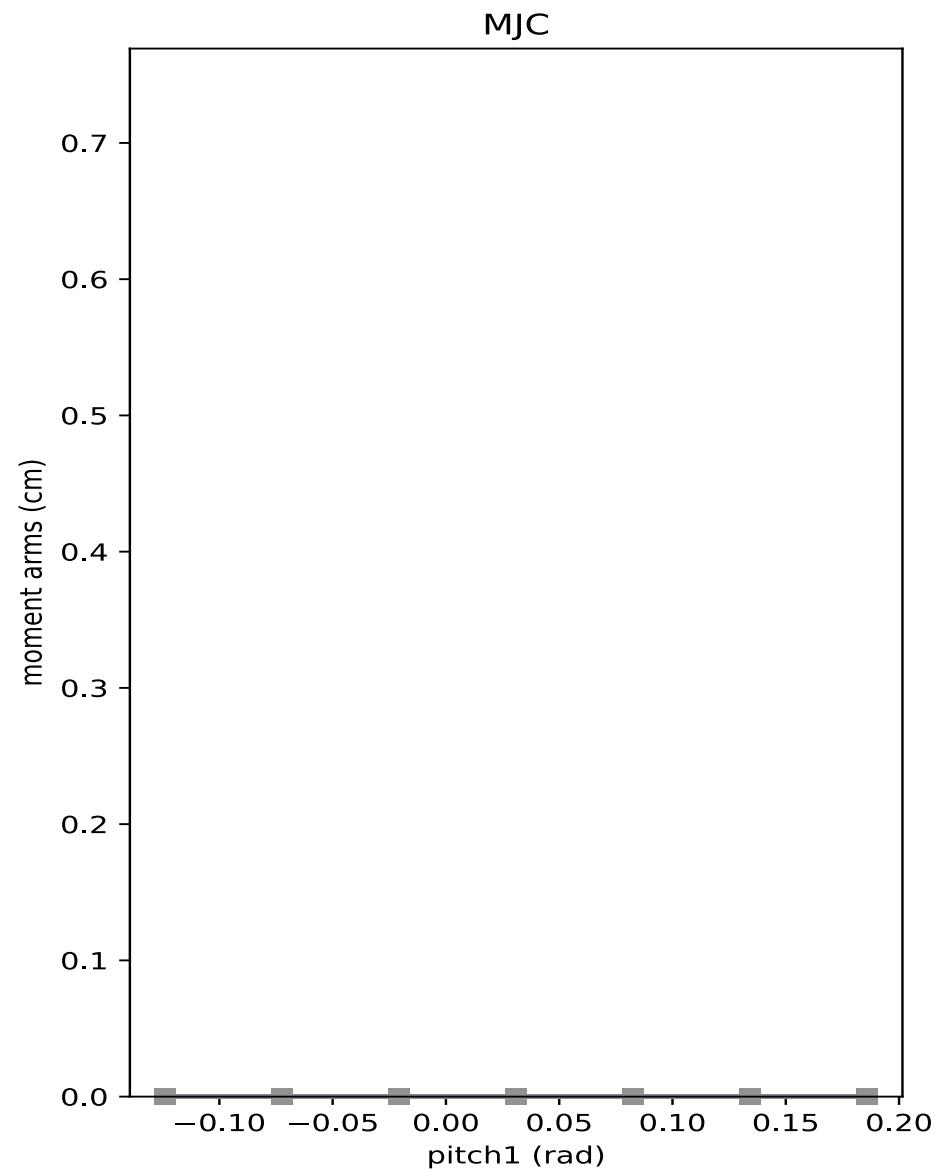
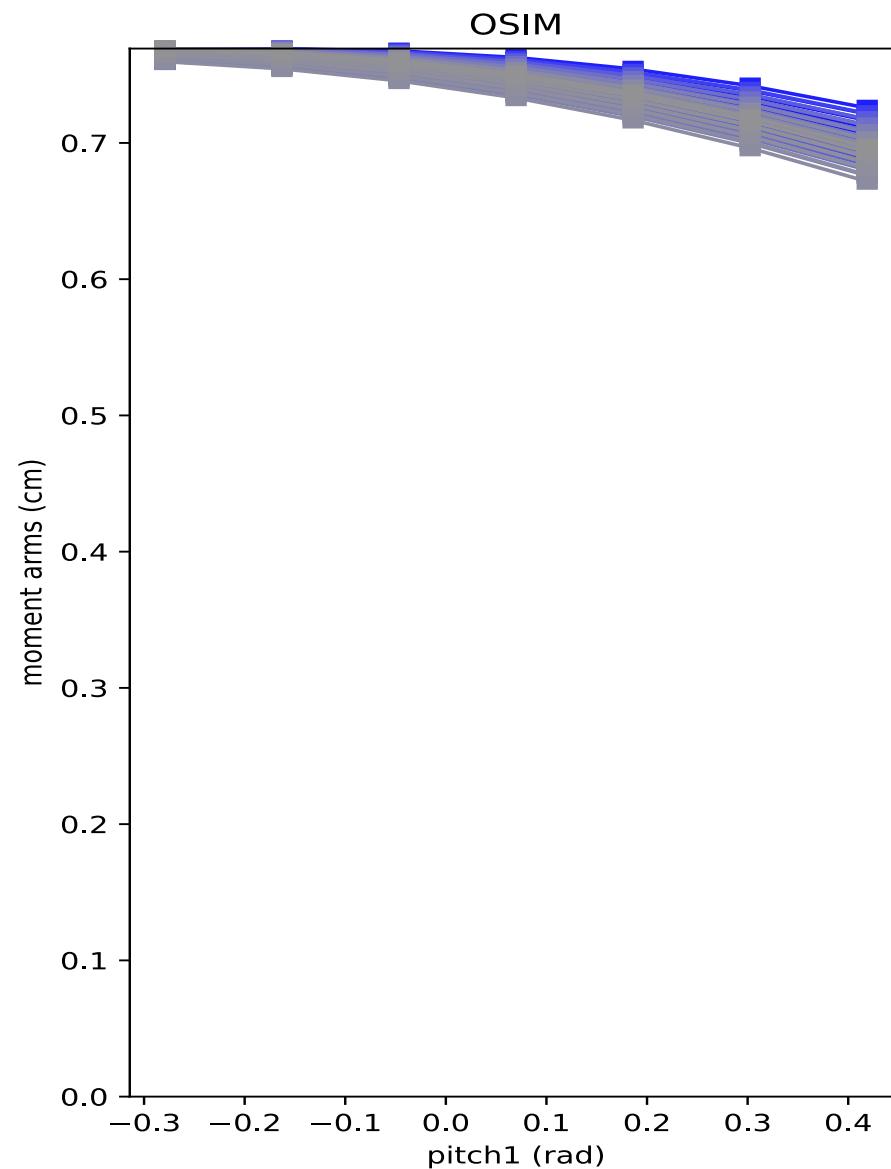
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib_L - pitch2 - roll2 - yaw2



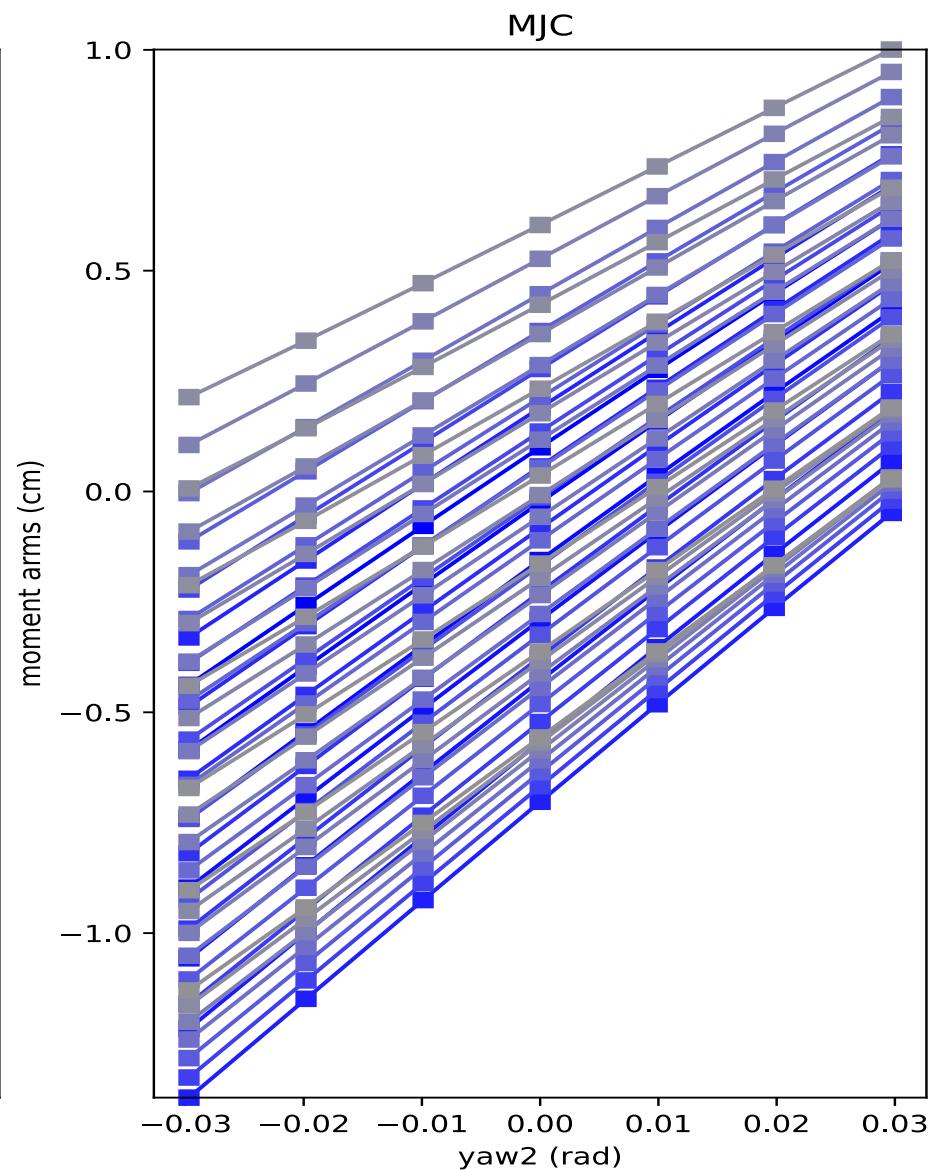
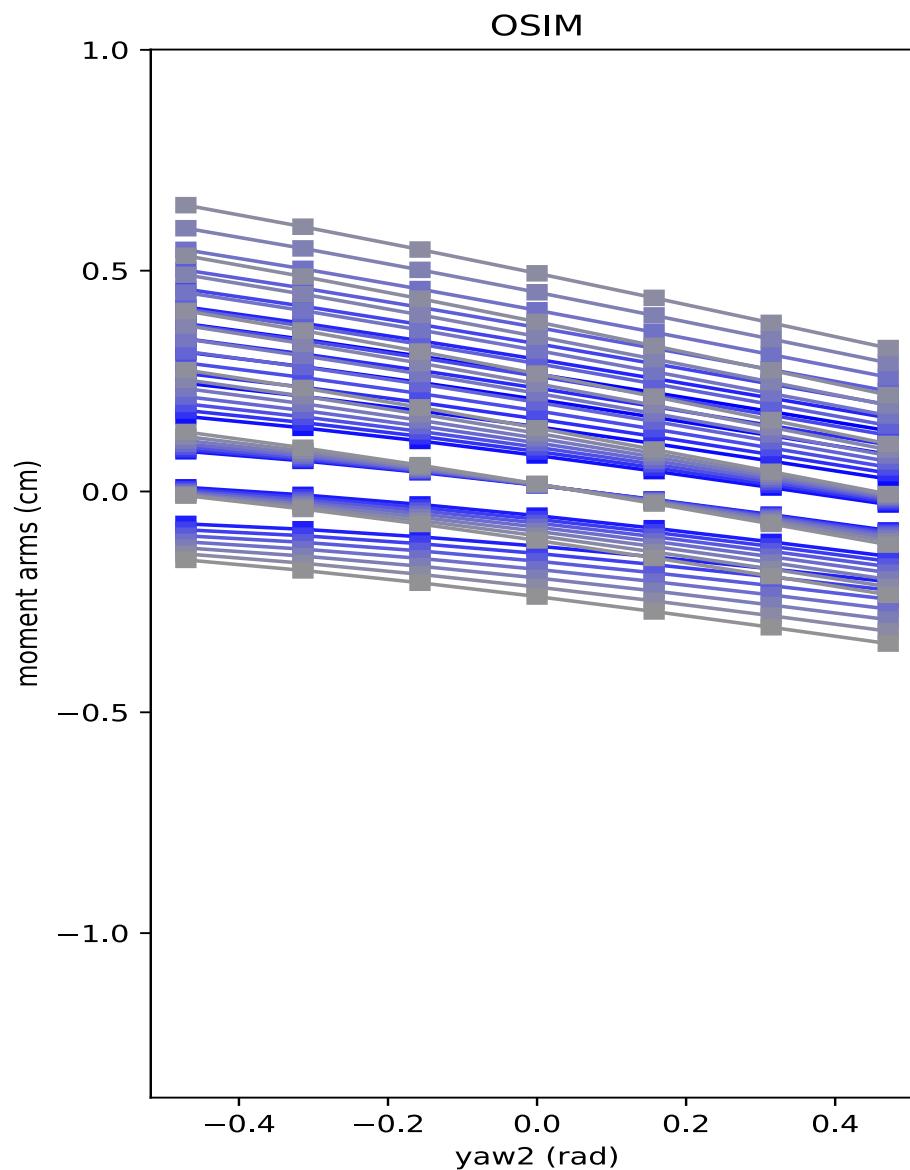
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup - pitch1 - roll1 - yaw1



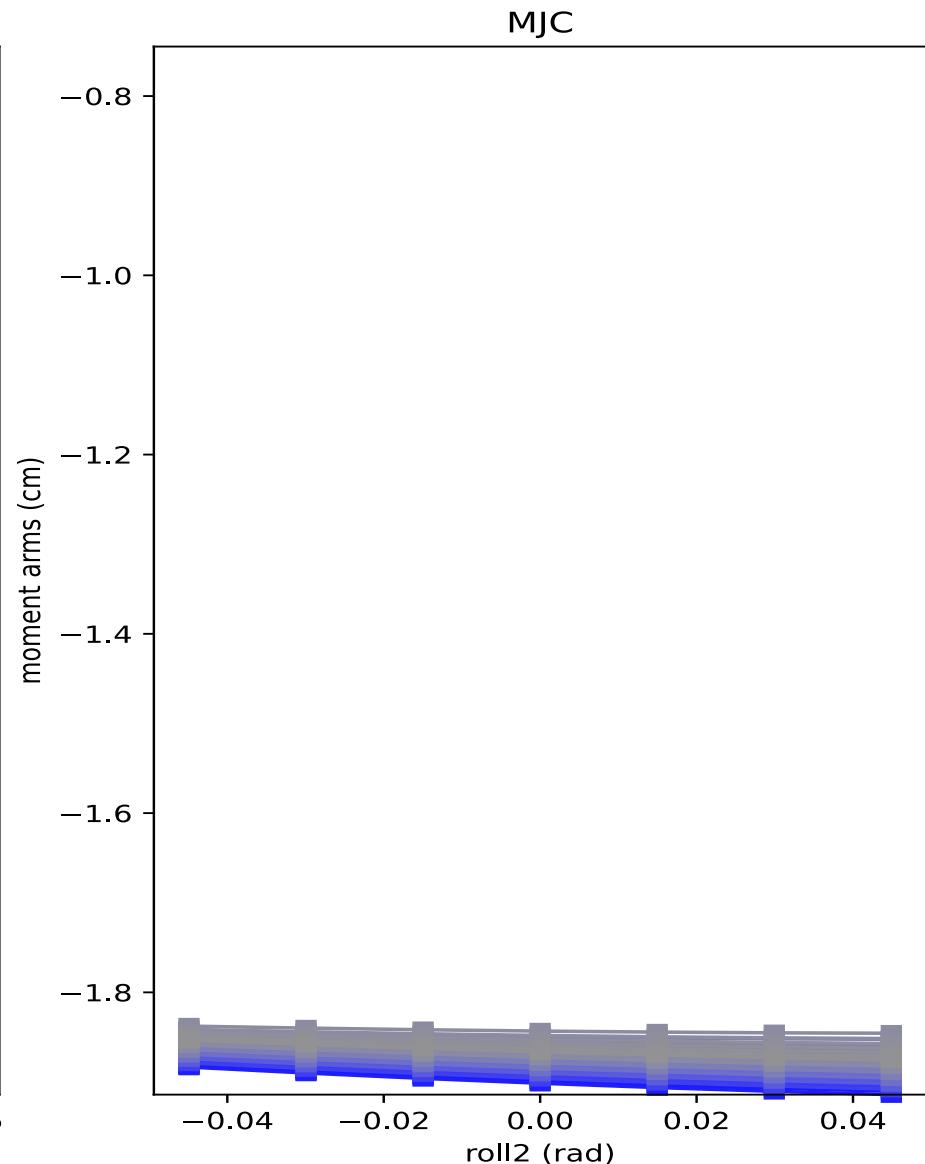
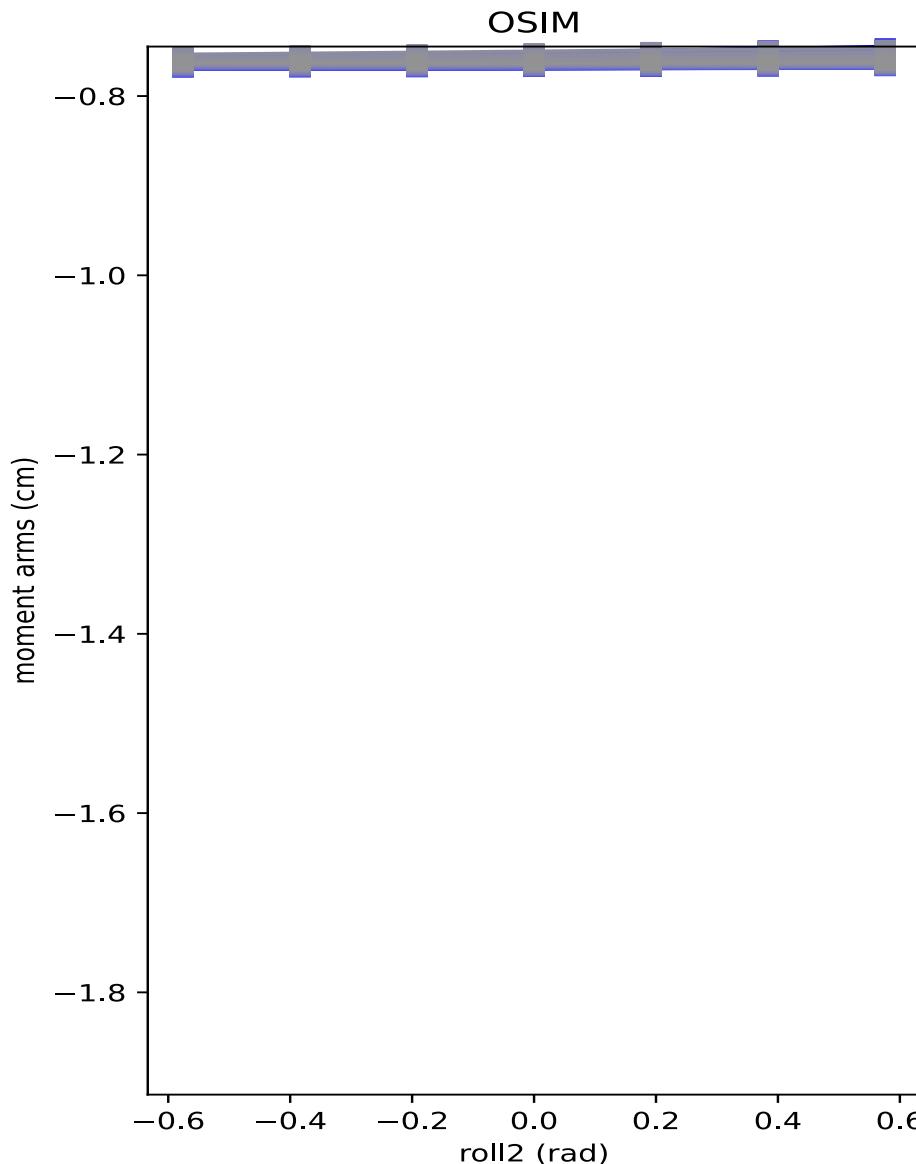
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant - pitch2 - roll2 - yaw2



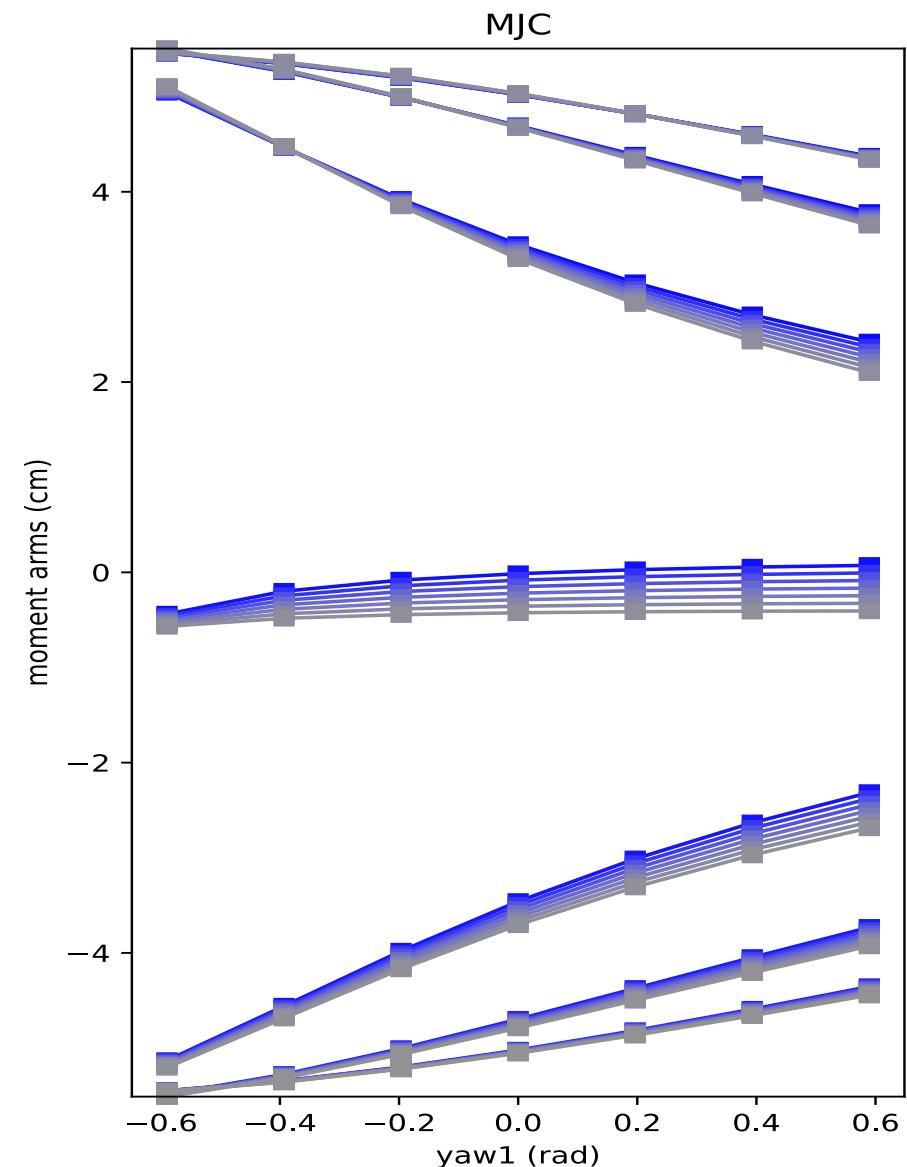
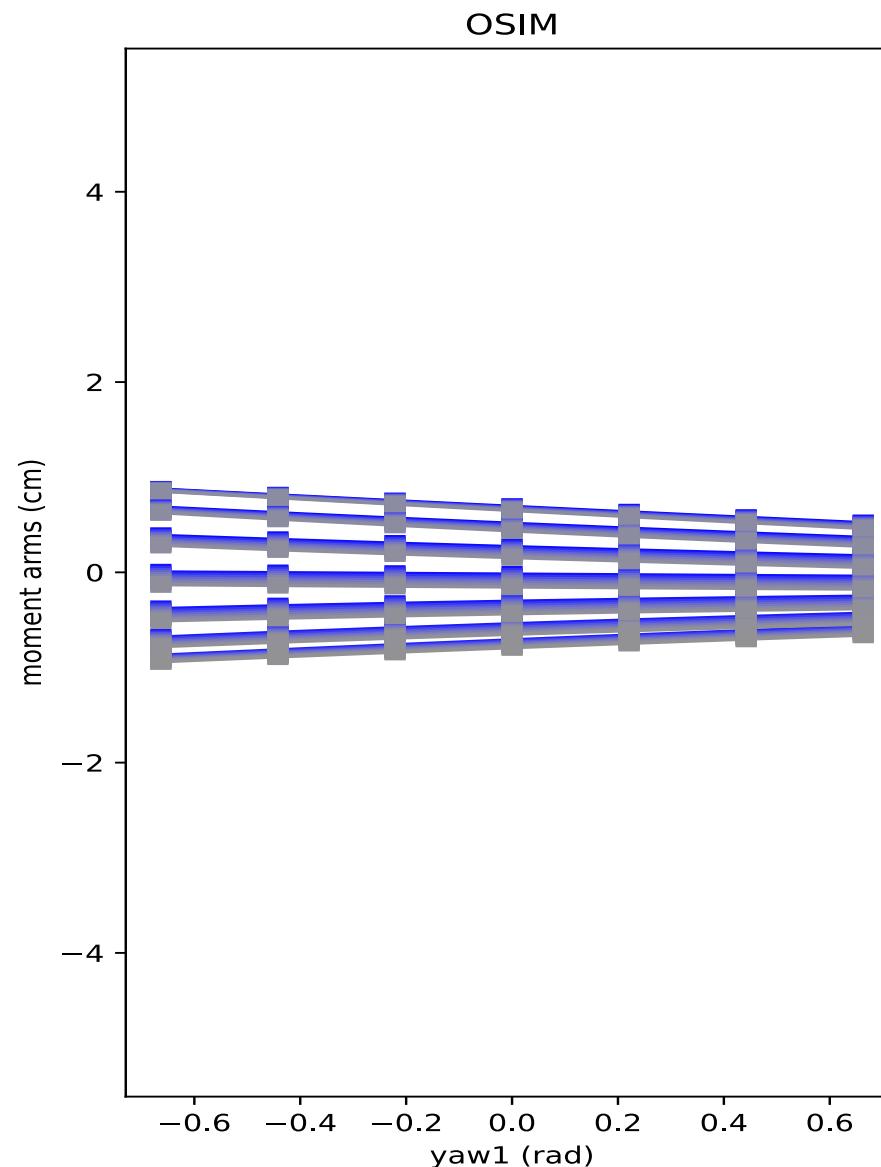
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx_L - pitch2 - roll2 - yaw2



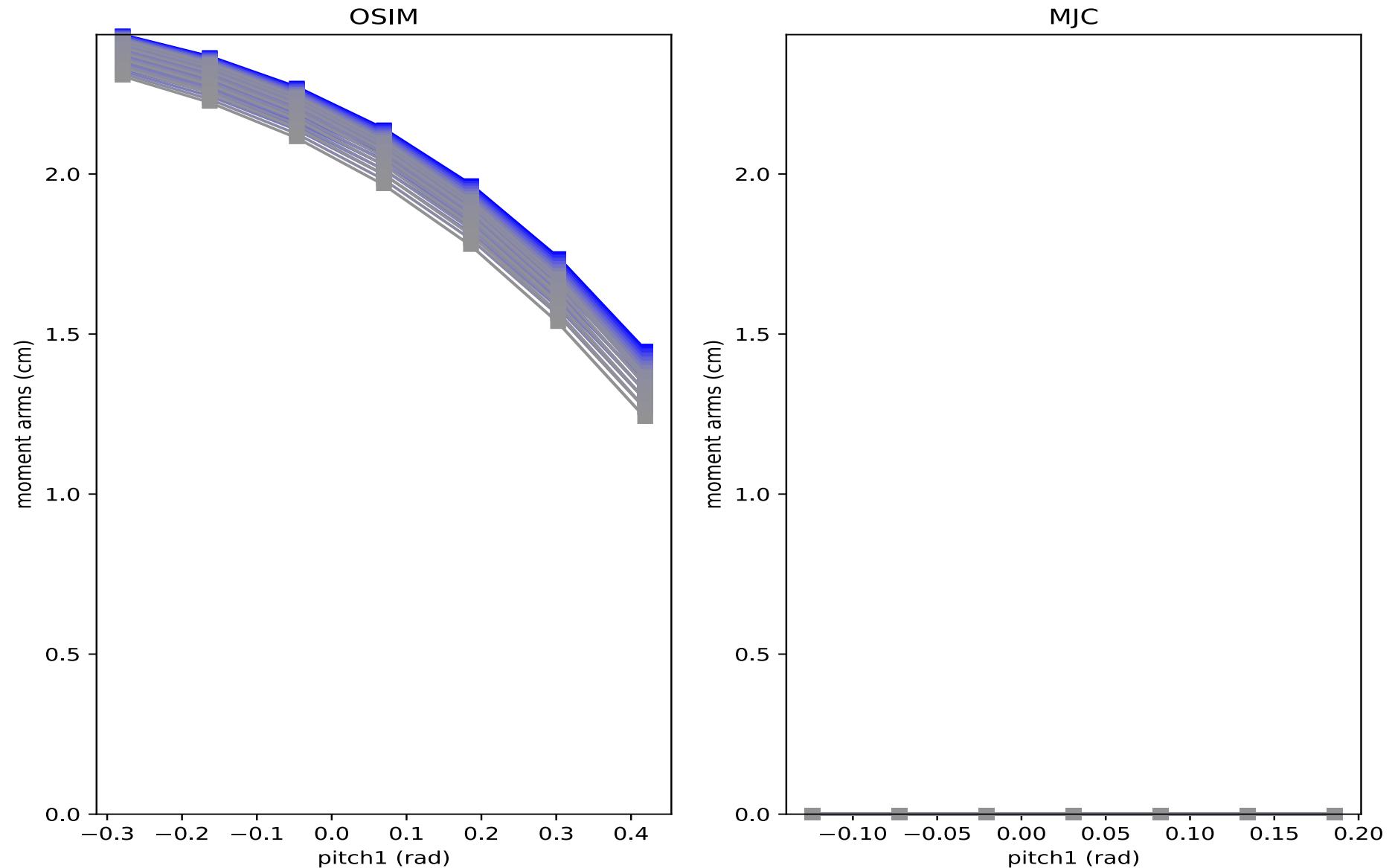
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch1 - roll1 - yaw1



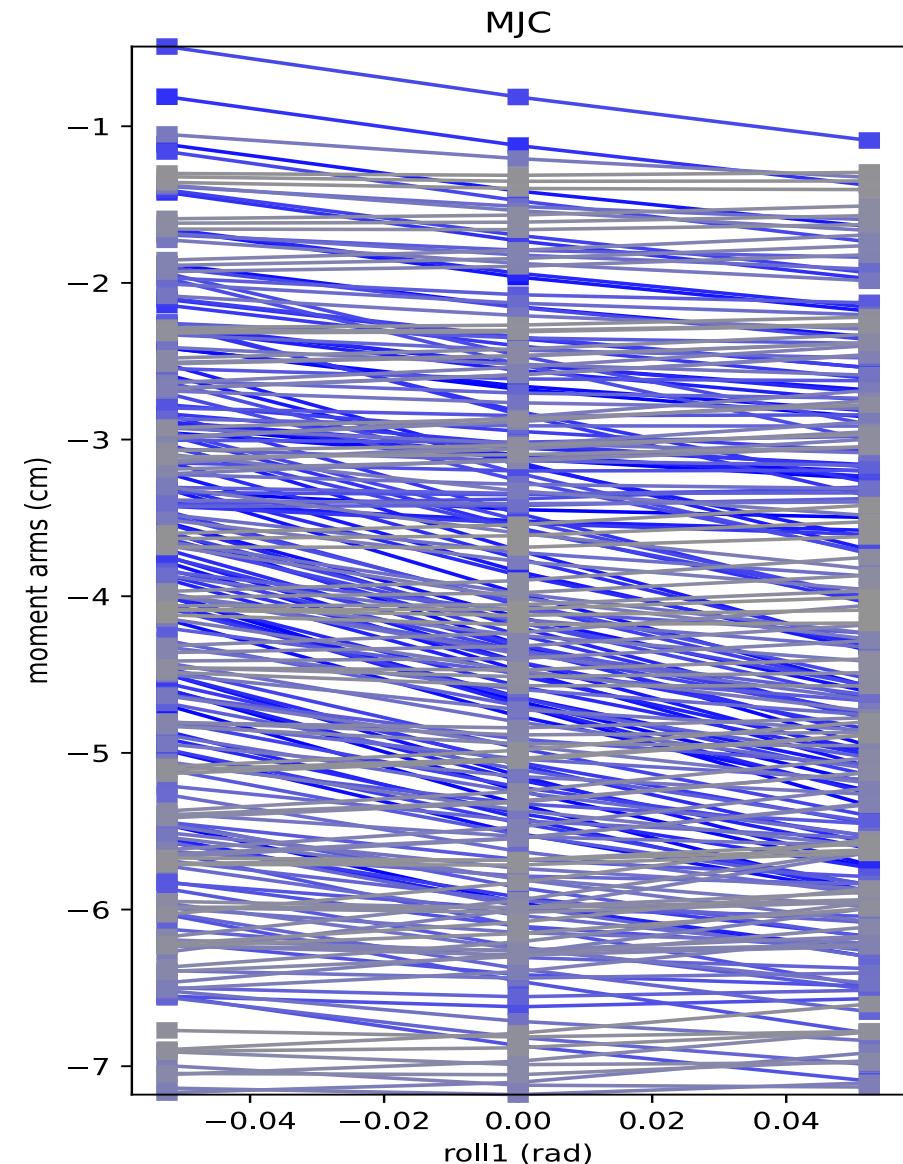
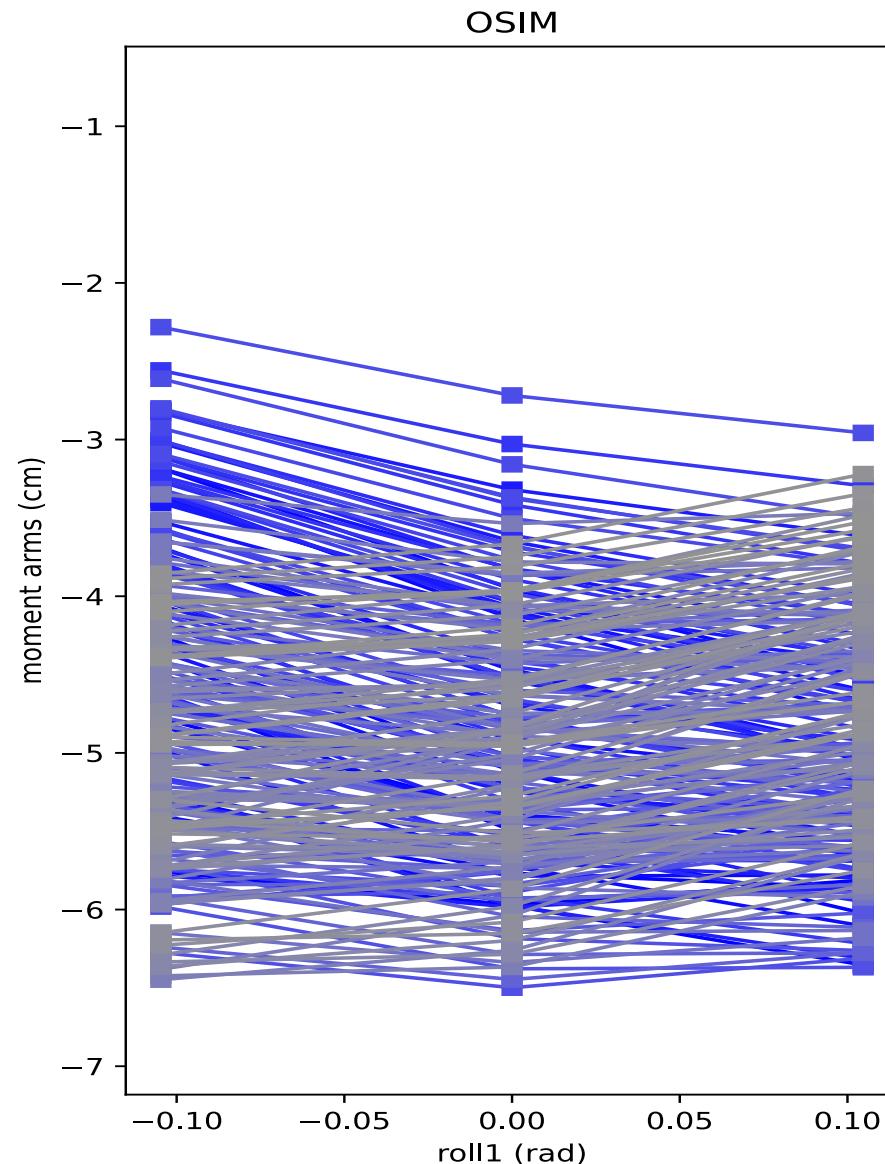
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min - pitch1 - roll1 - yaw1



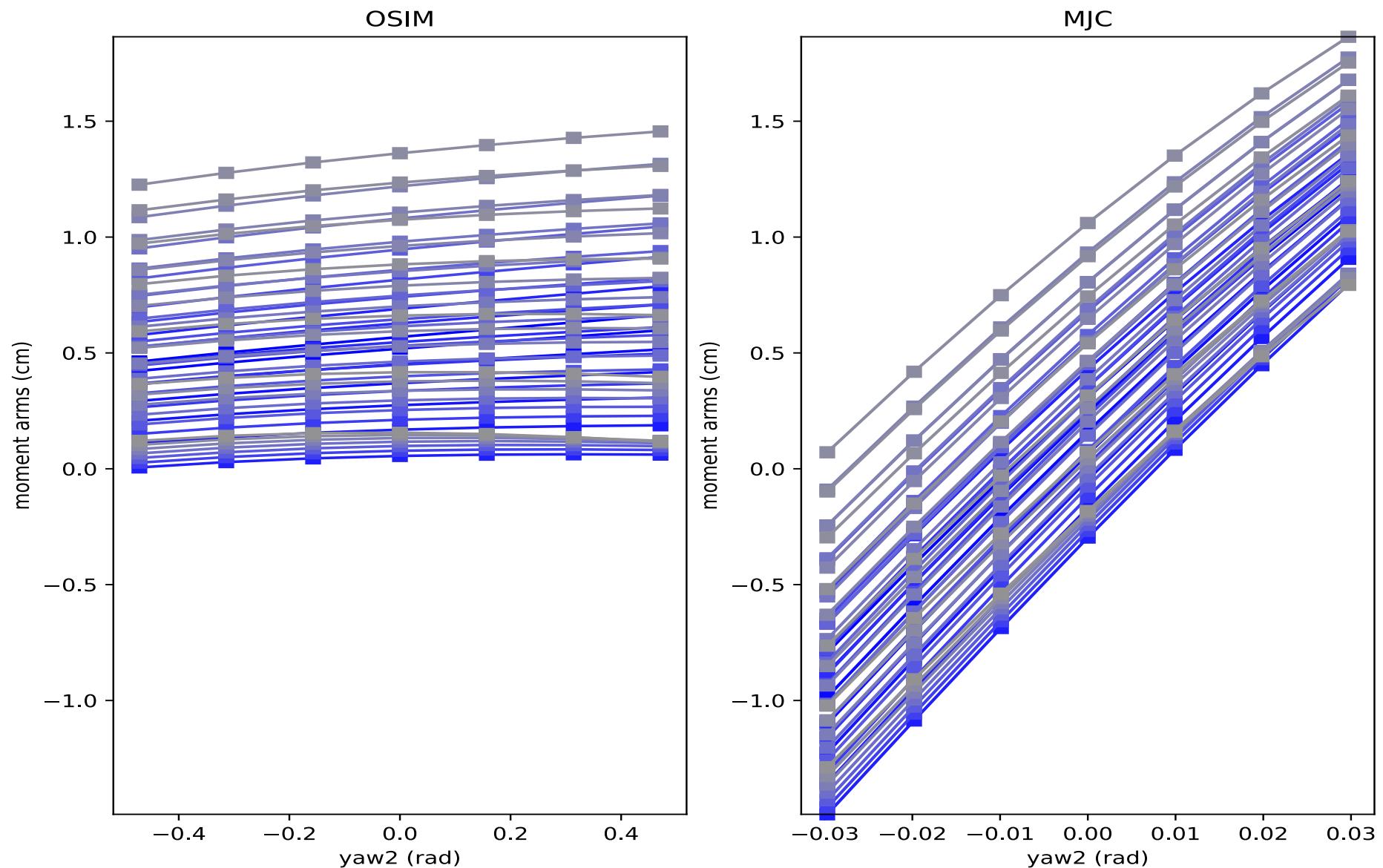
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



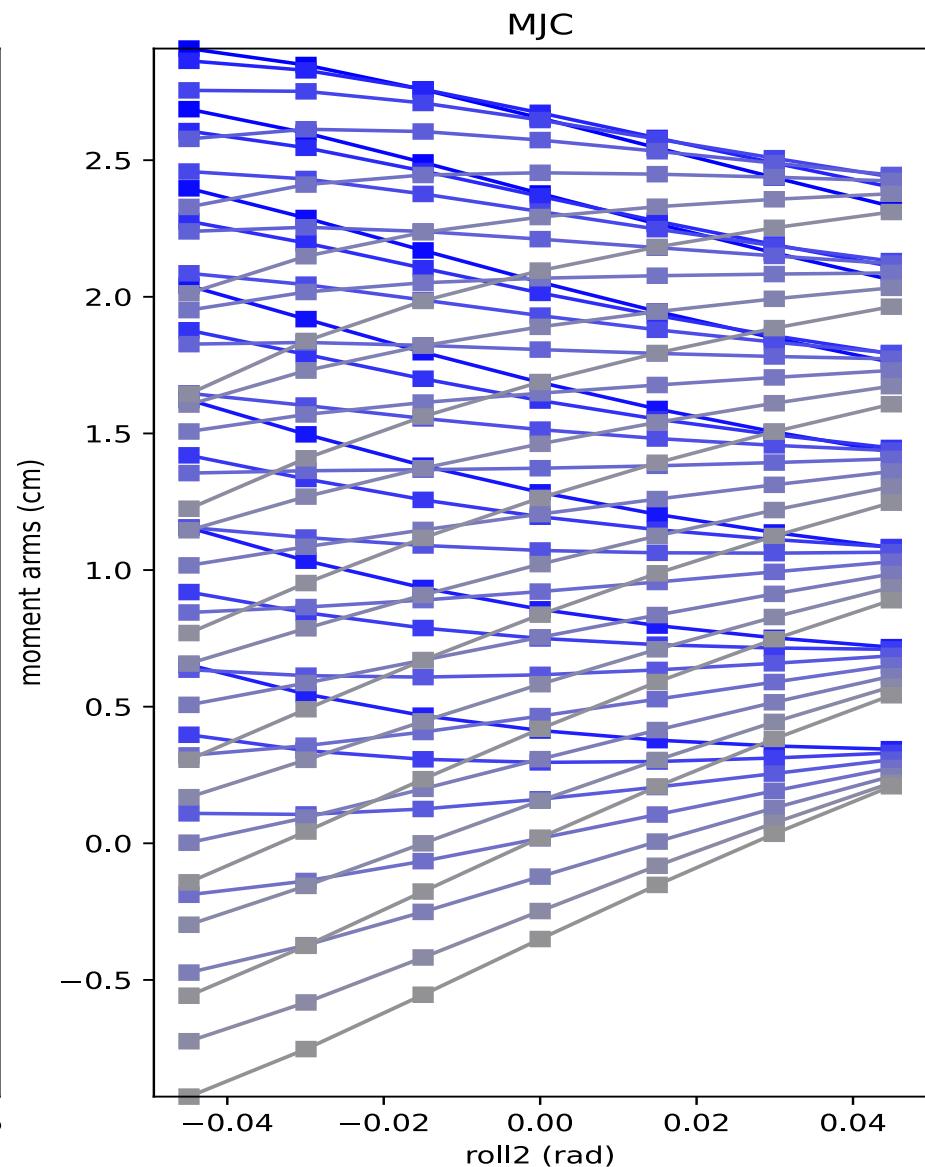
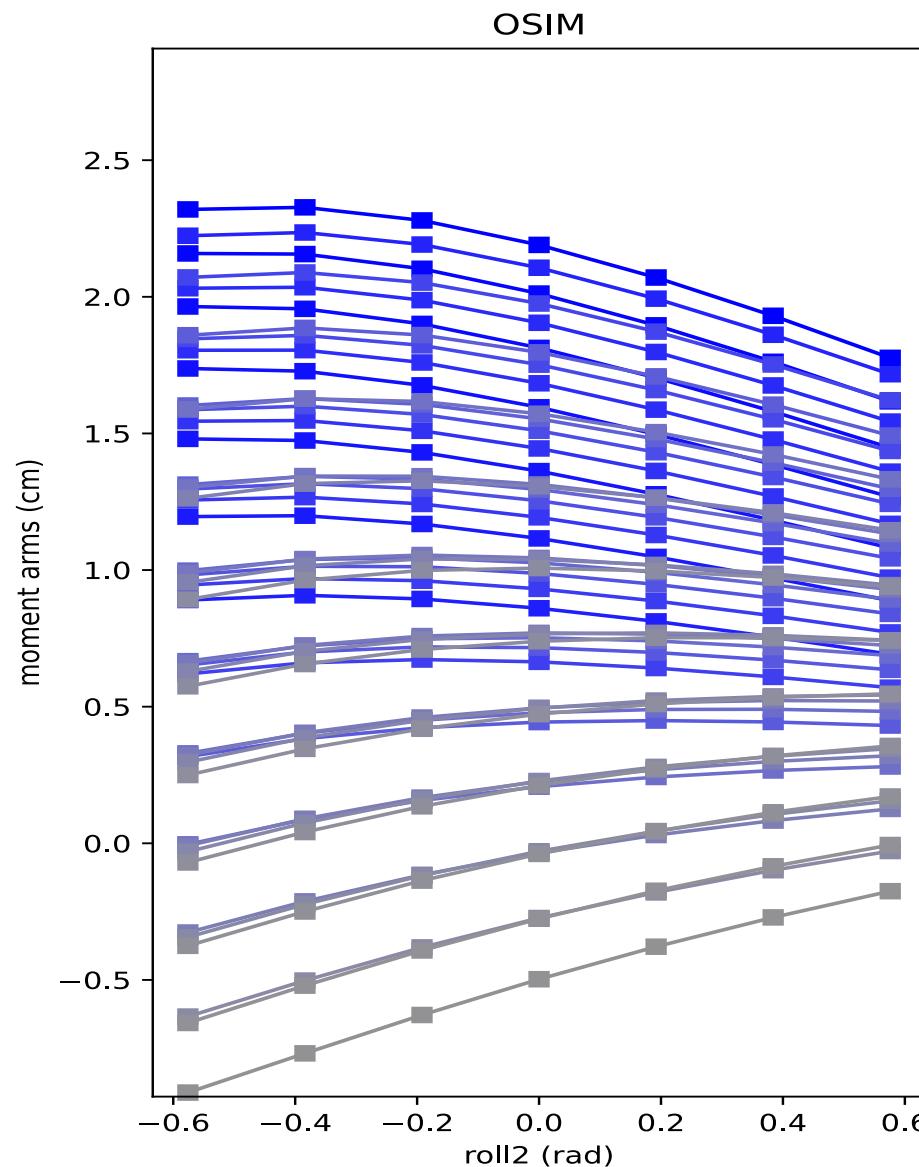
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med - pitch2 - roll2 - yaw2



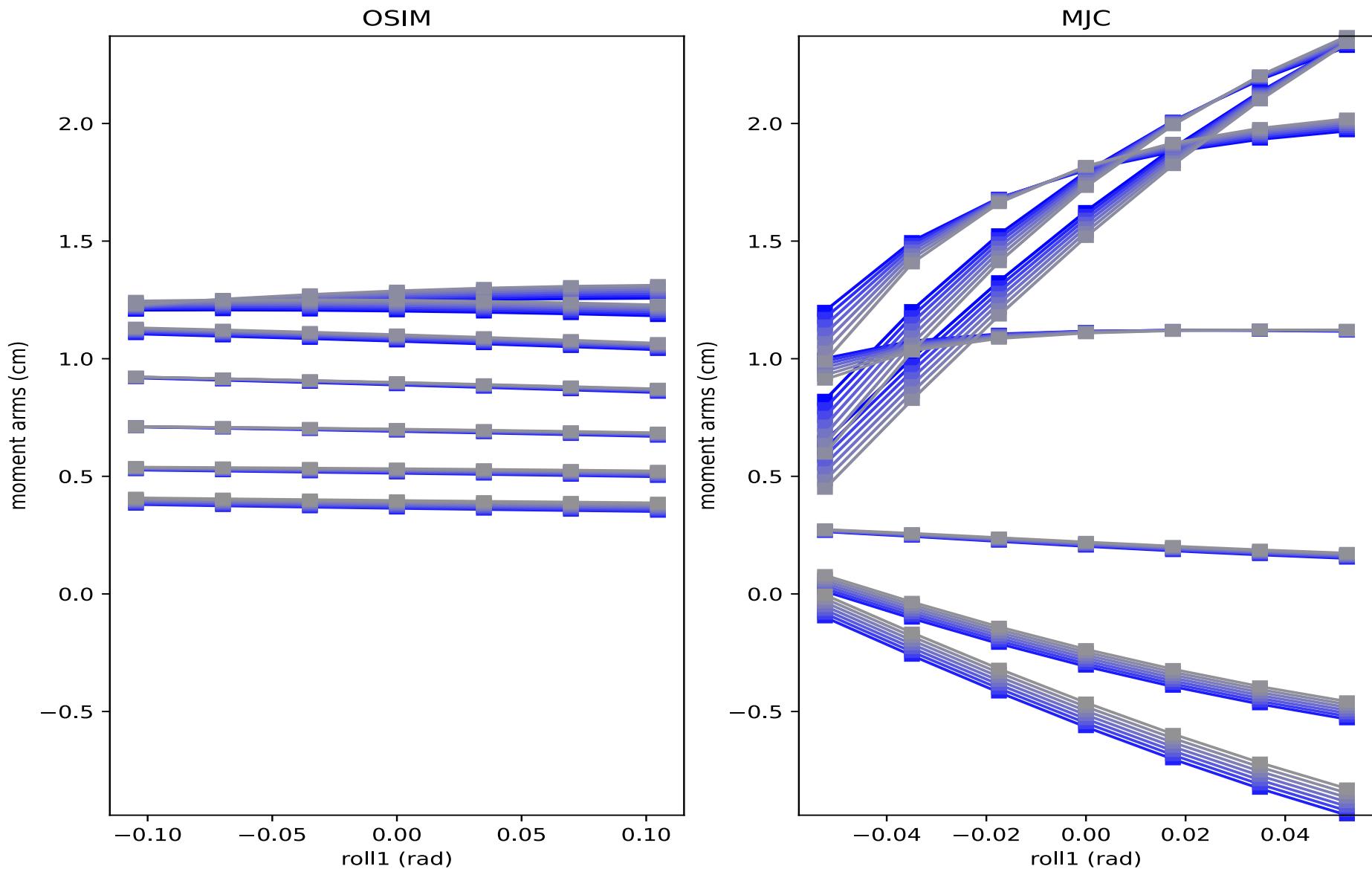
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid - pitch2 - roll2 - yaw2



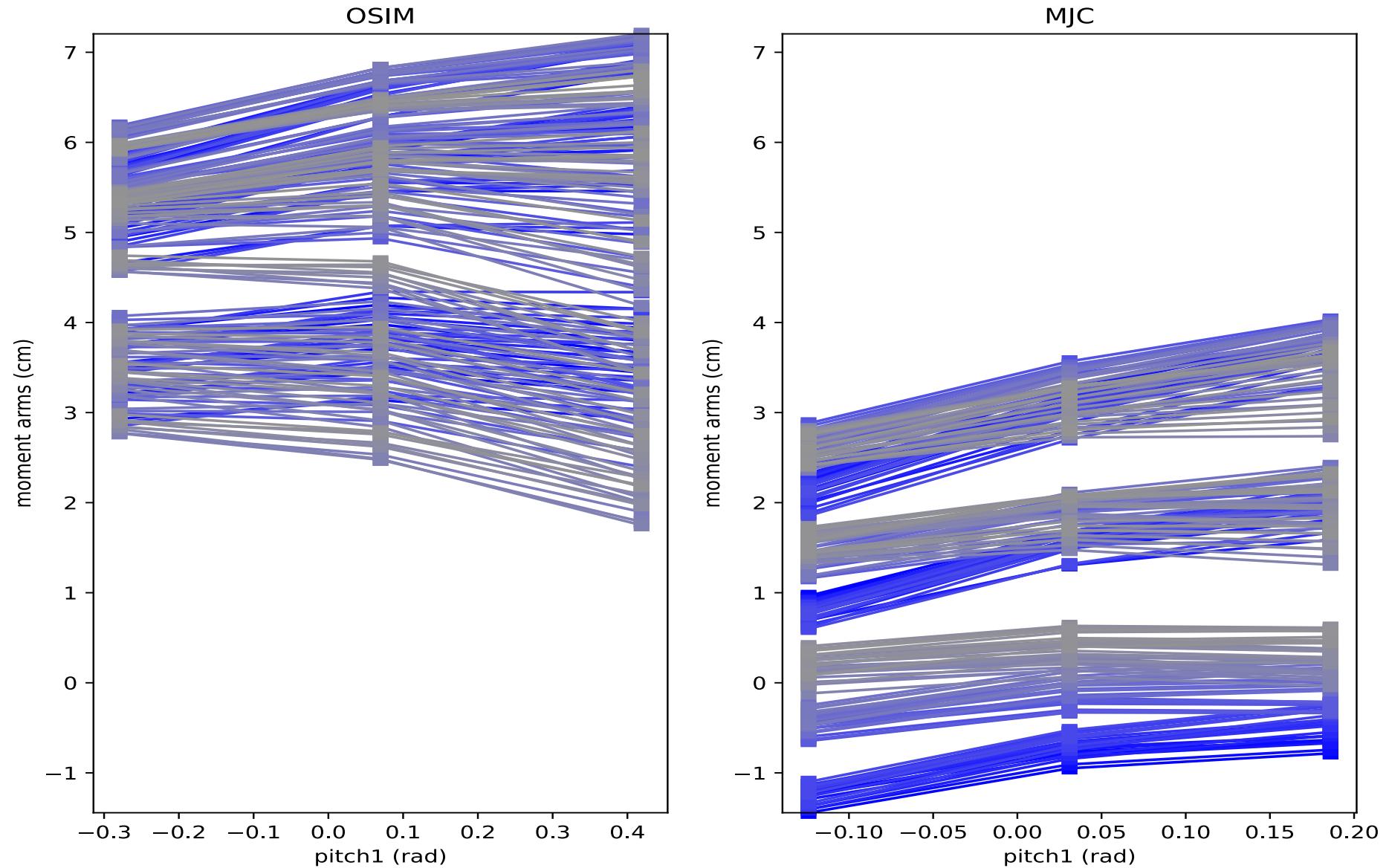
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch1 - roll1 - yaw1



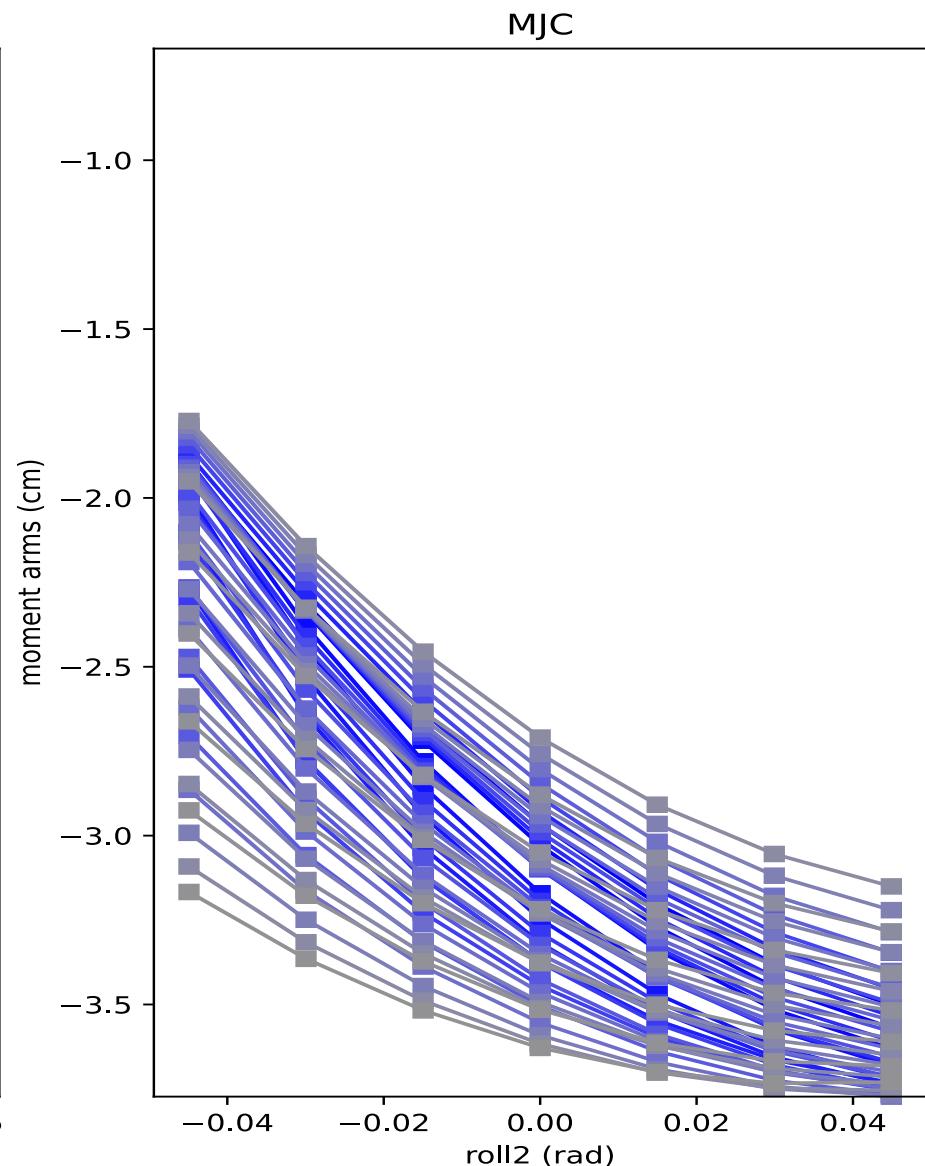
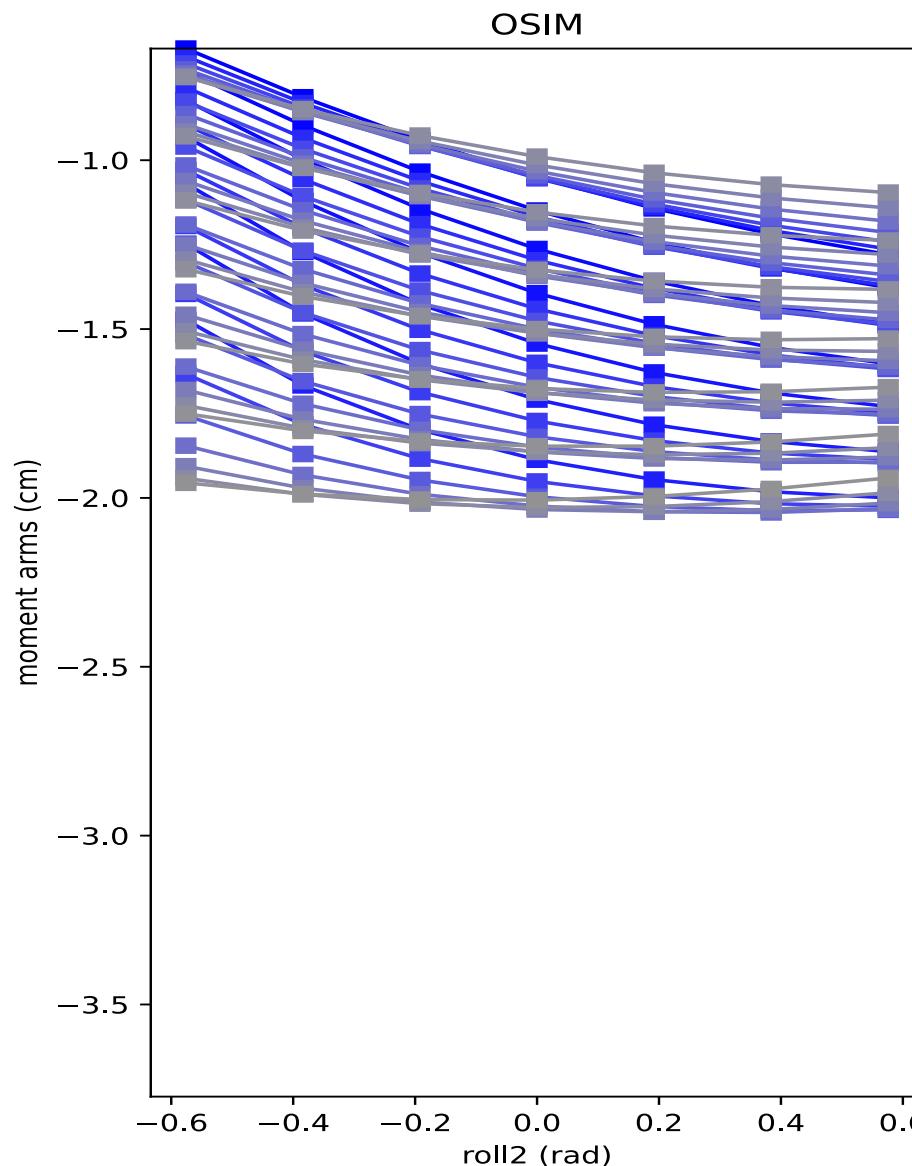
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



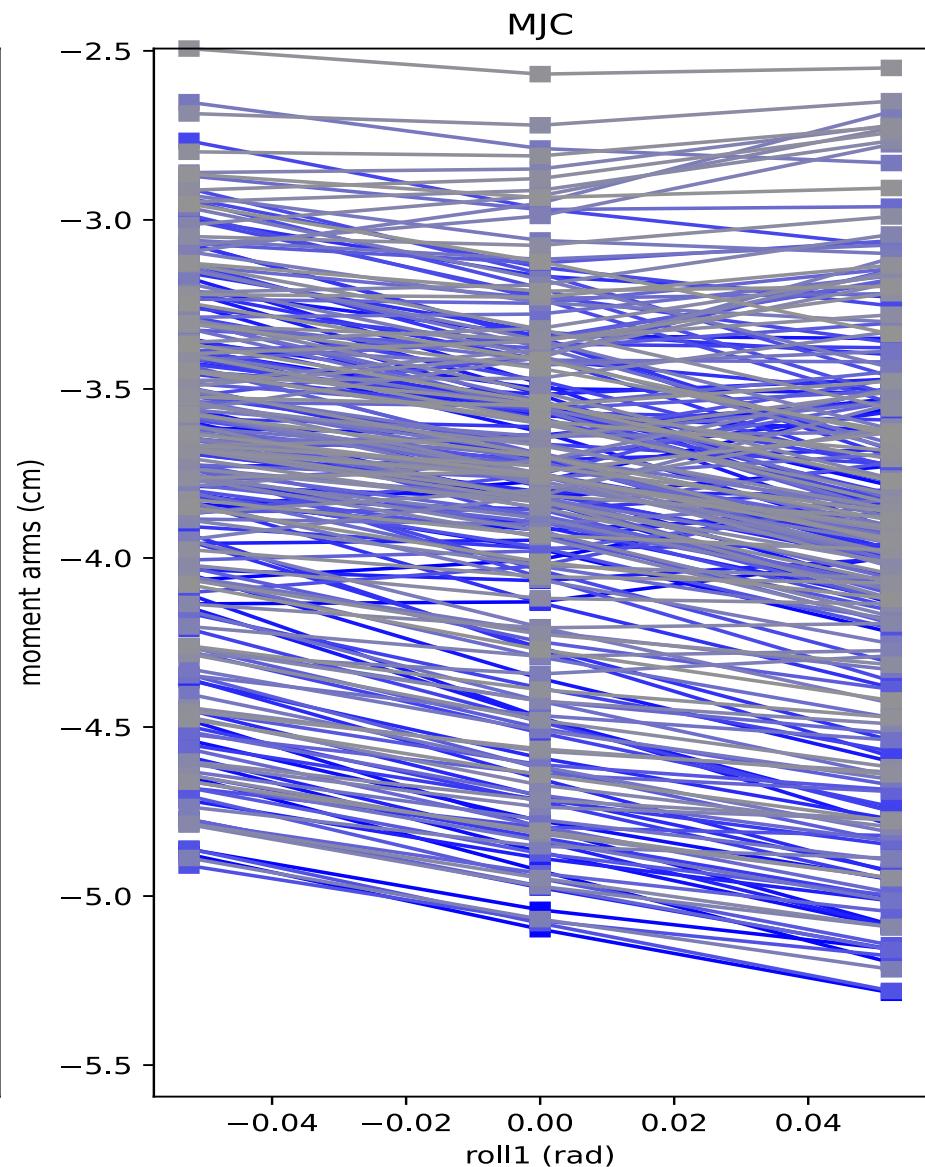
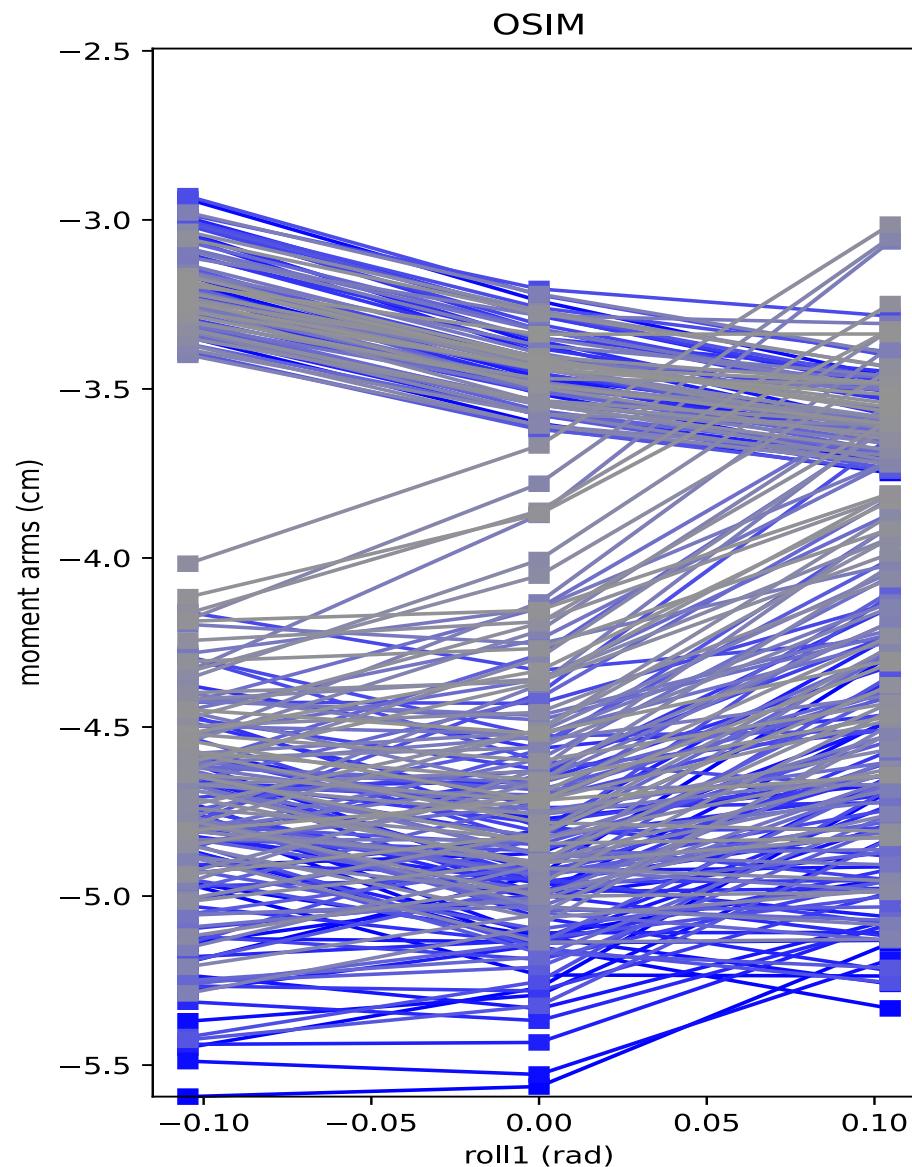
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyooid_L - pitch2 - roll2 - yaw2



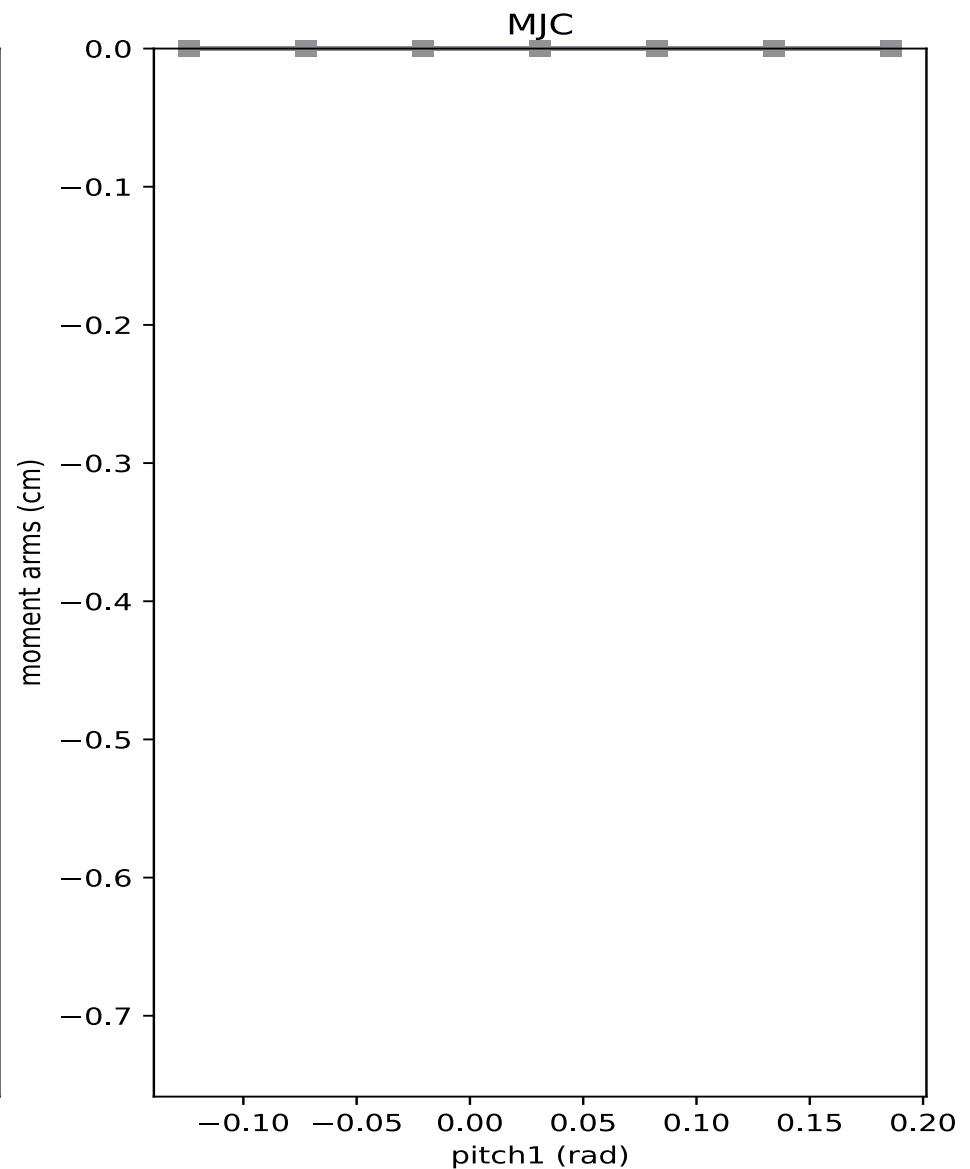
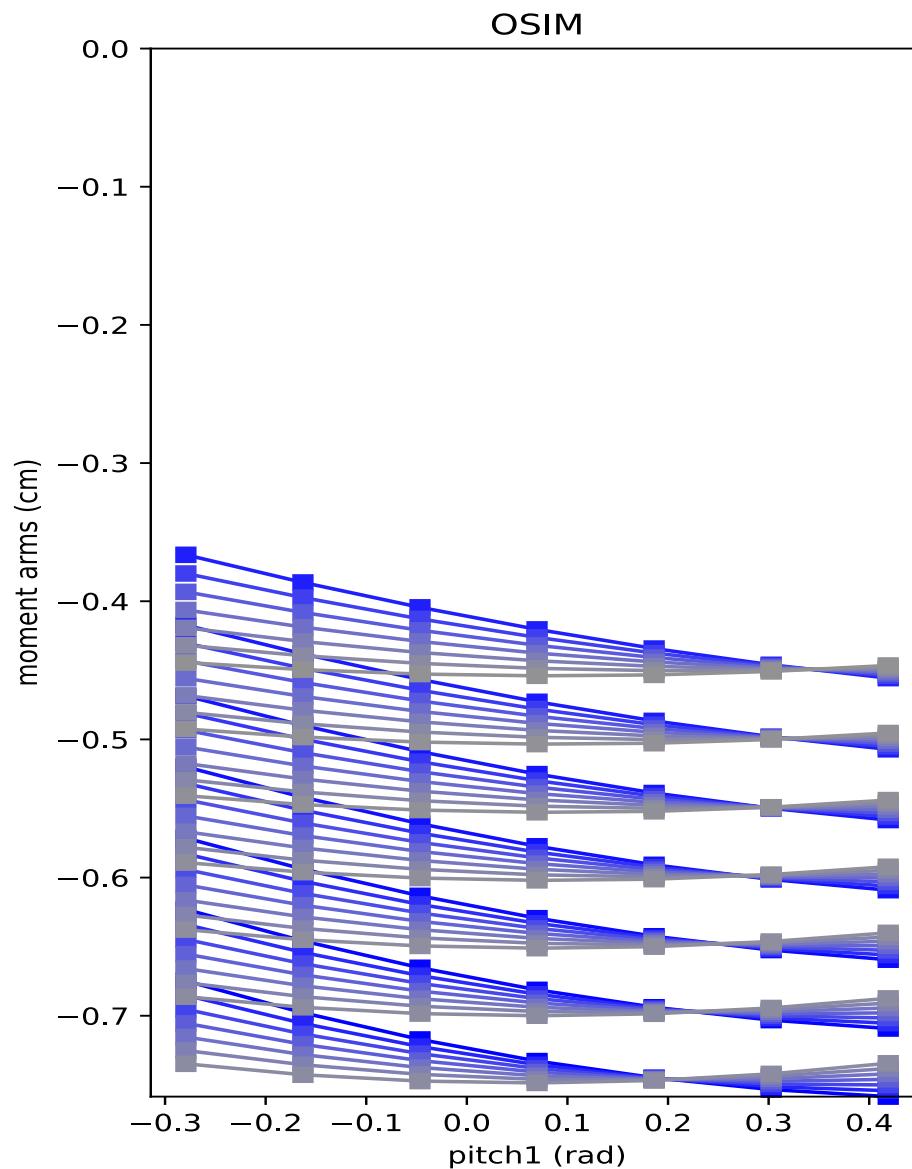
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



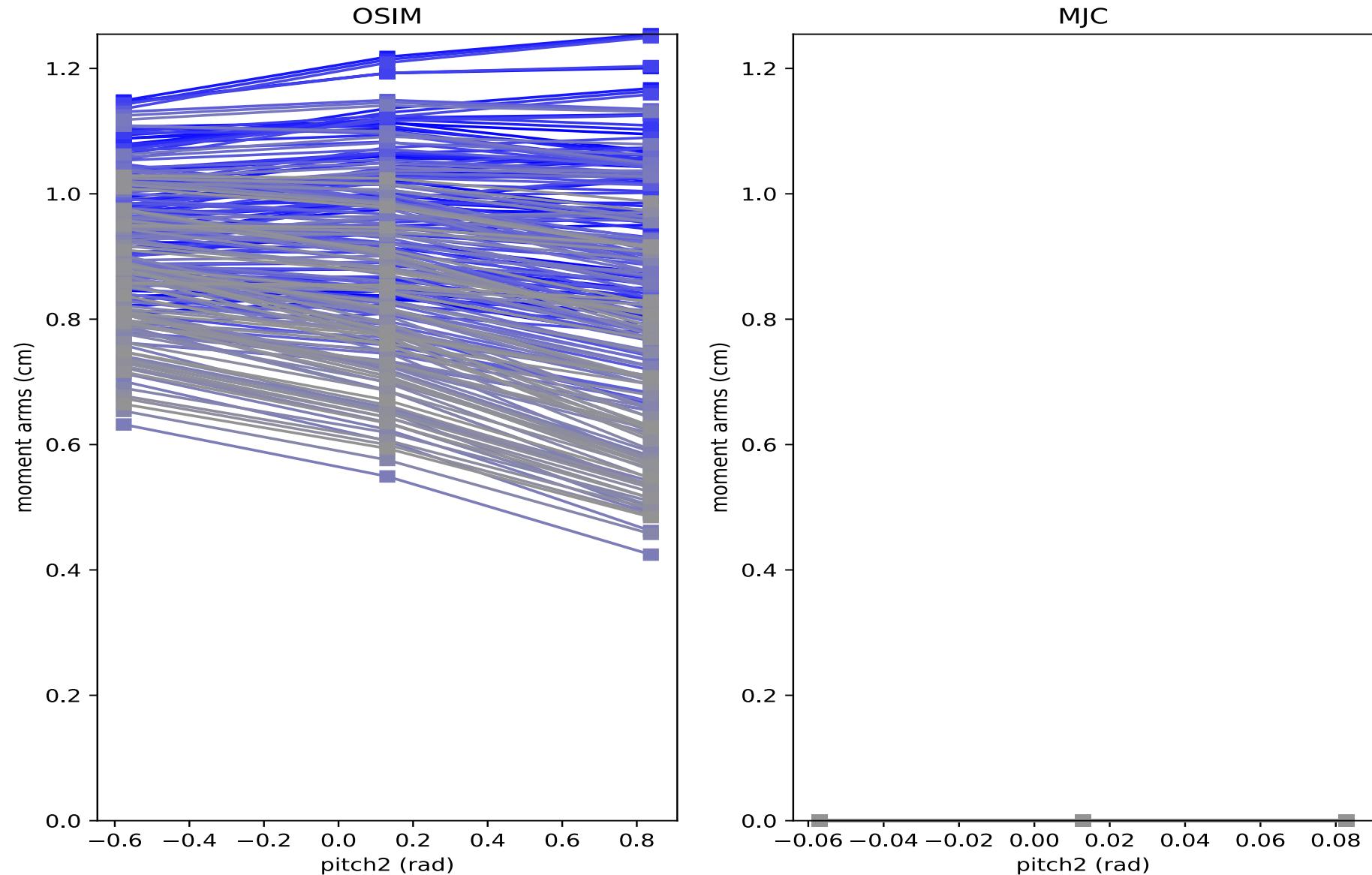
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat_L - pitch1 - roll1 - yaw1



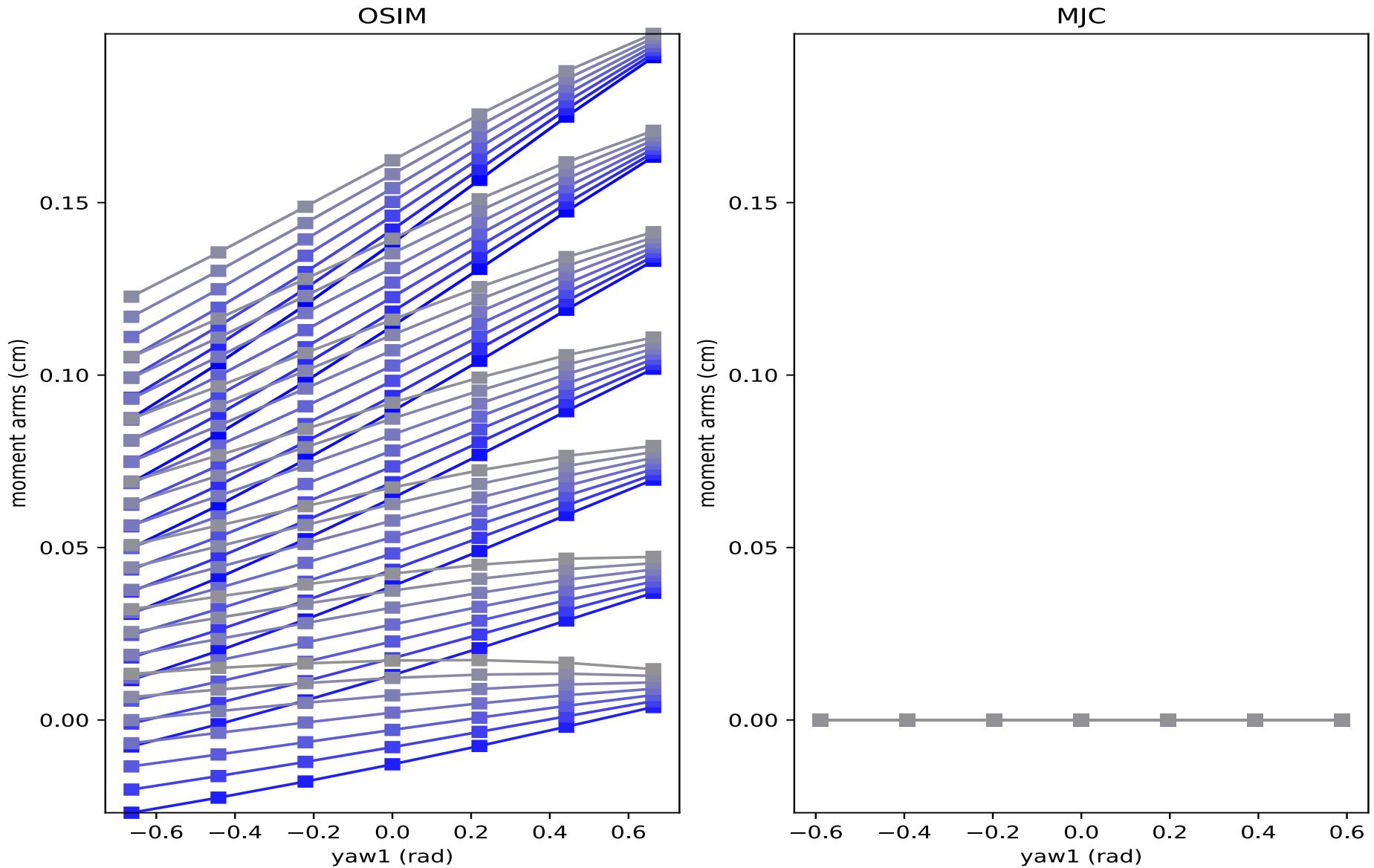
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



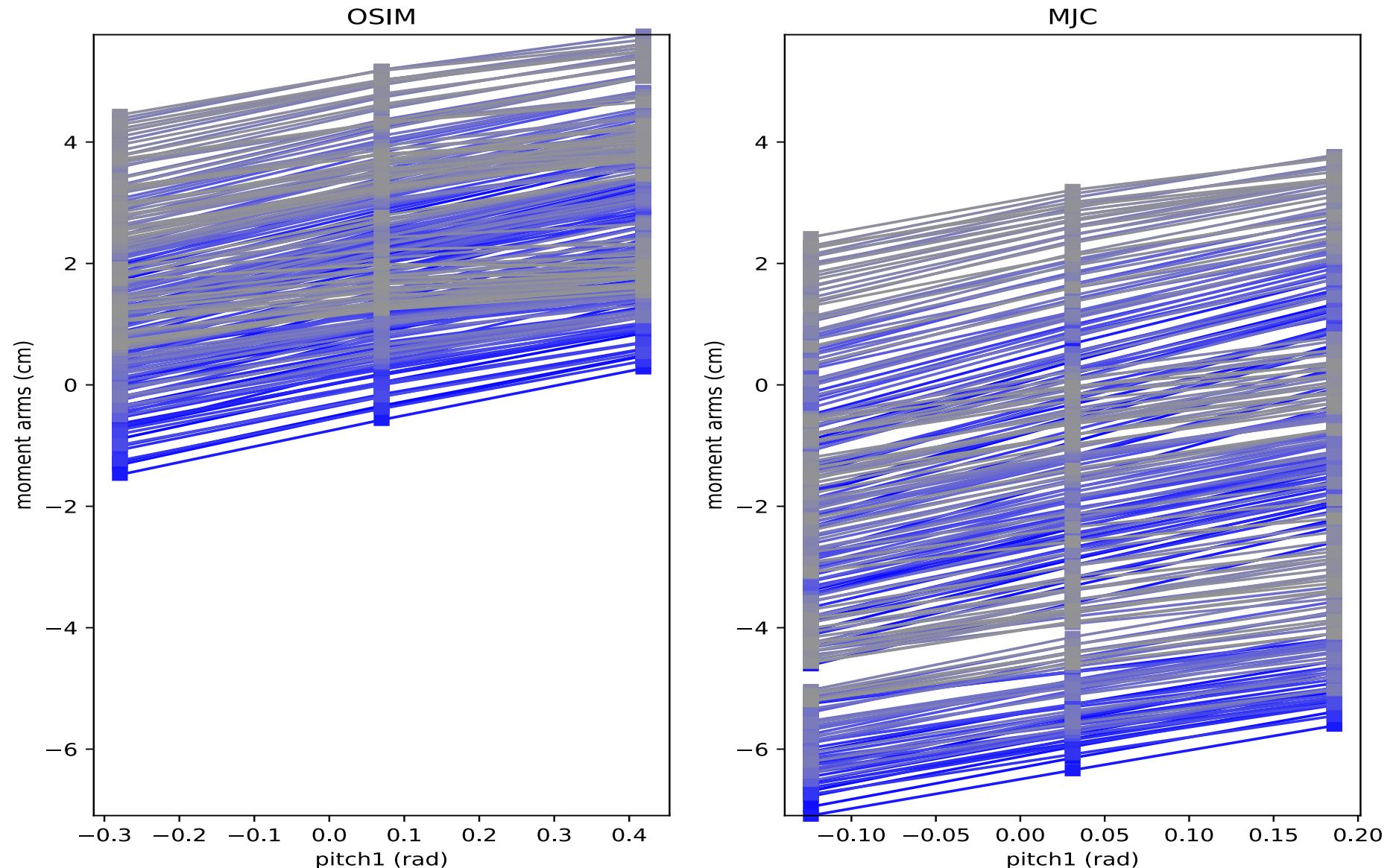
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min_L - pitch1 - roll1 - yaw1



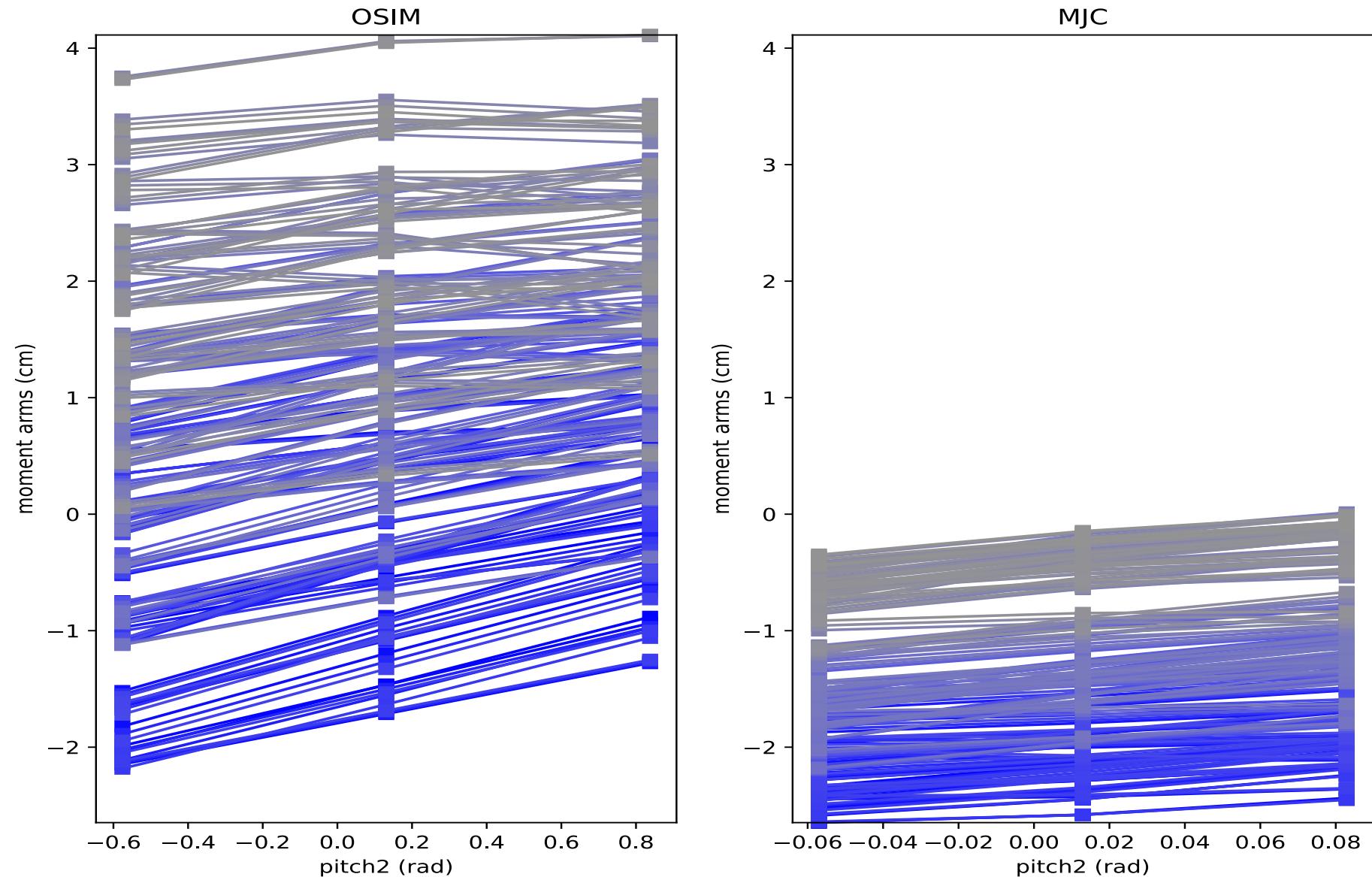
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



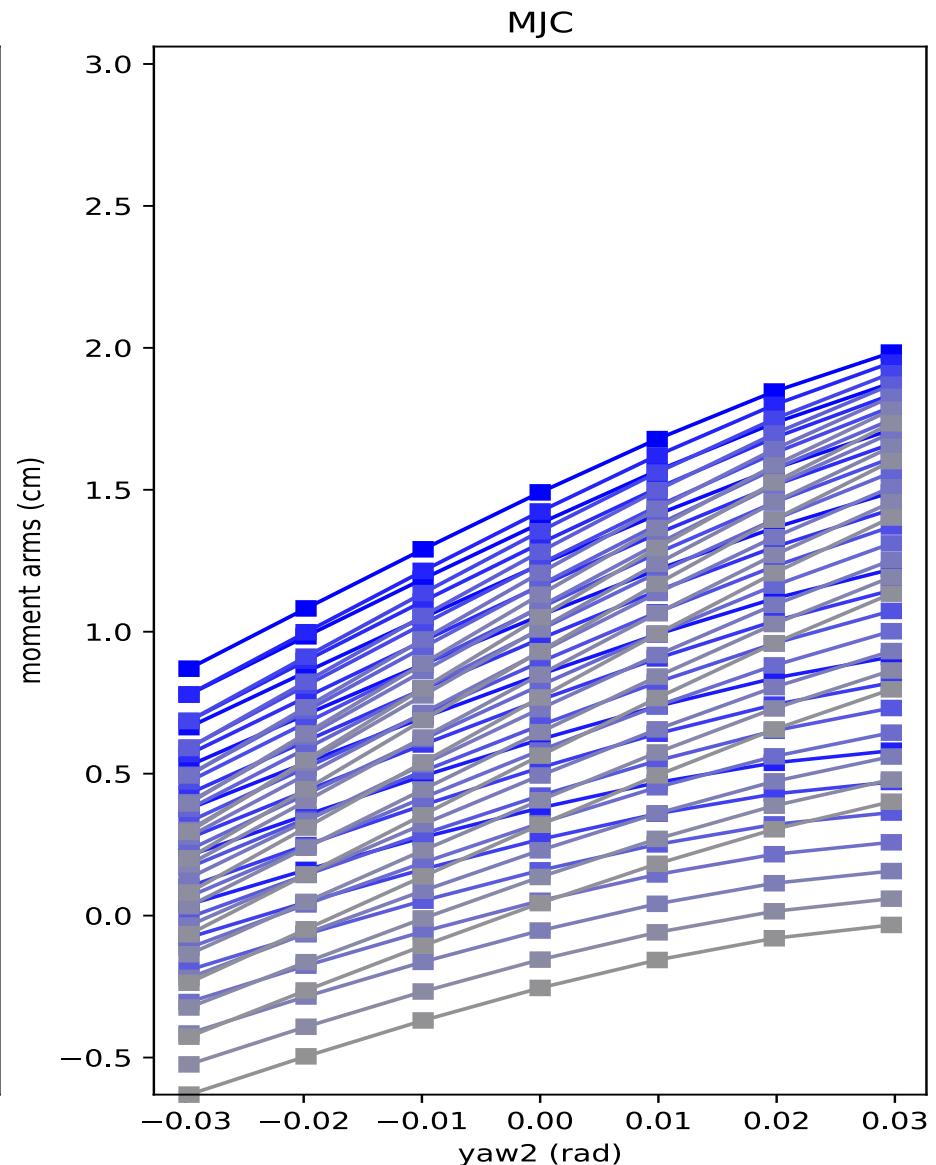
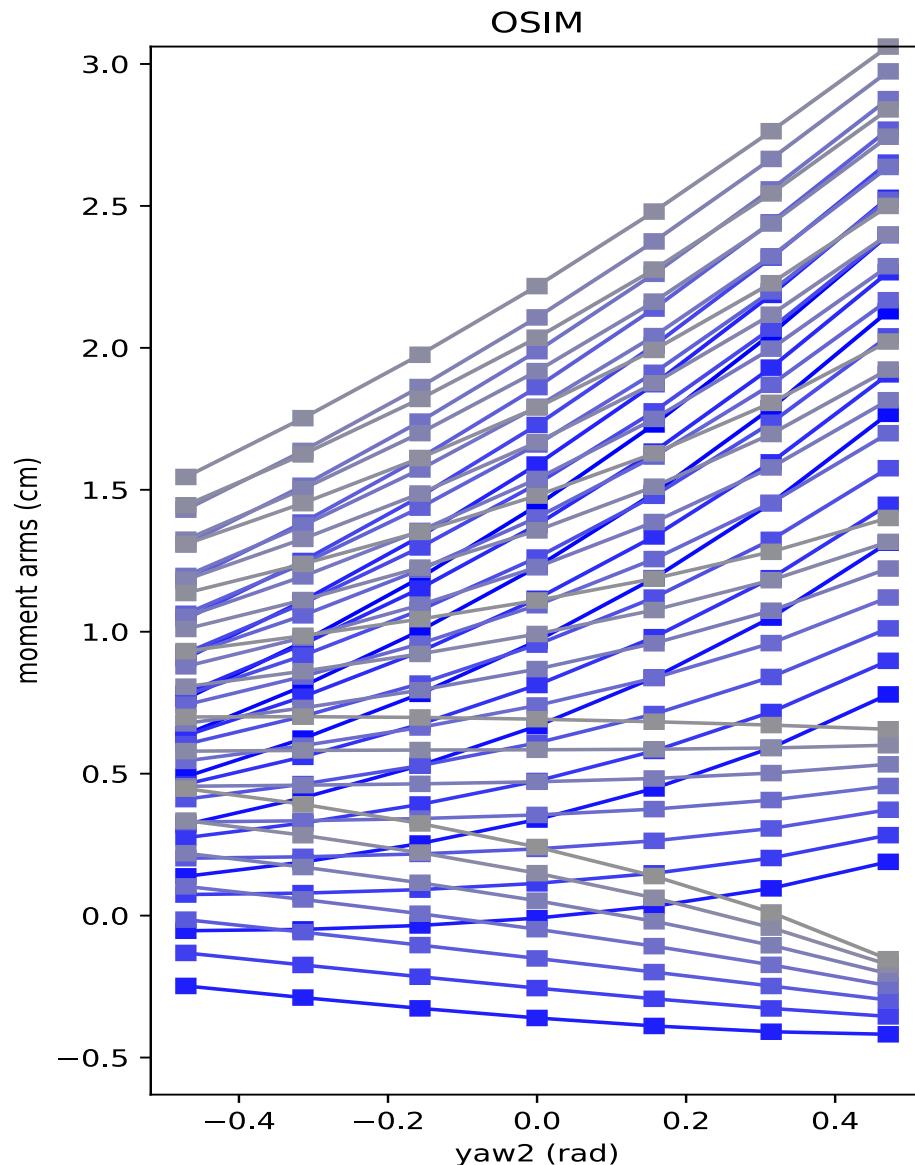
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



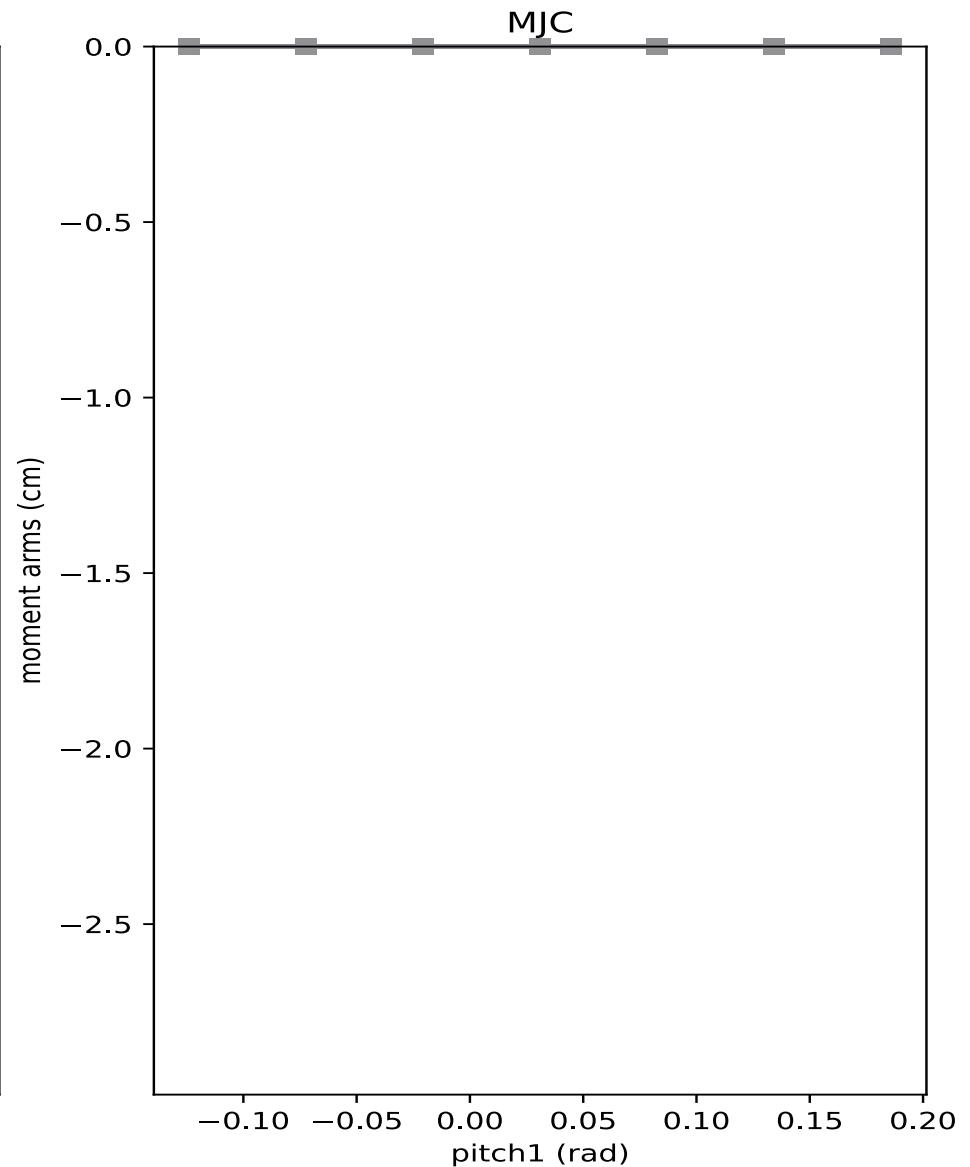
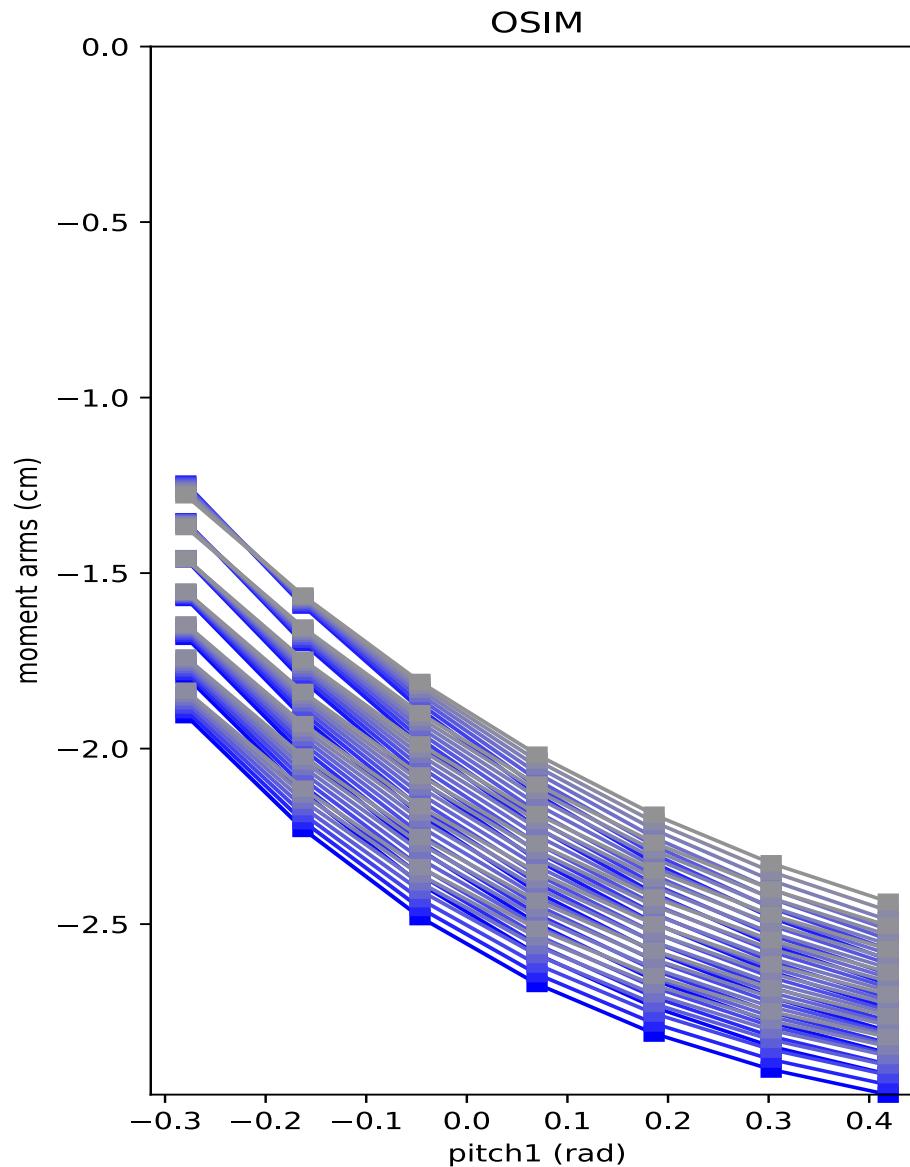
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx - pitch2 - roll2 - yaw2



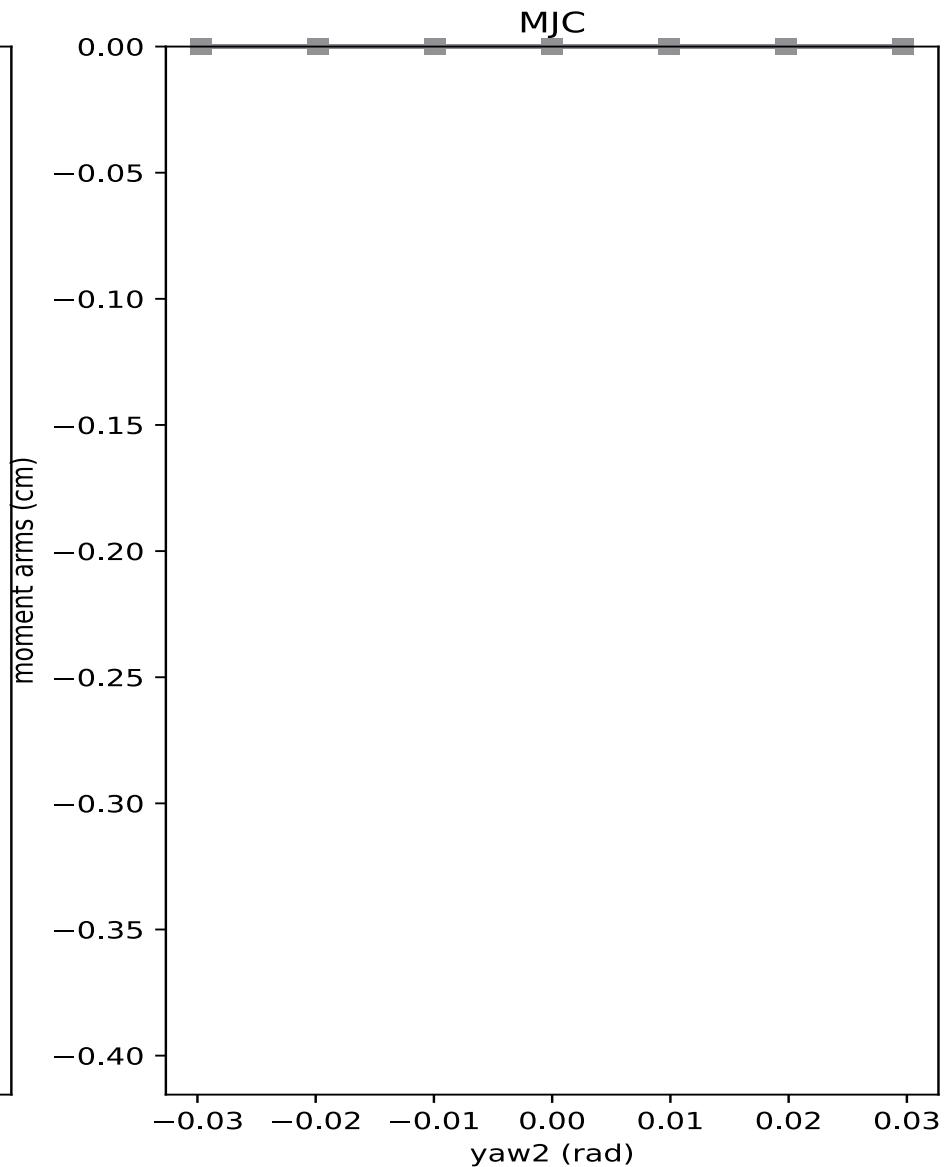
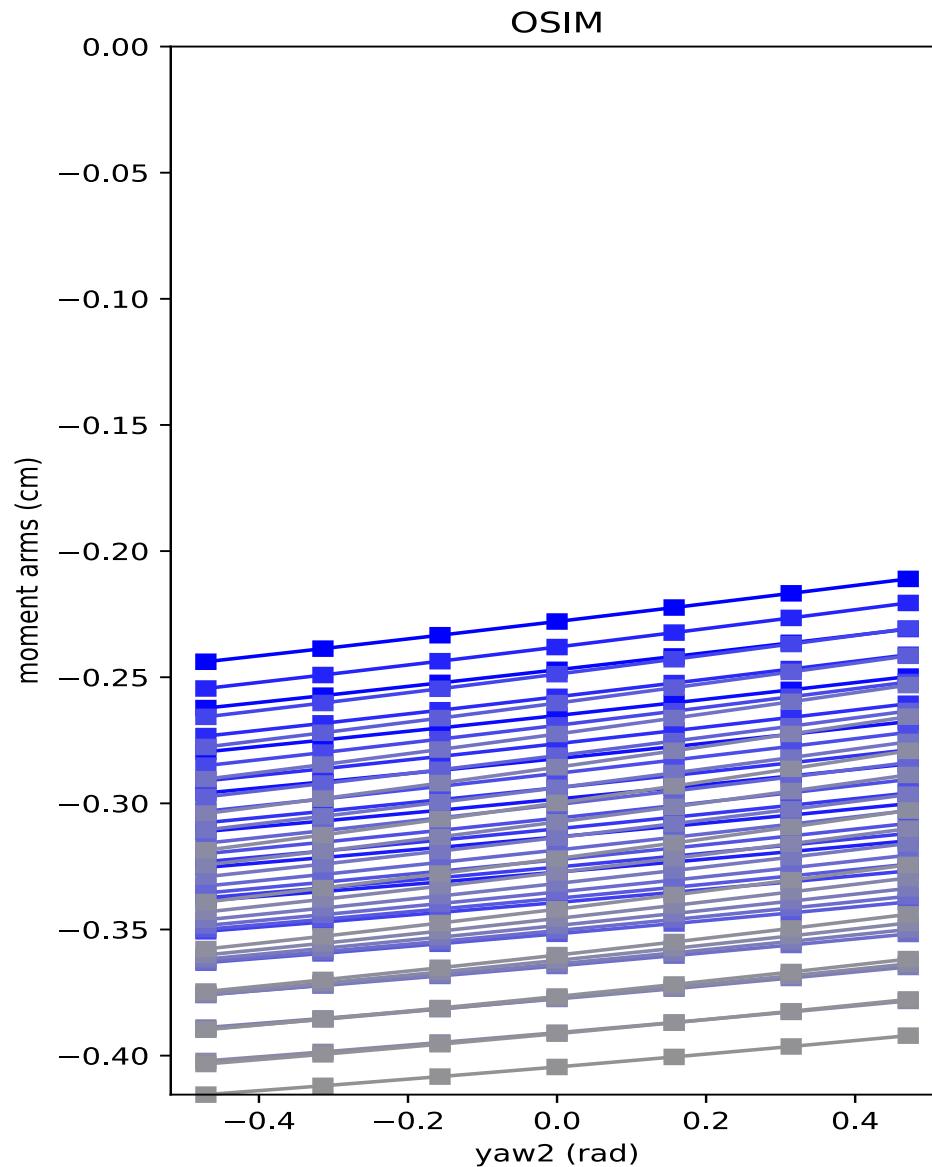
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post_L - pitch1 - roll1 - yaw1



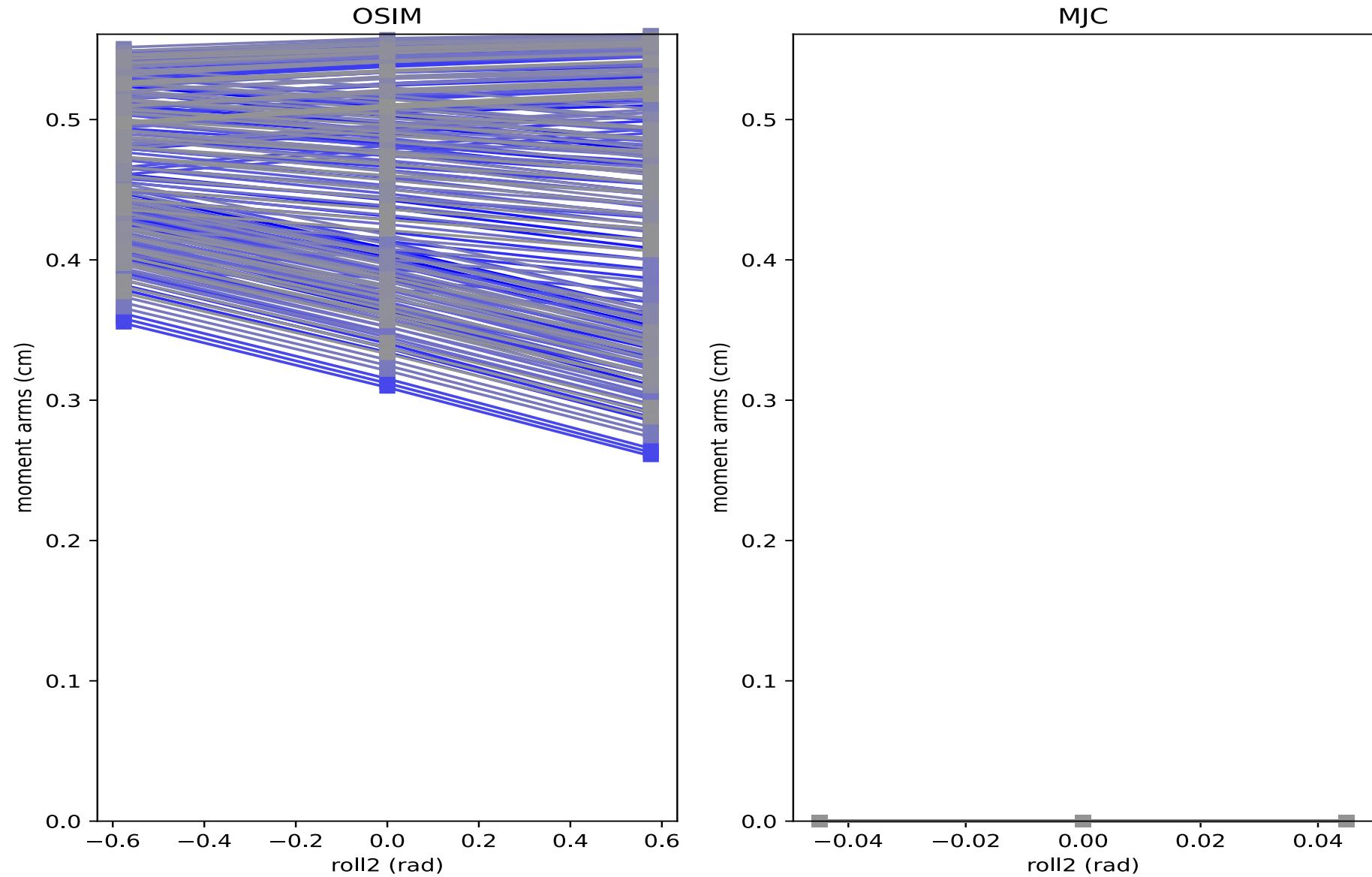
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch2 - roll2 - yaw2



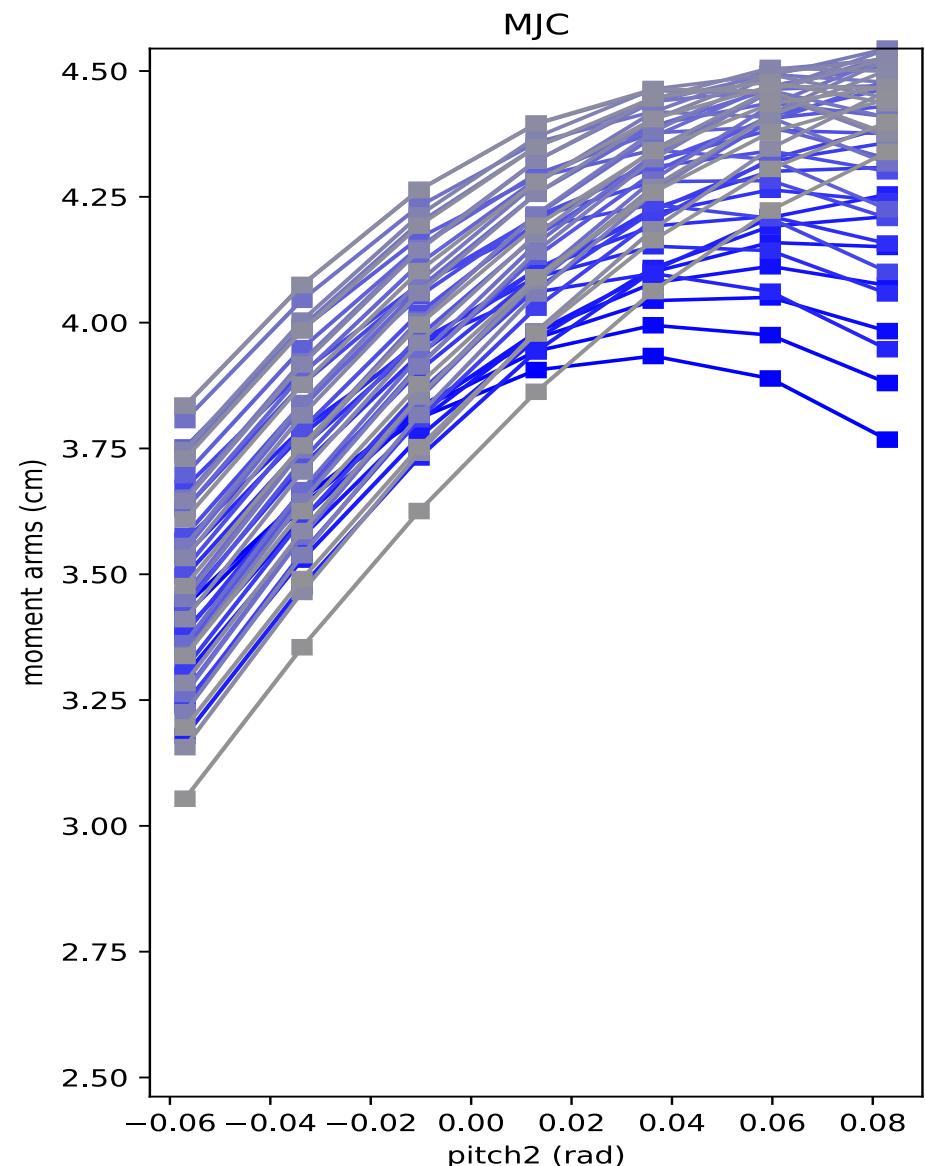
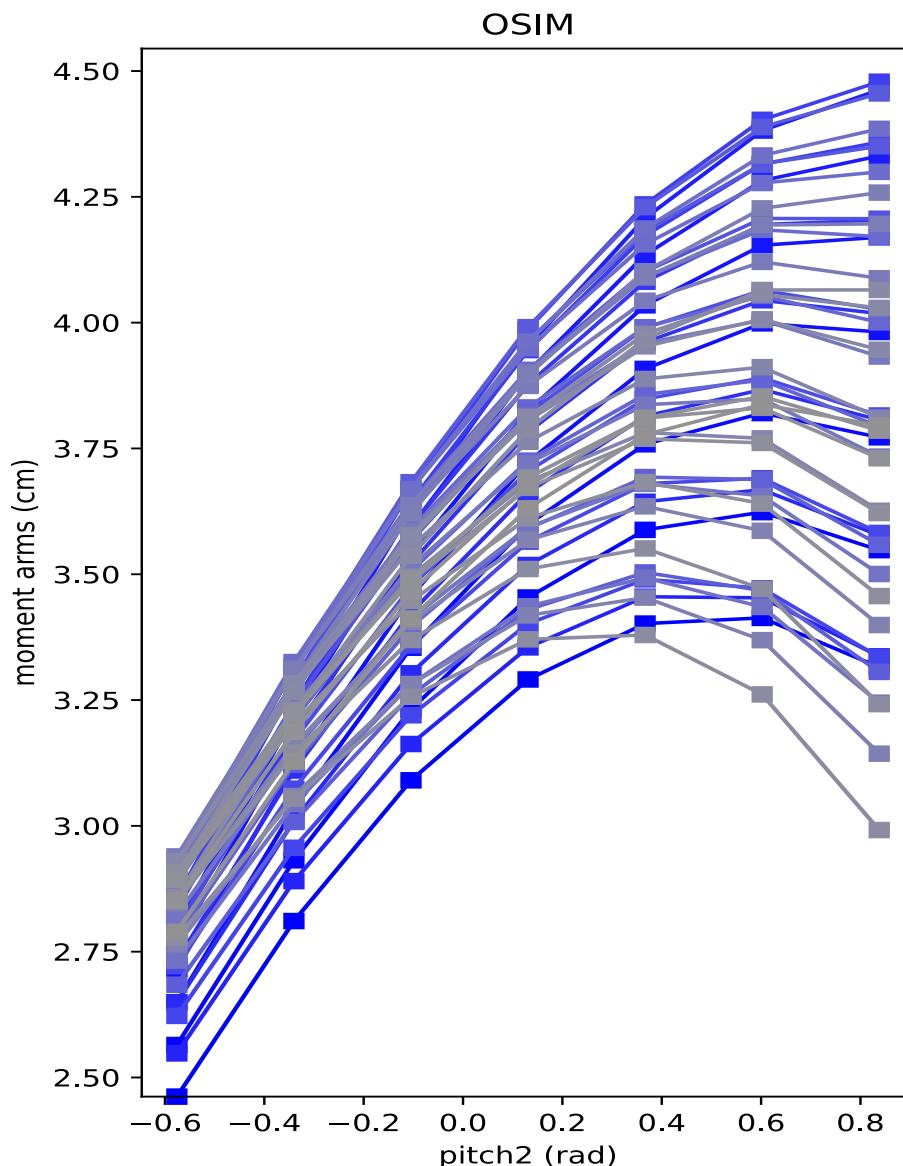
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



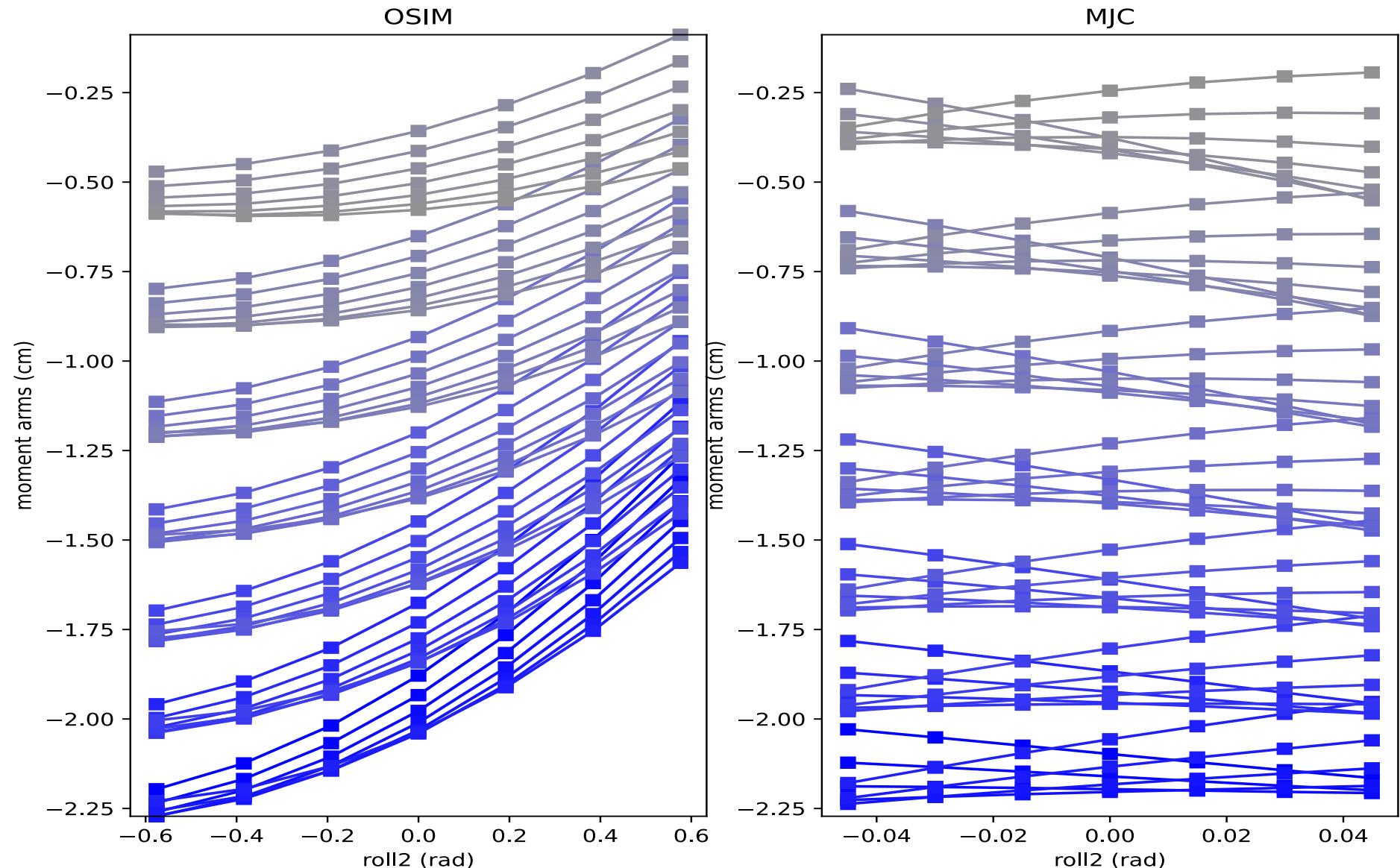
Muscle specific moment arm comparison with Osim model after optimization

levator_scap - pitch2 - roll2 - yaw2



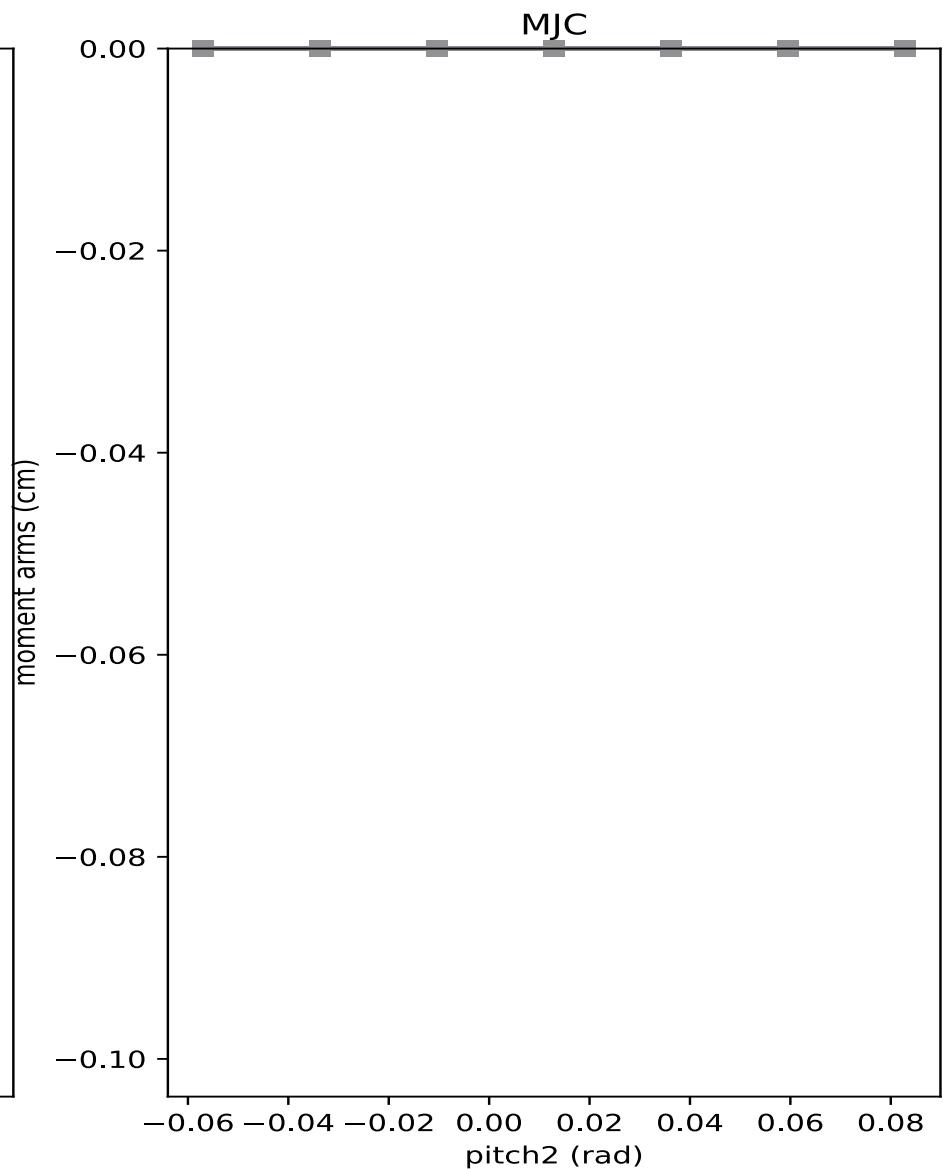
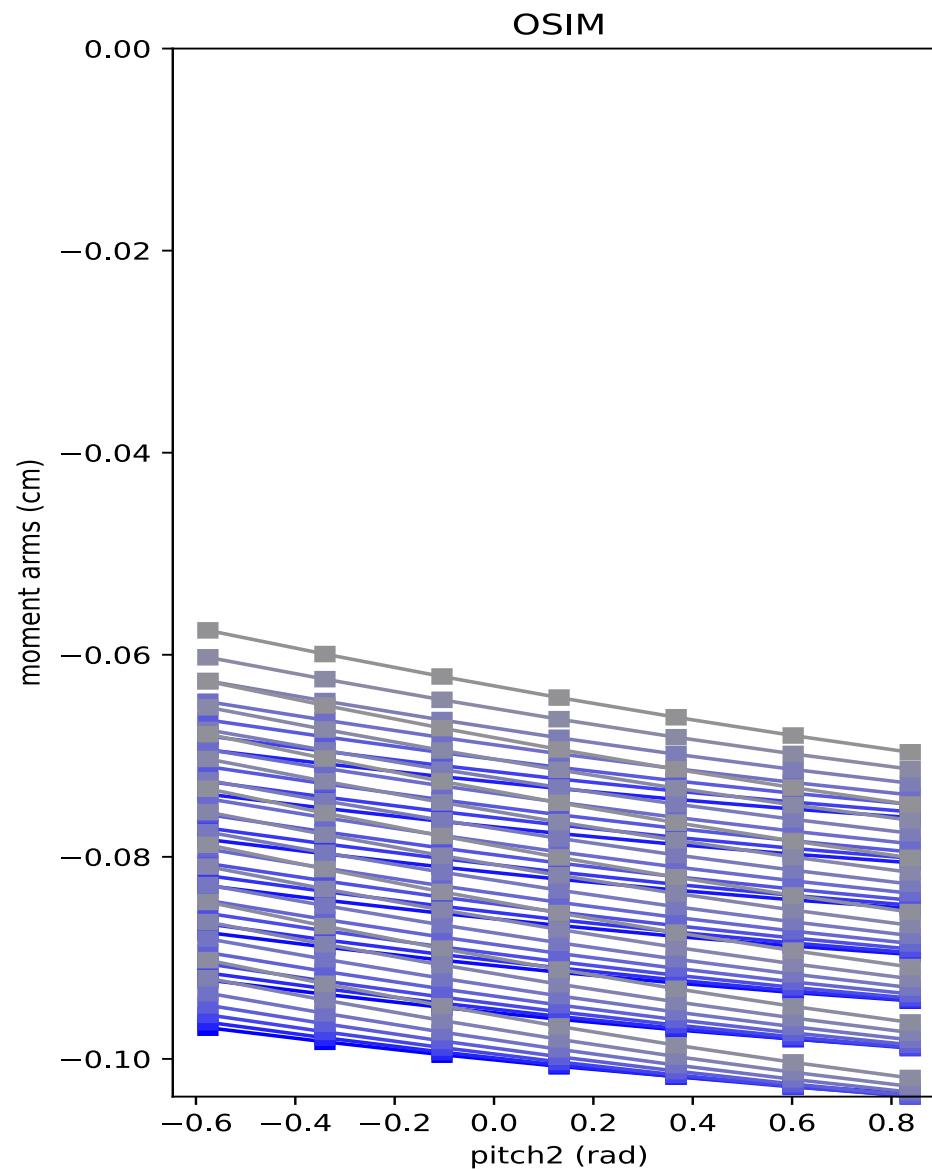
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx_L - pitch2 - roll2 - yaw2



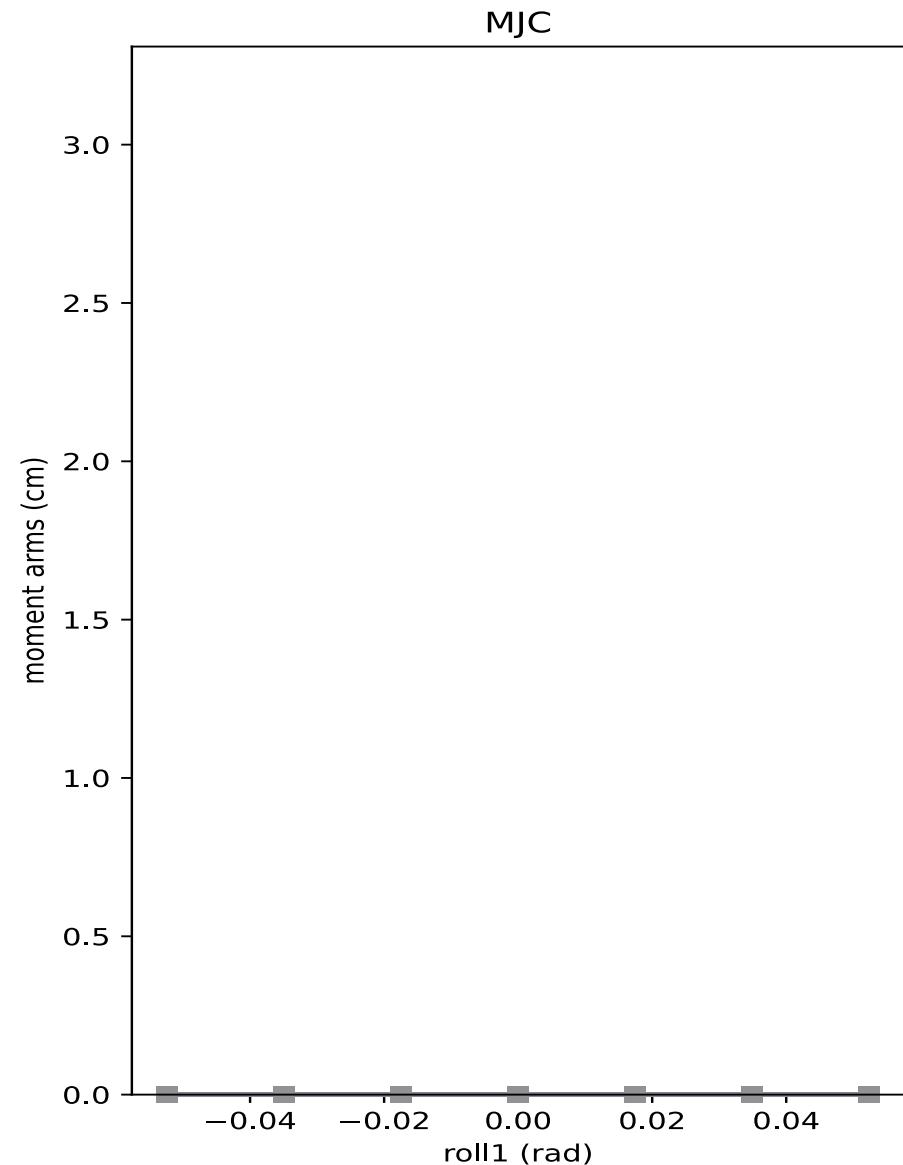
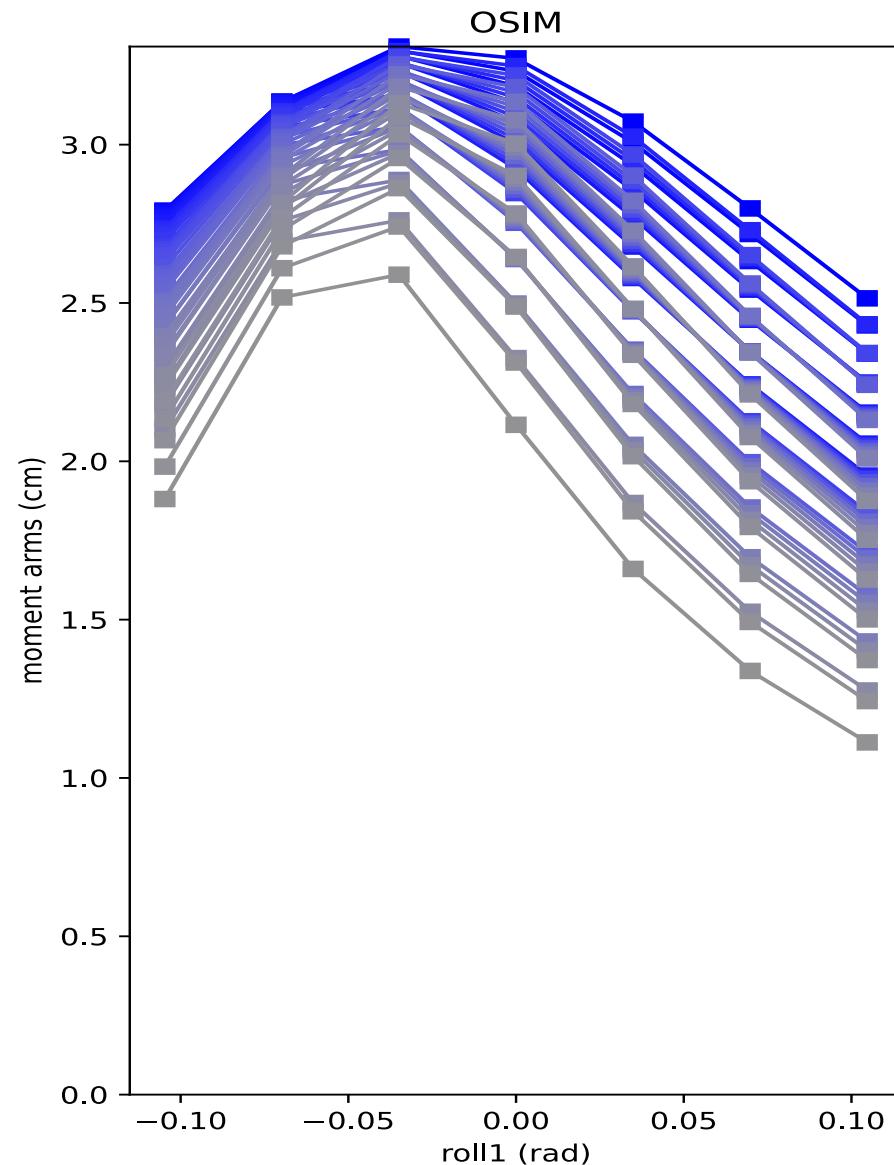
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch2 - roll2 - yaw2



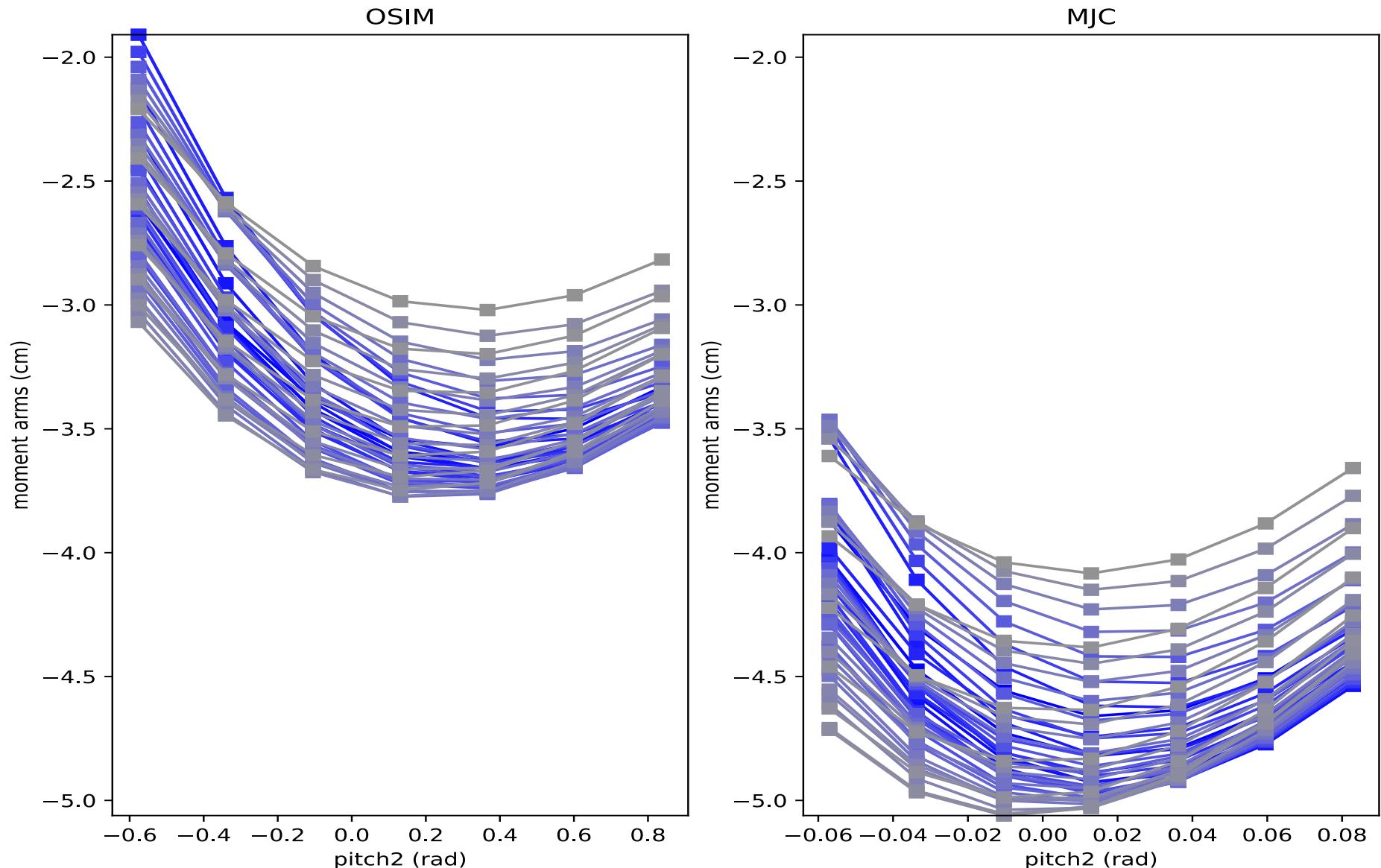
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant - pitch1 - roll1 - yaw1



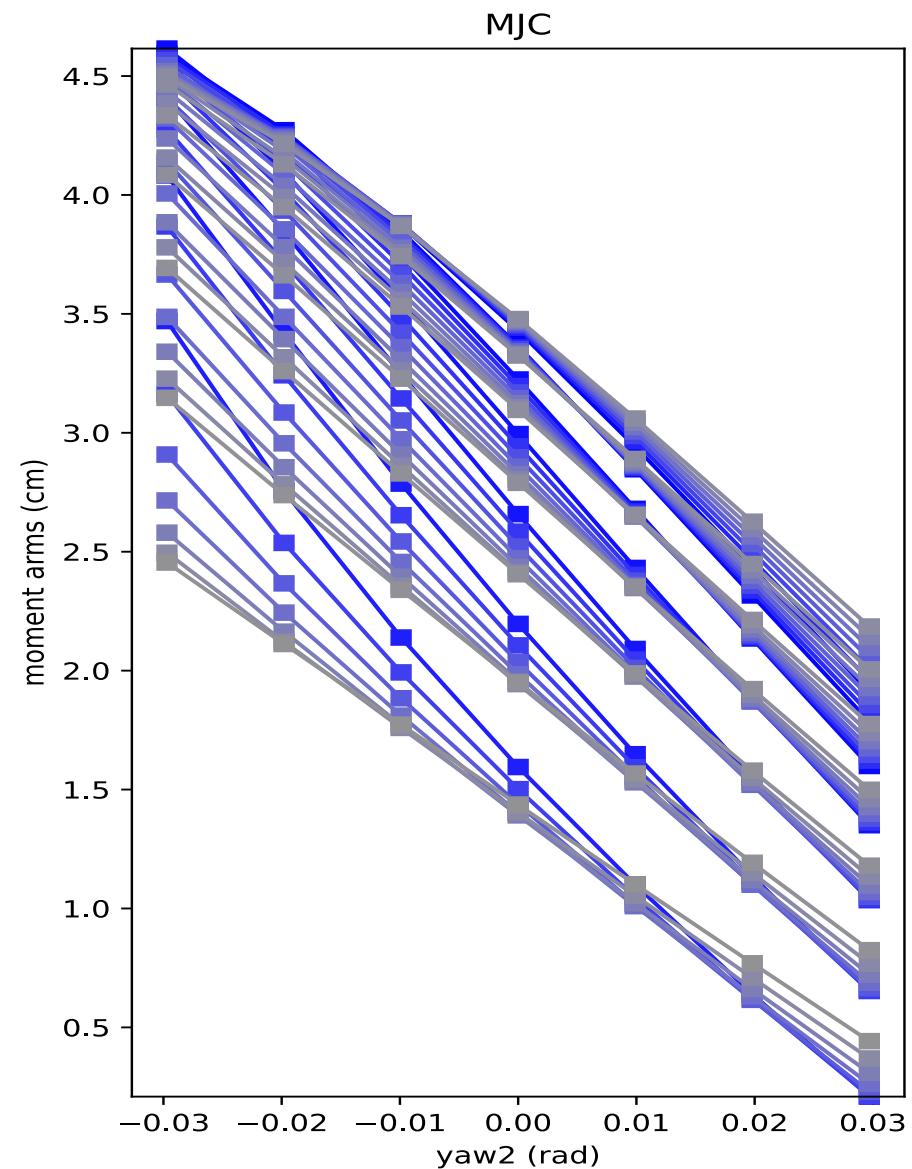
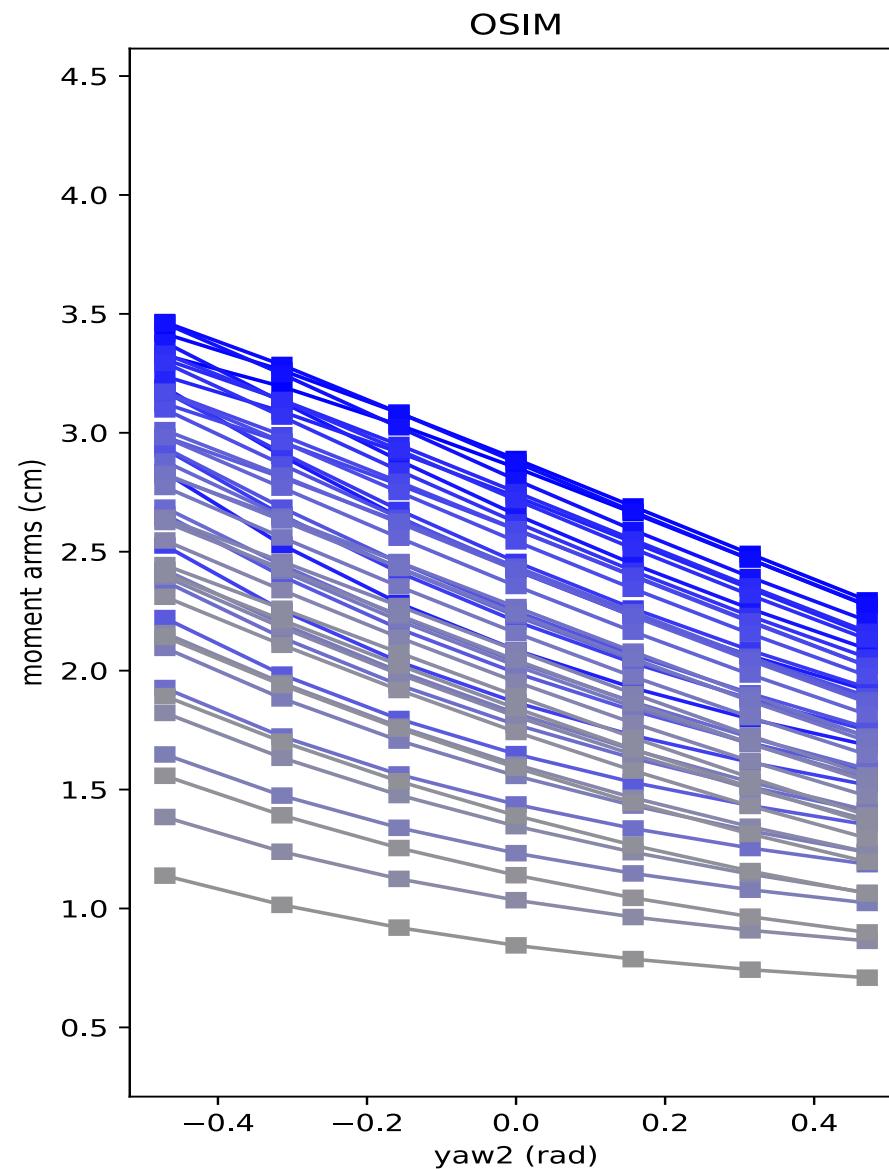
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid_L - pitch2 - roll2 - yaw2



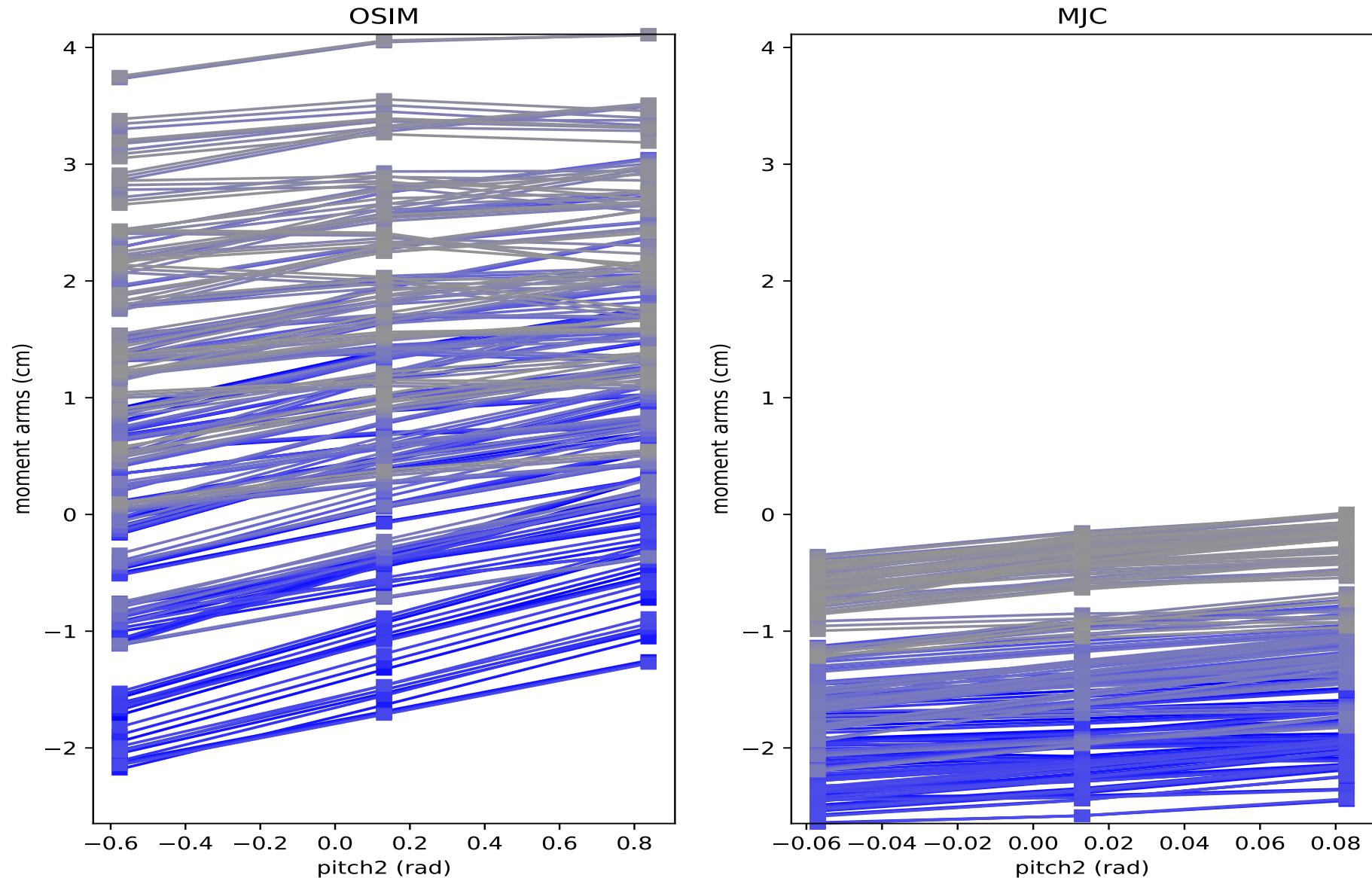
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyooid_L - pitch2 - roll2 - yaw2



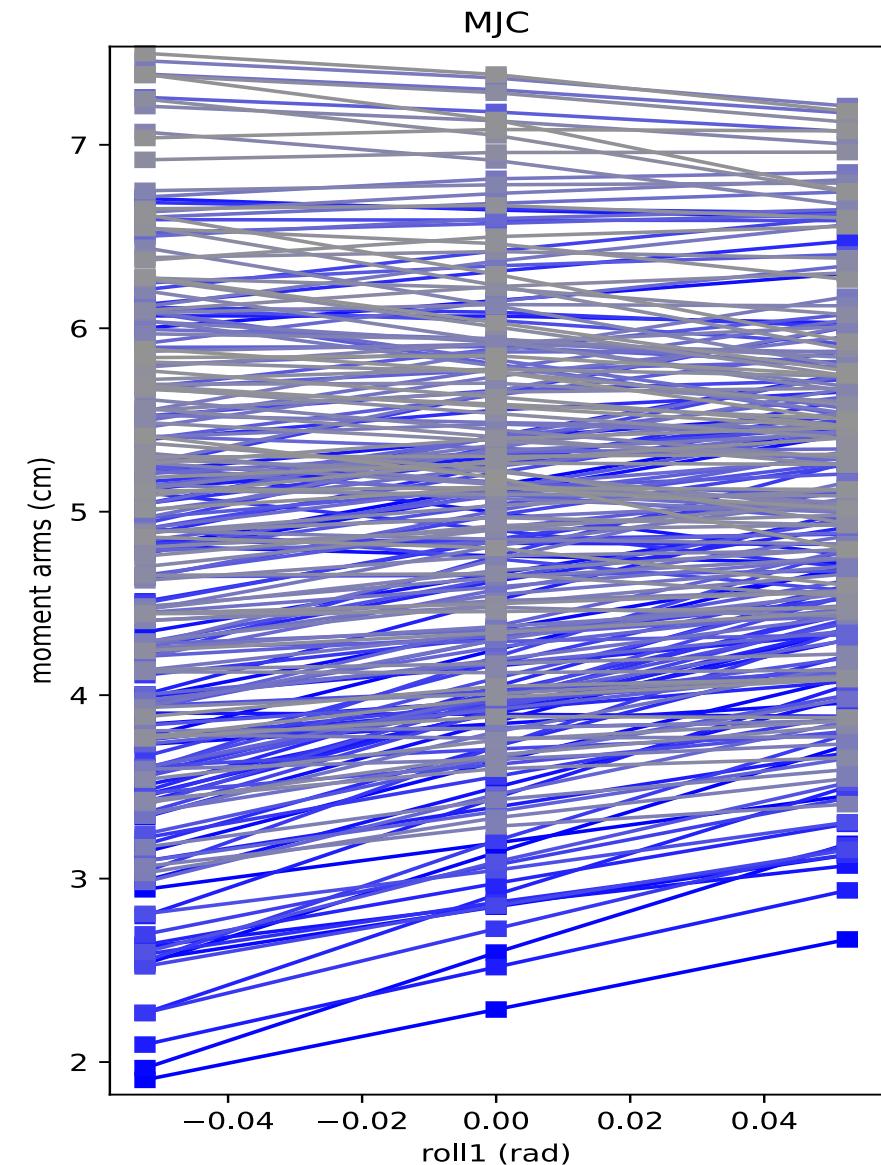
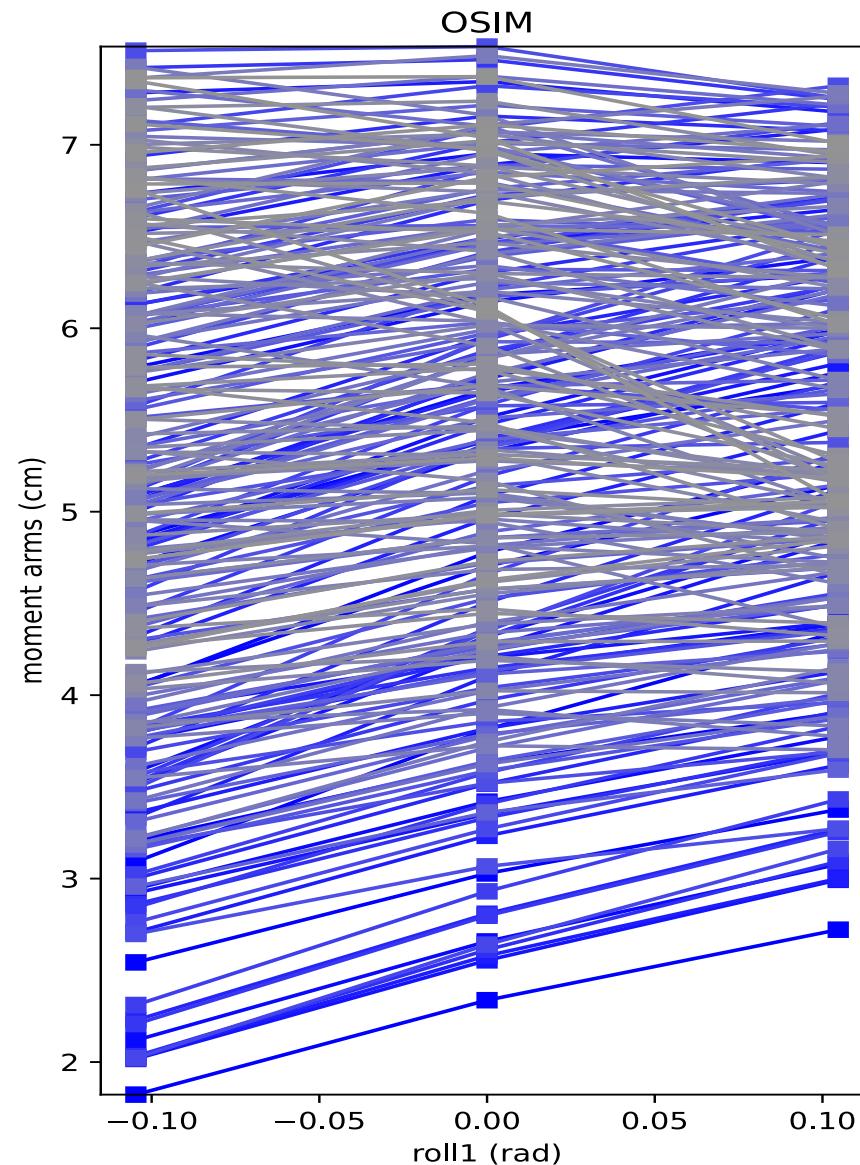
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



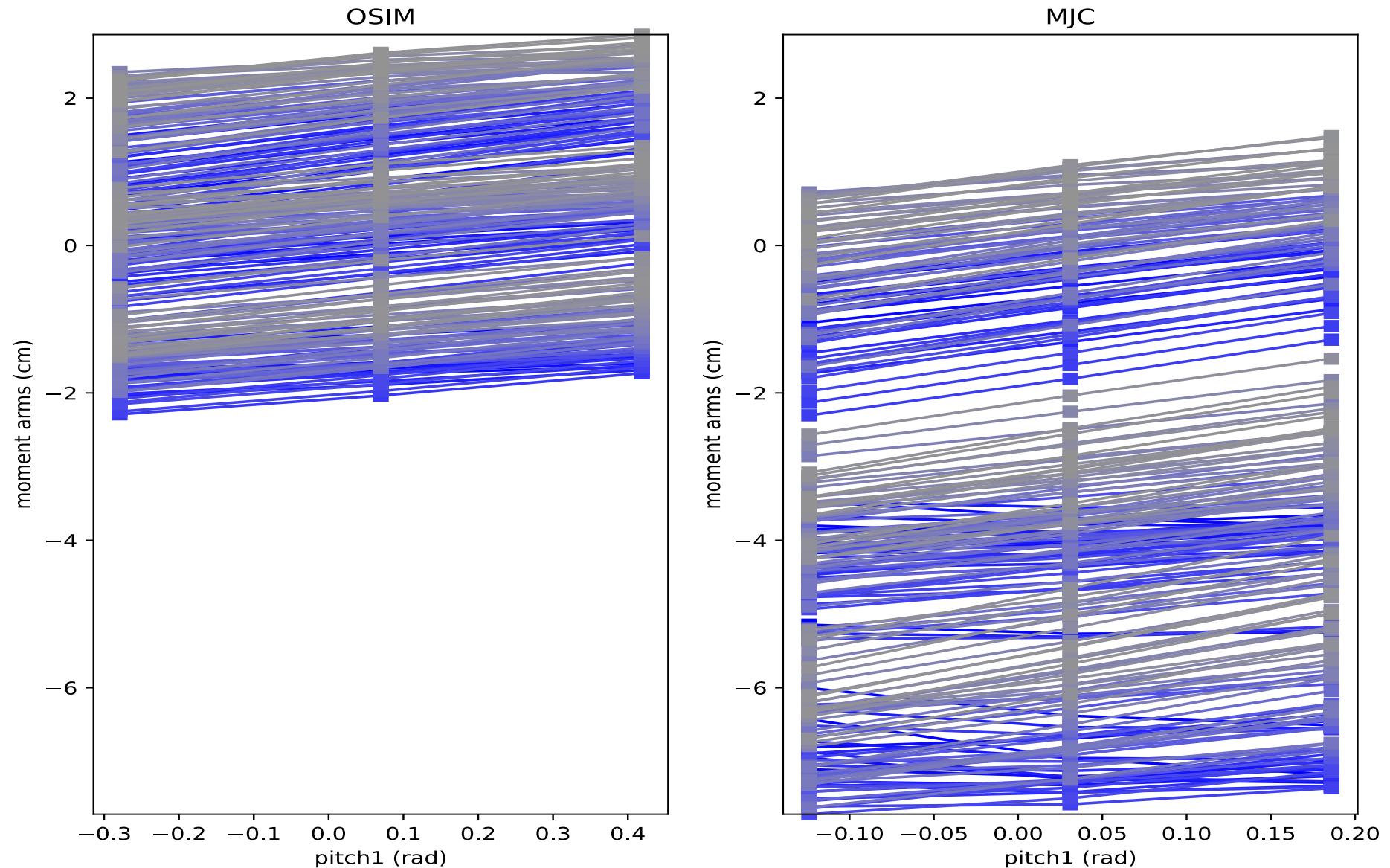
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



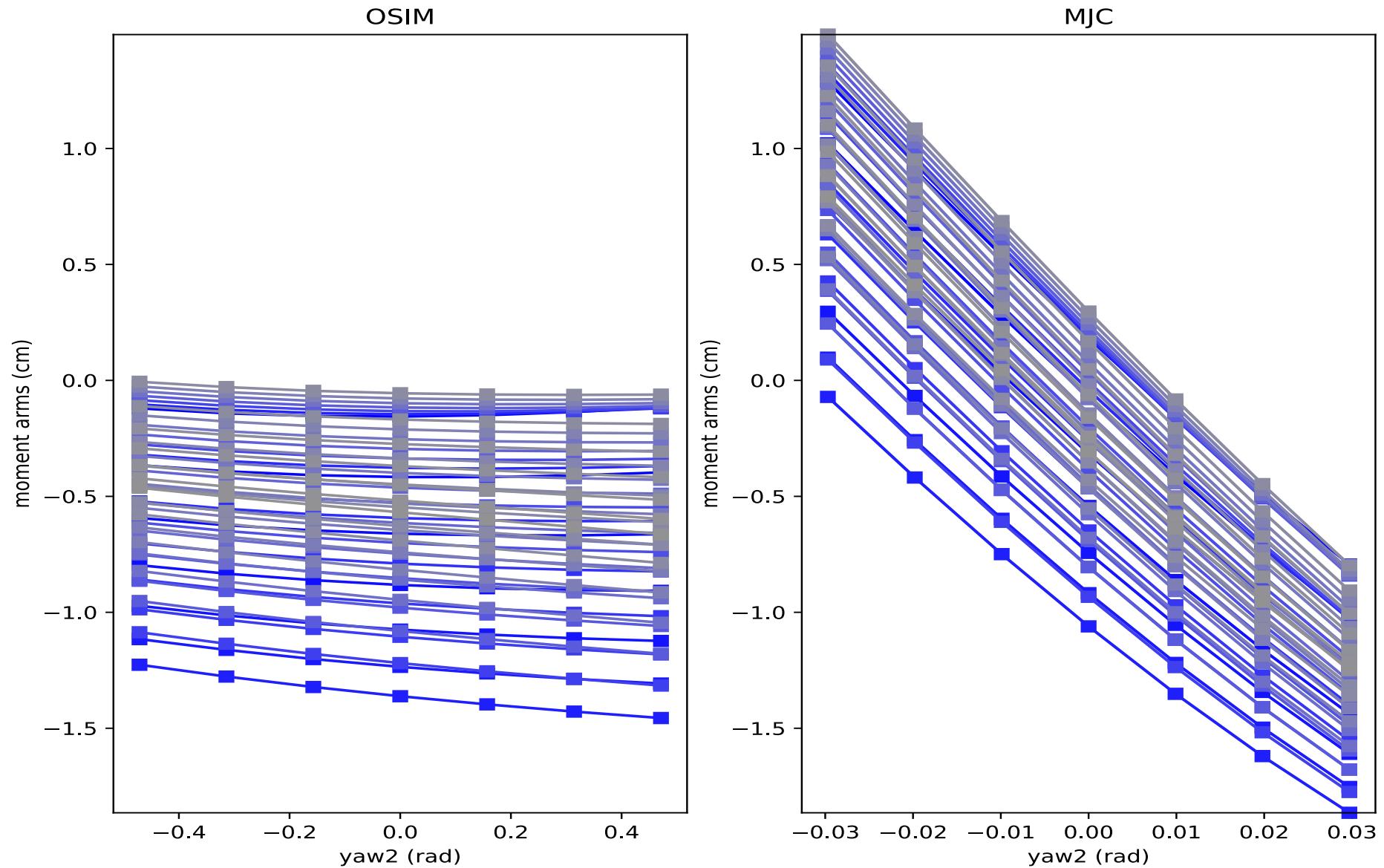
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



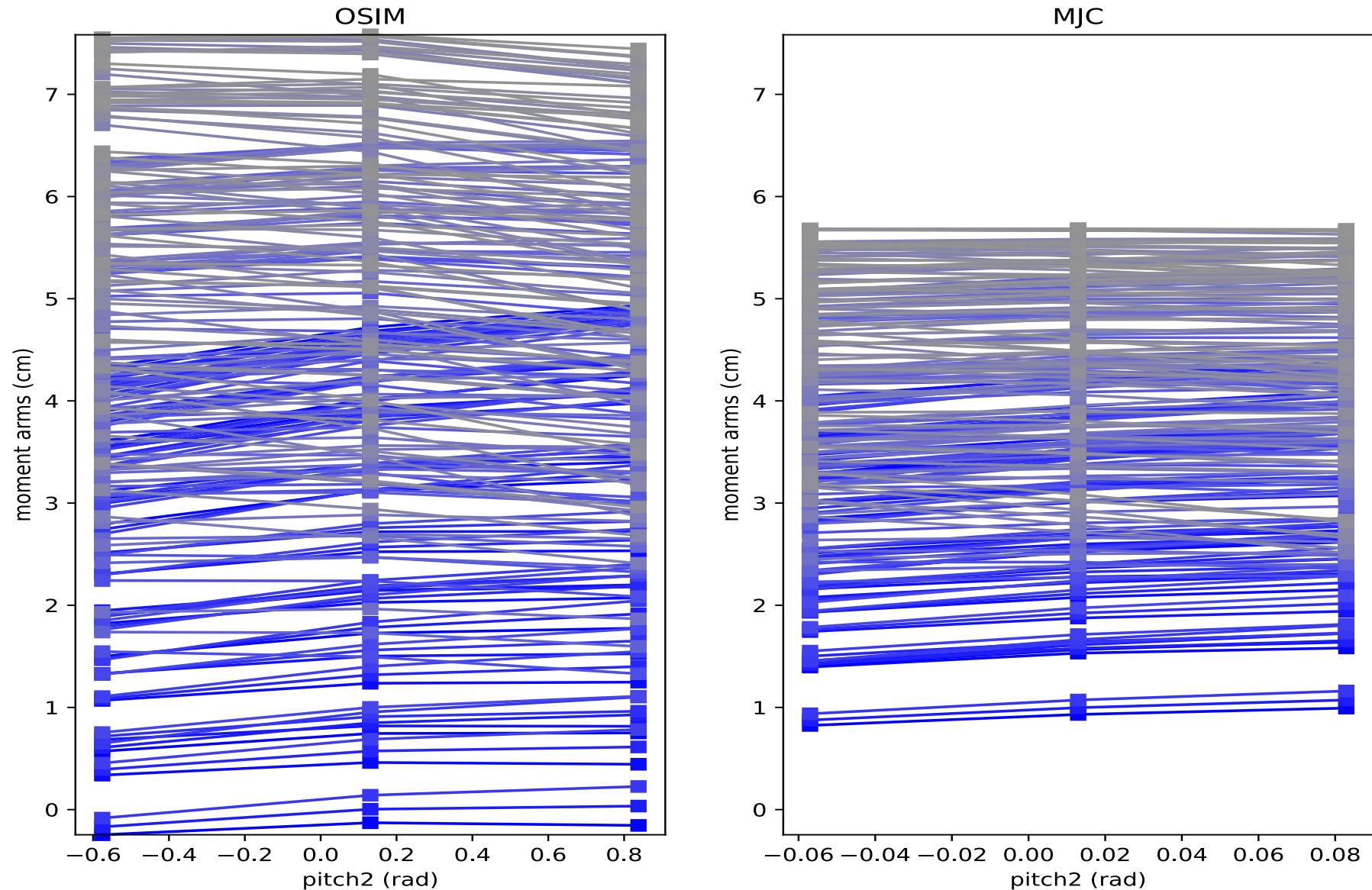
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med_L - pitch2 - roll2 - yaw2



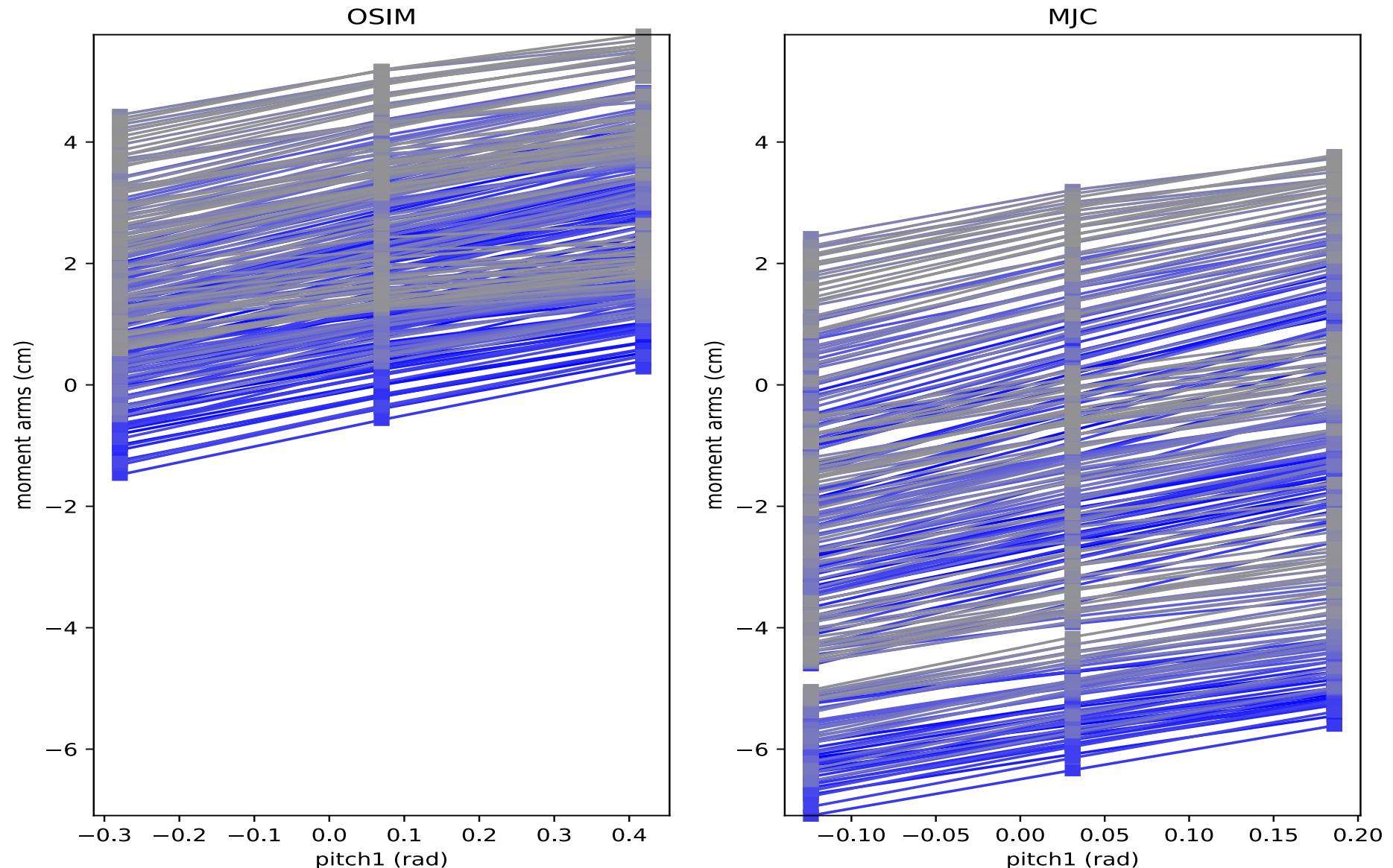
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



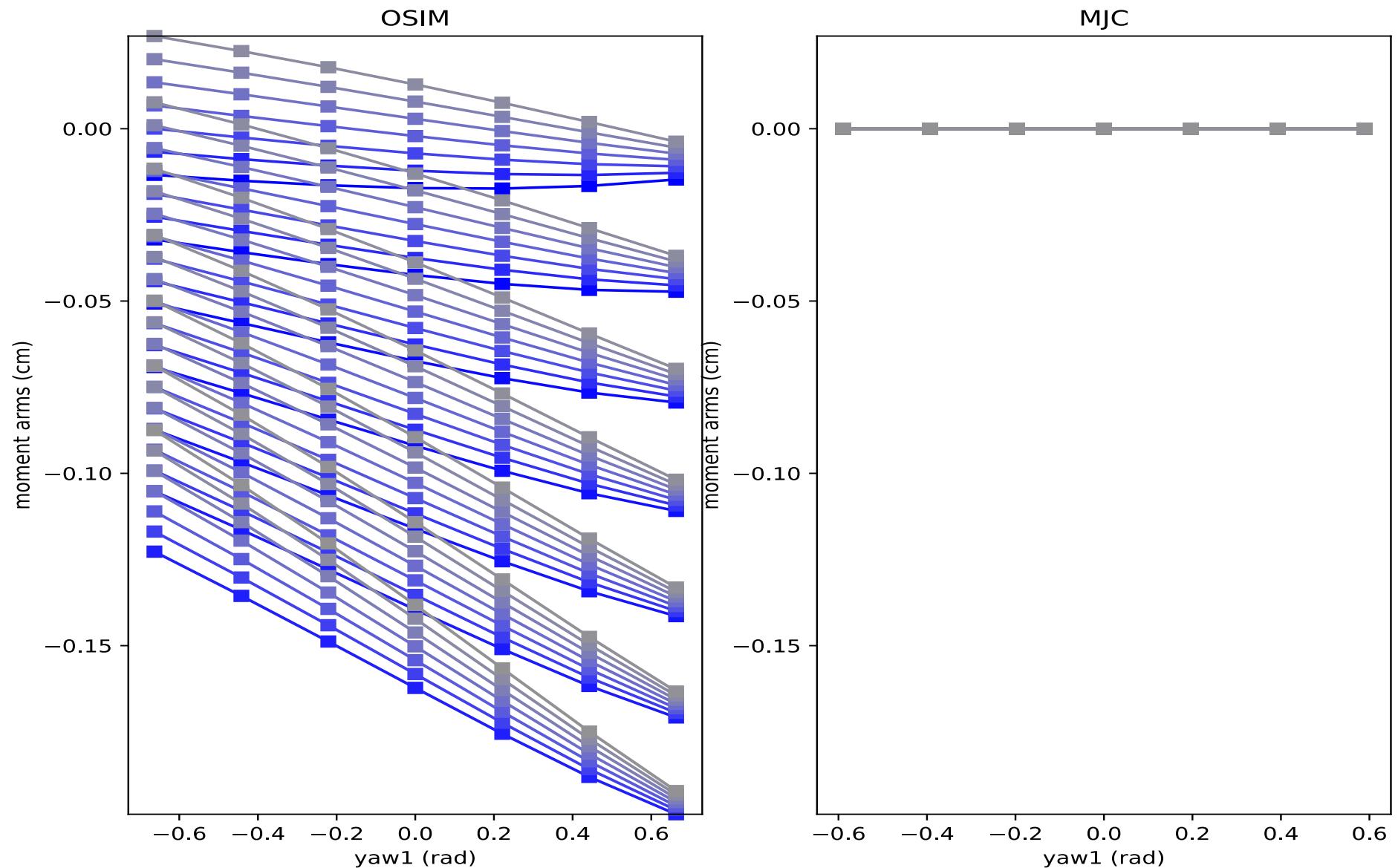
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



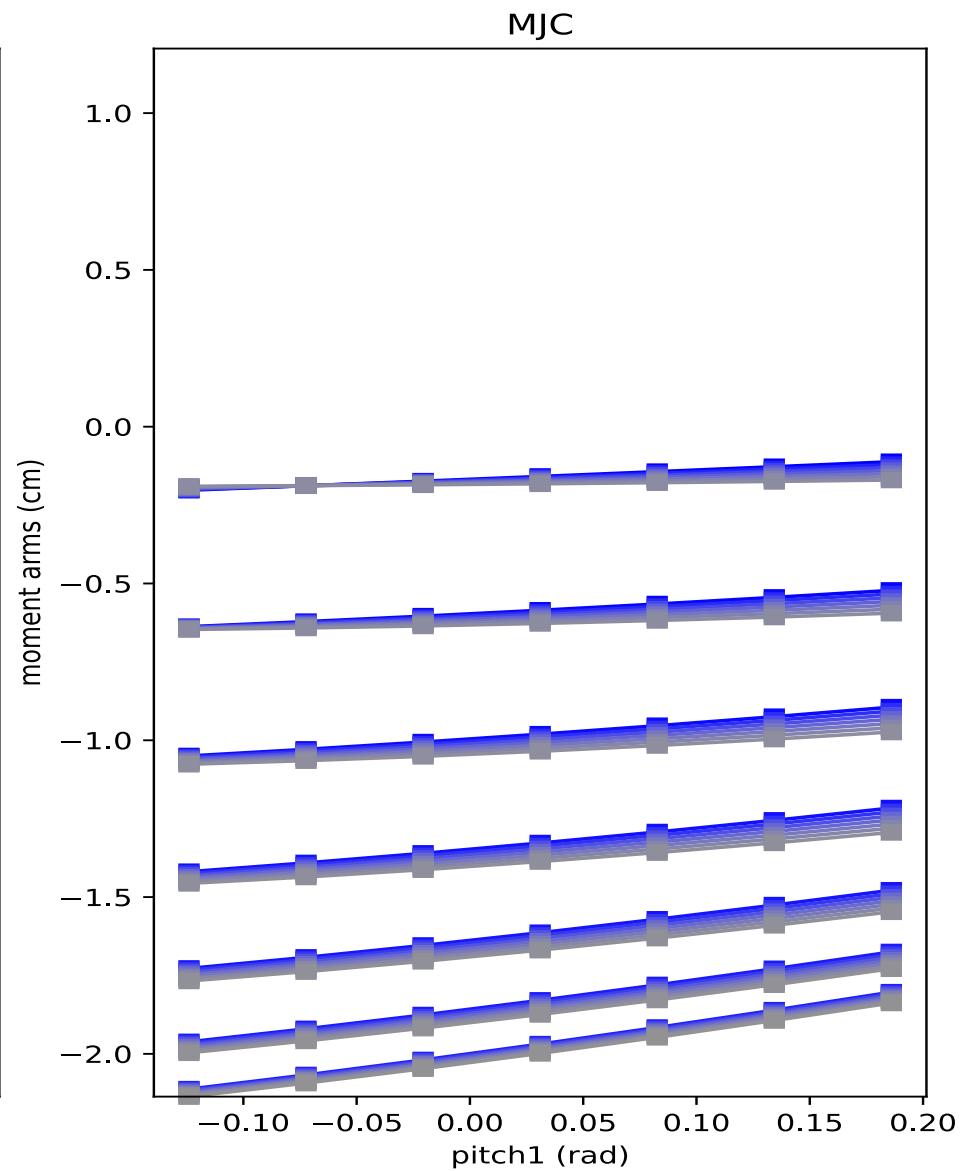
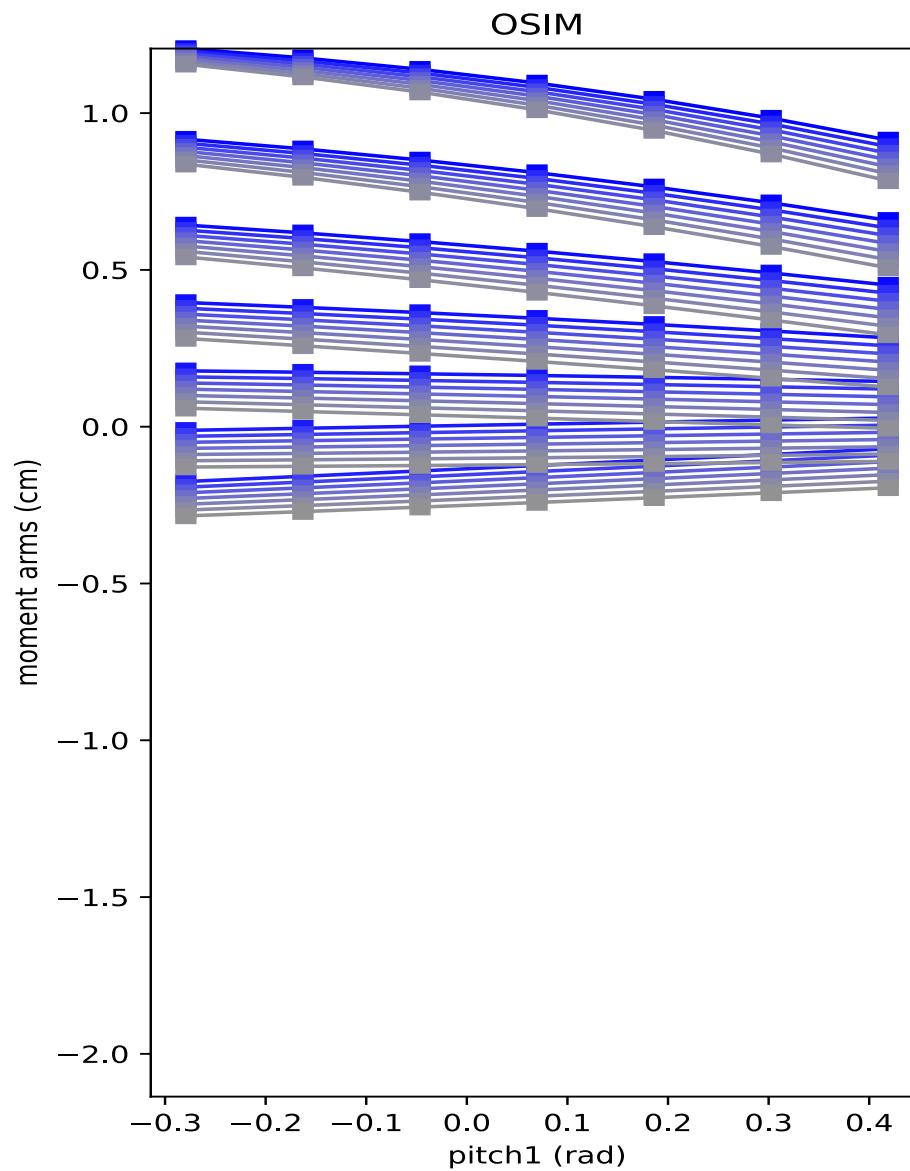
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min - pitch1 - roll1 - yaw1



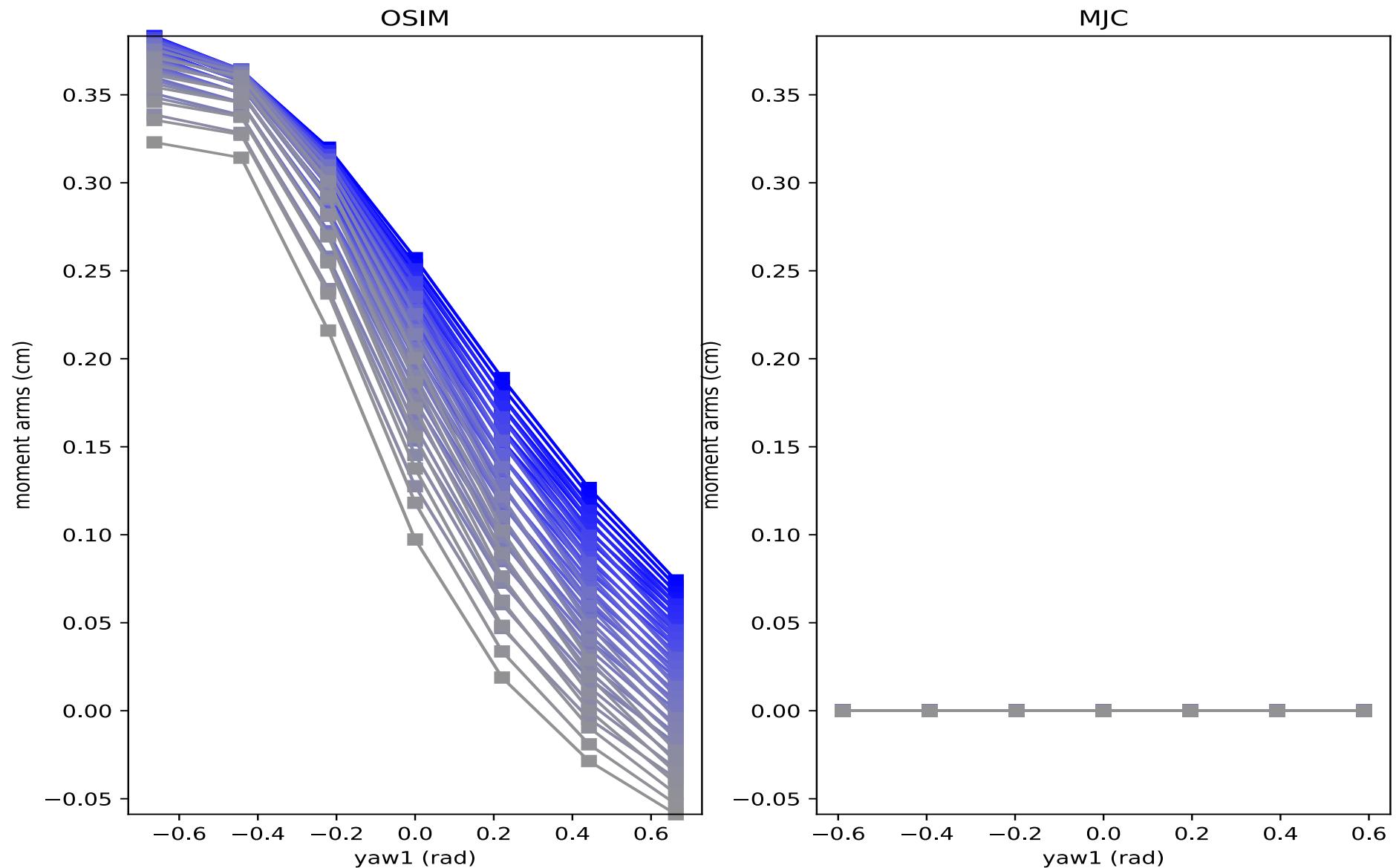
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_inf - pitch1 - roll1 - yaw1



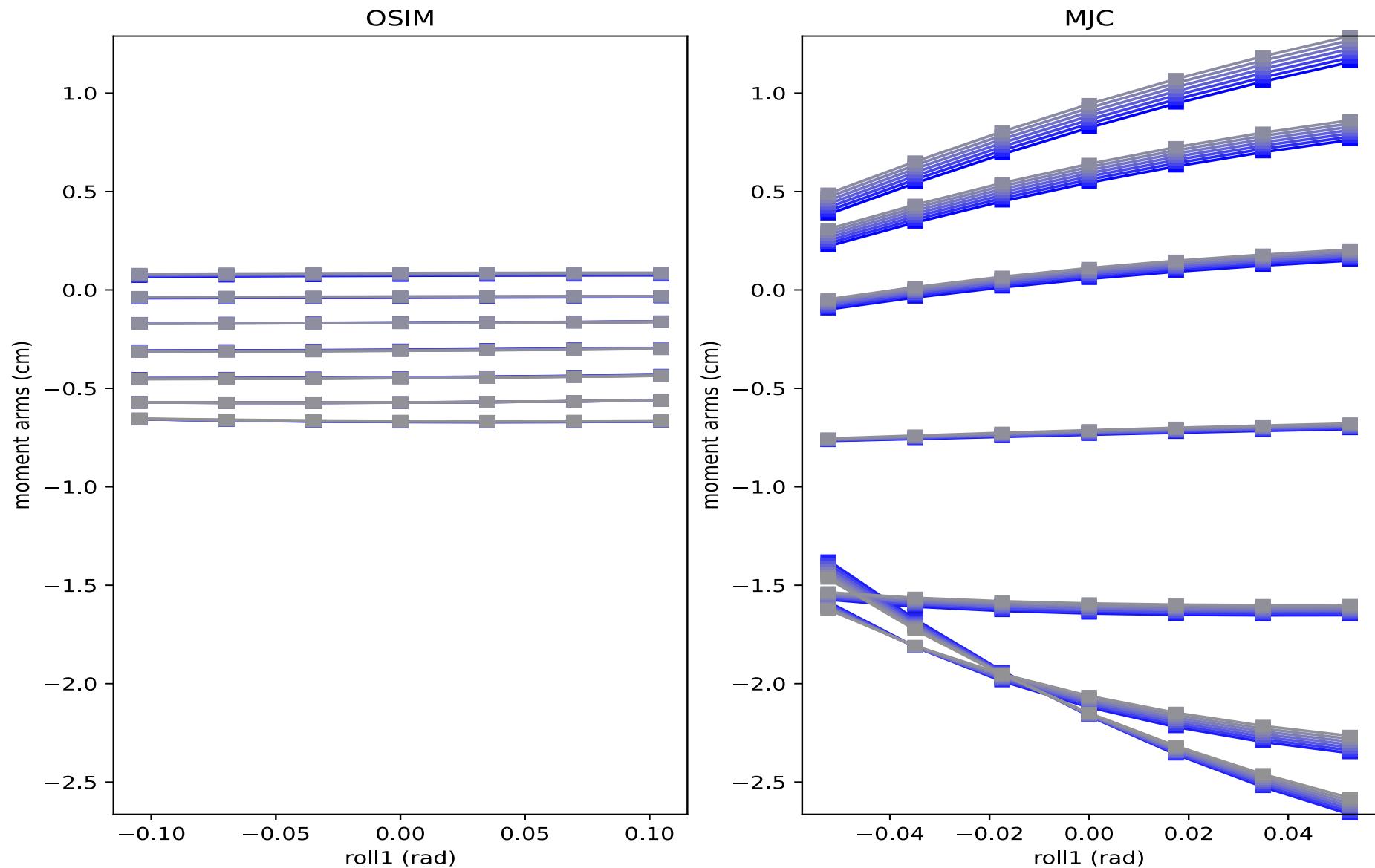
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant - pitch1 - roll1 - yaw1



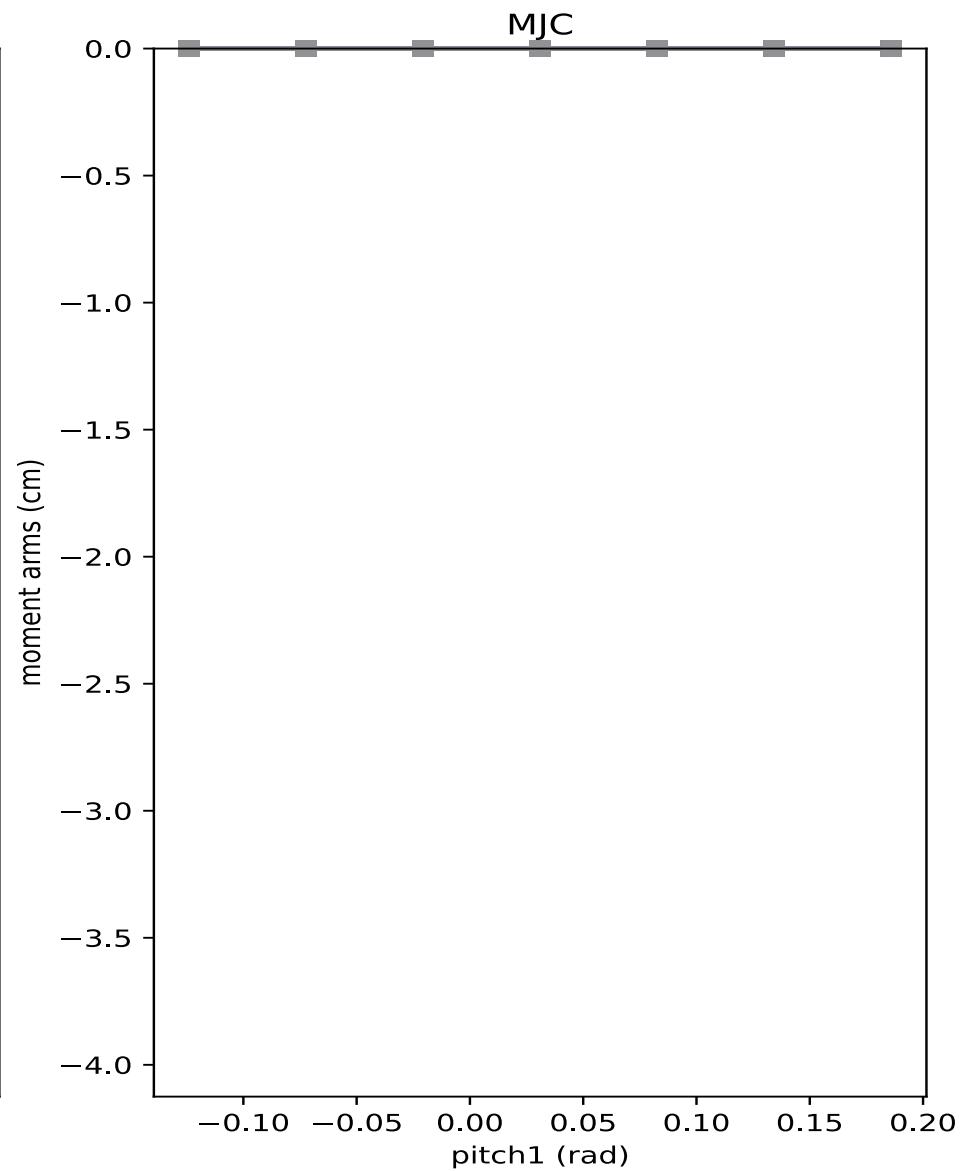
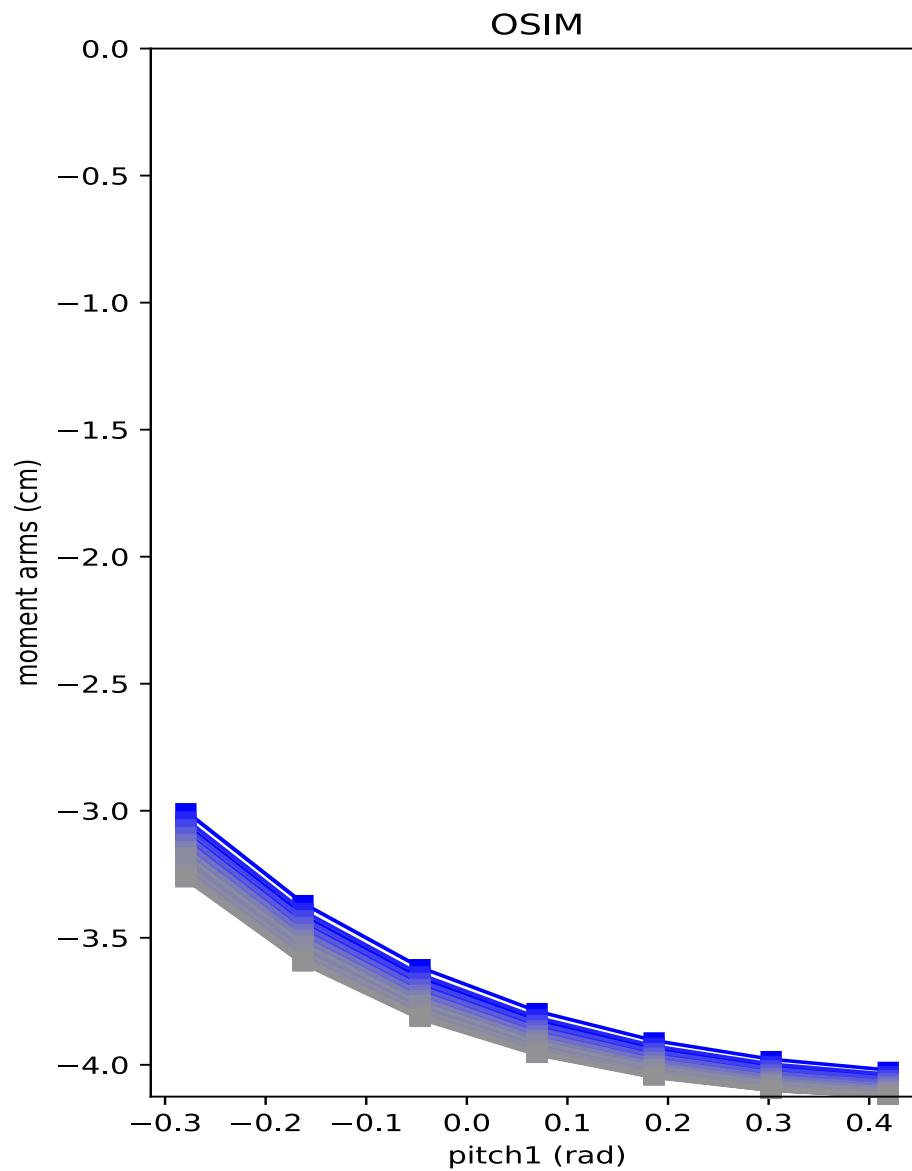
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch1 - roll1 - yaw1



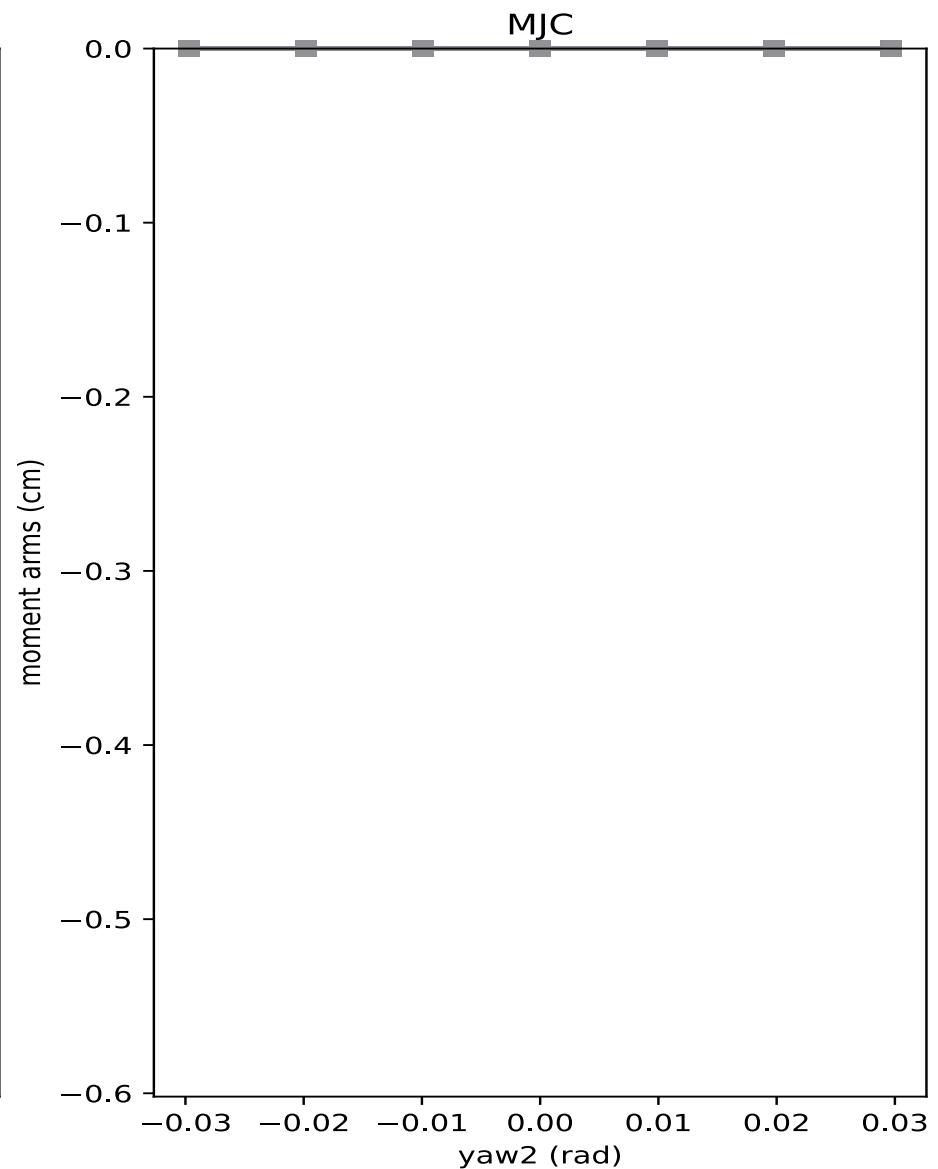
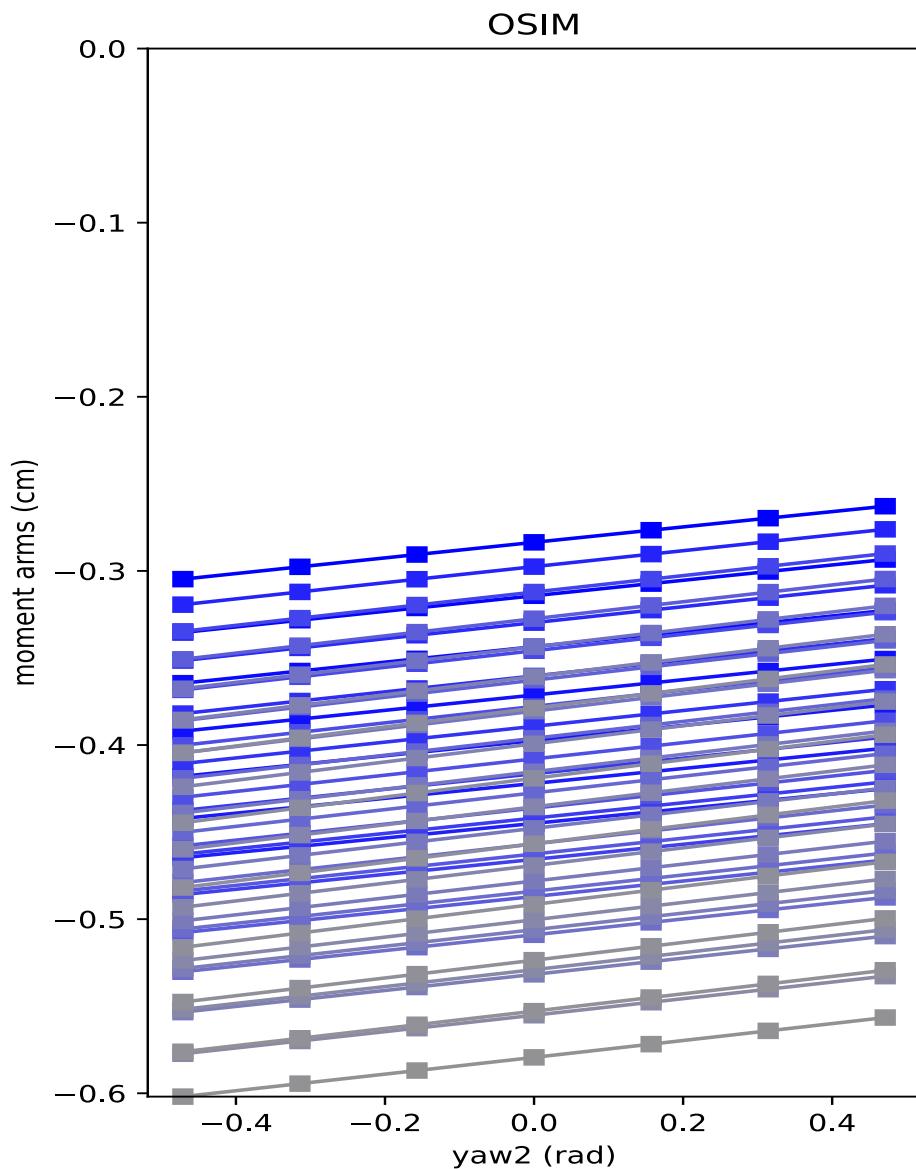
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid_L - pitch1 - roll1 - yaw1



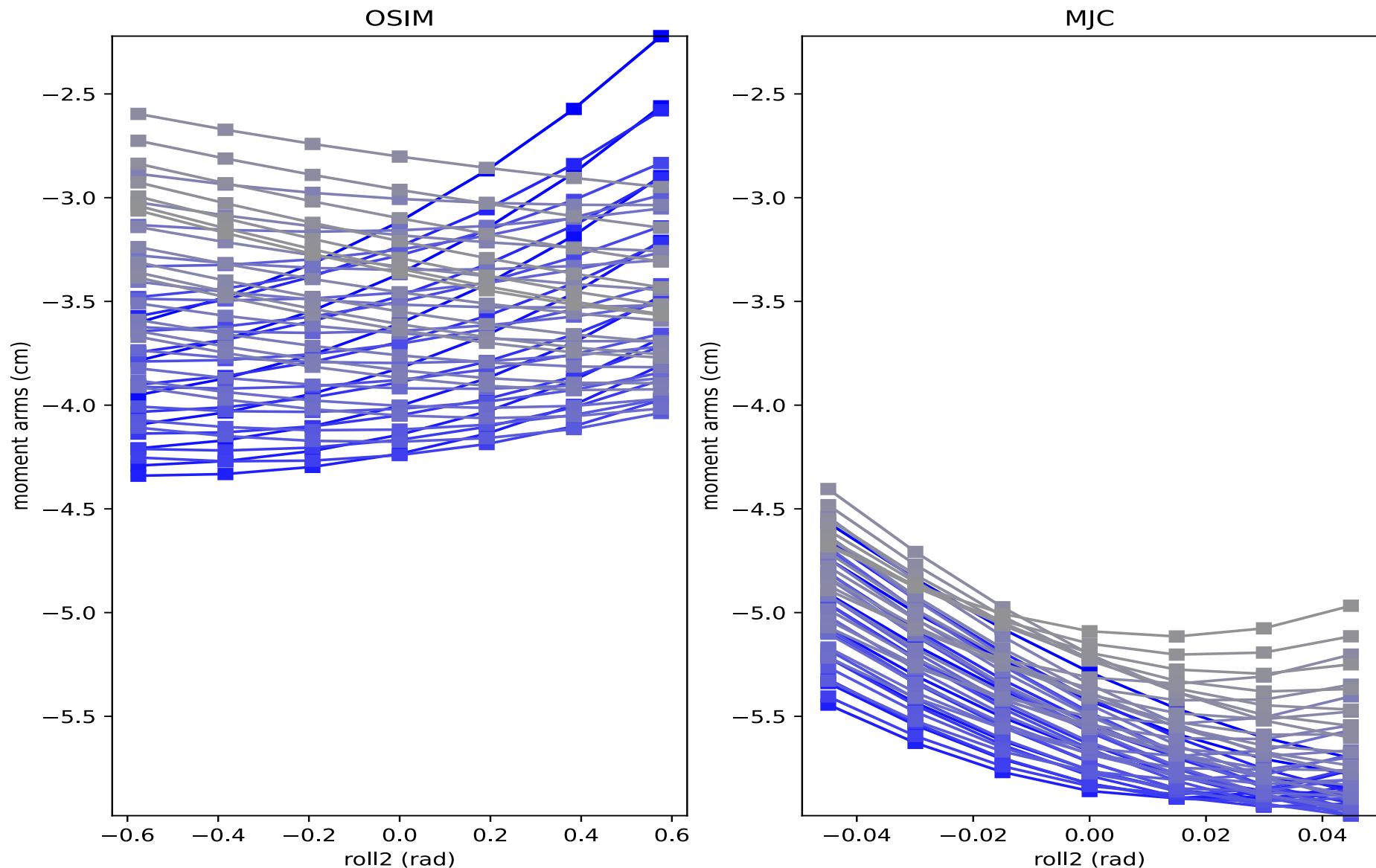
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5 - pitch2 - roll2 - yaw2



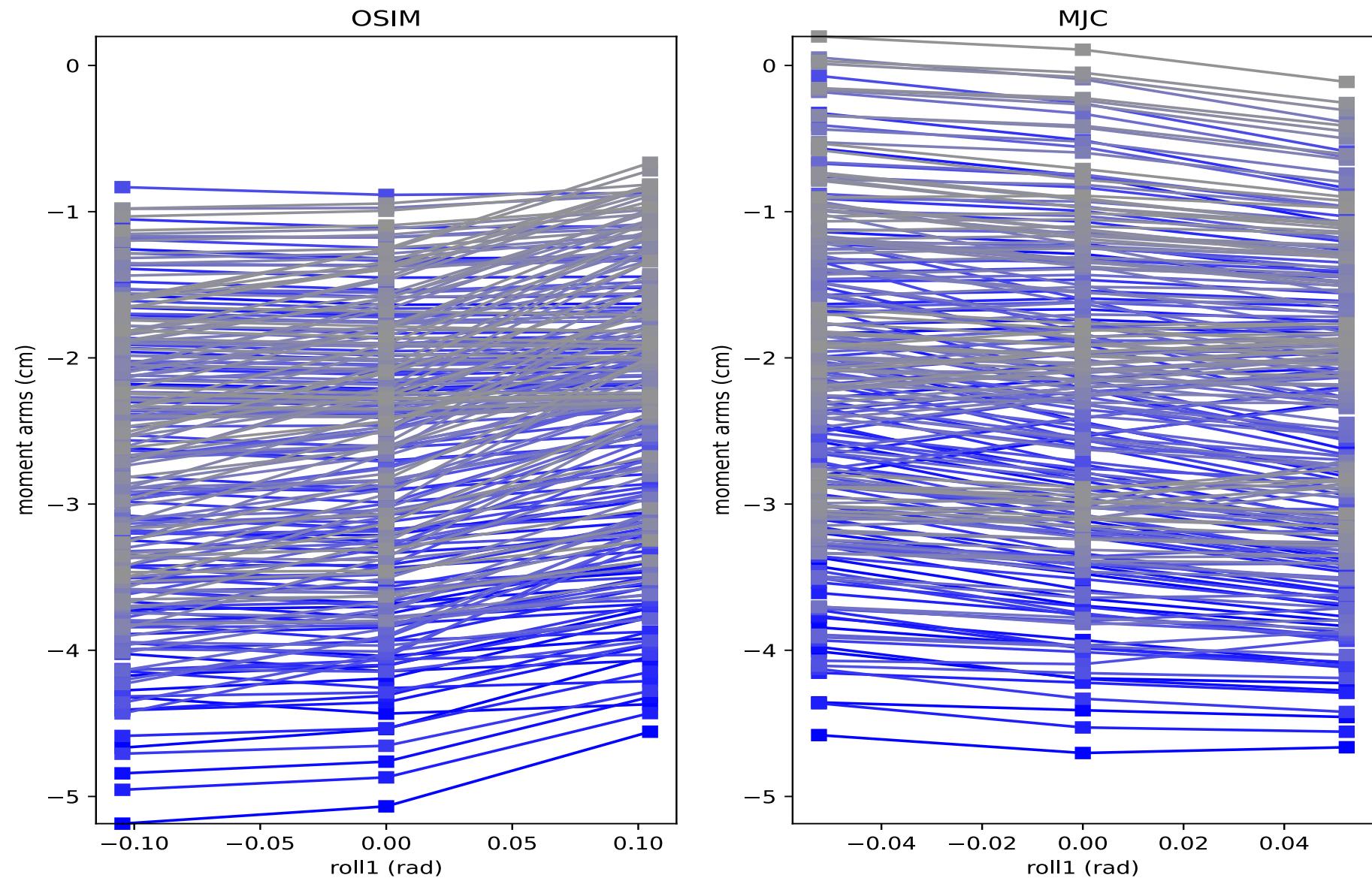
Muscle specific moment arm comparison with Osim model after optimization

levator_scap_L - pitch2 - roll2 - yaw2



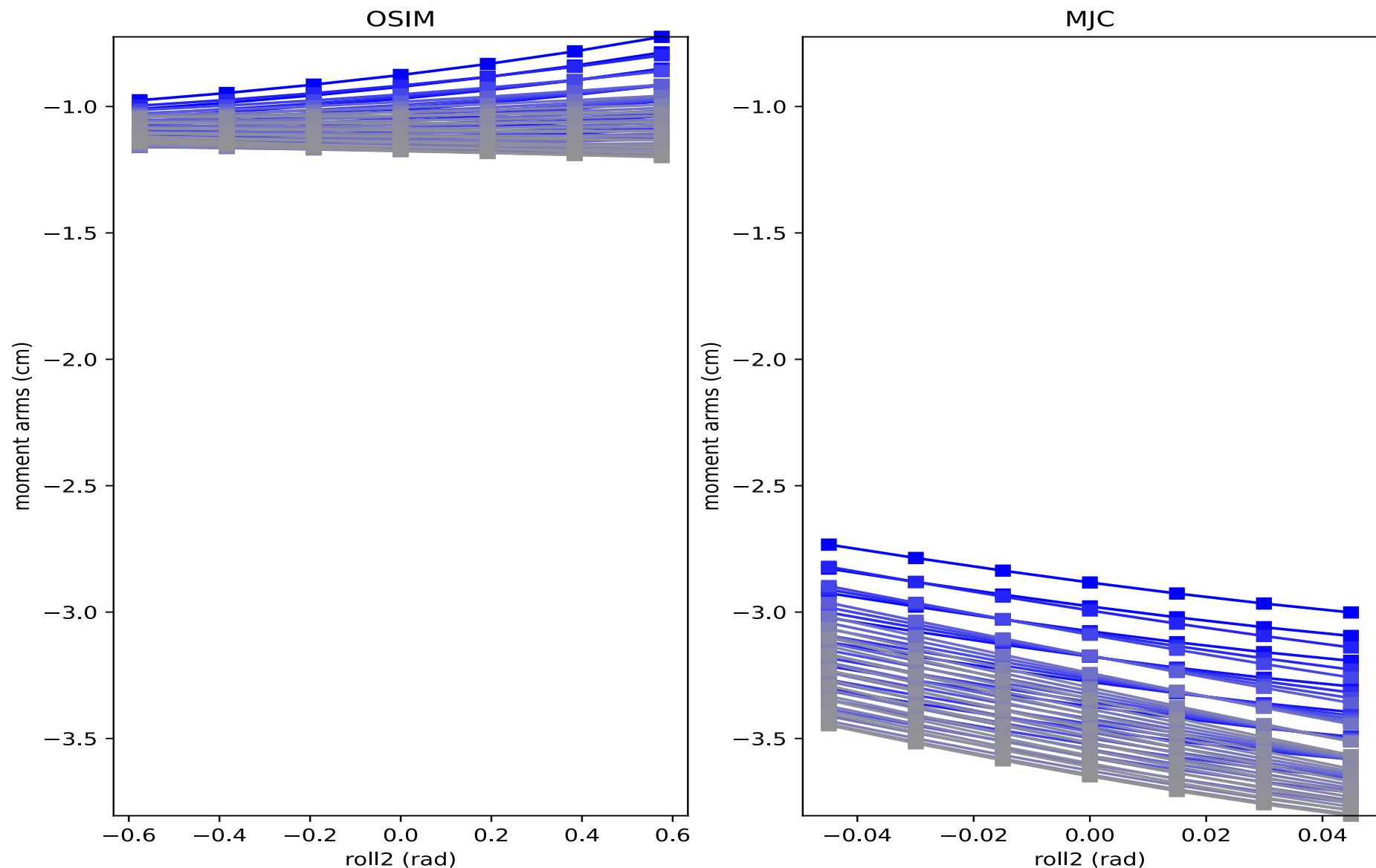
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



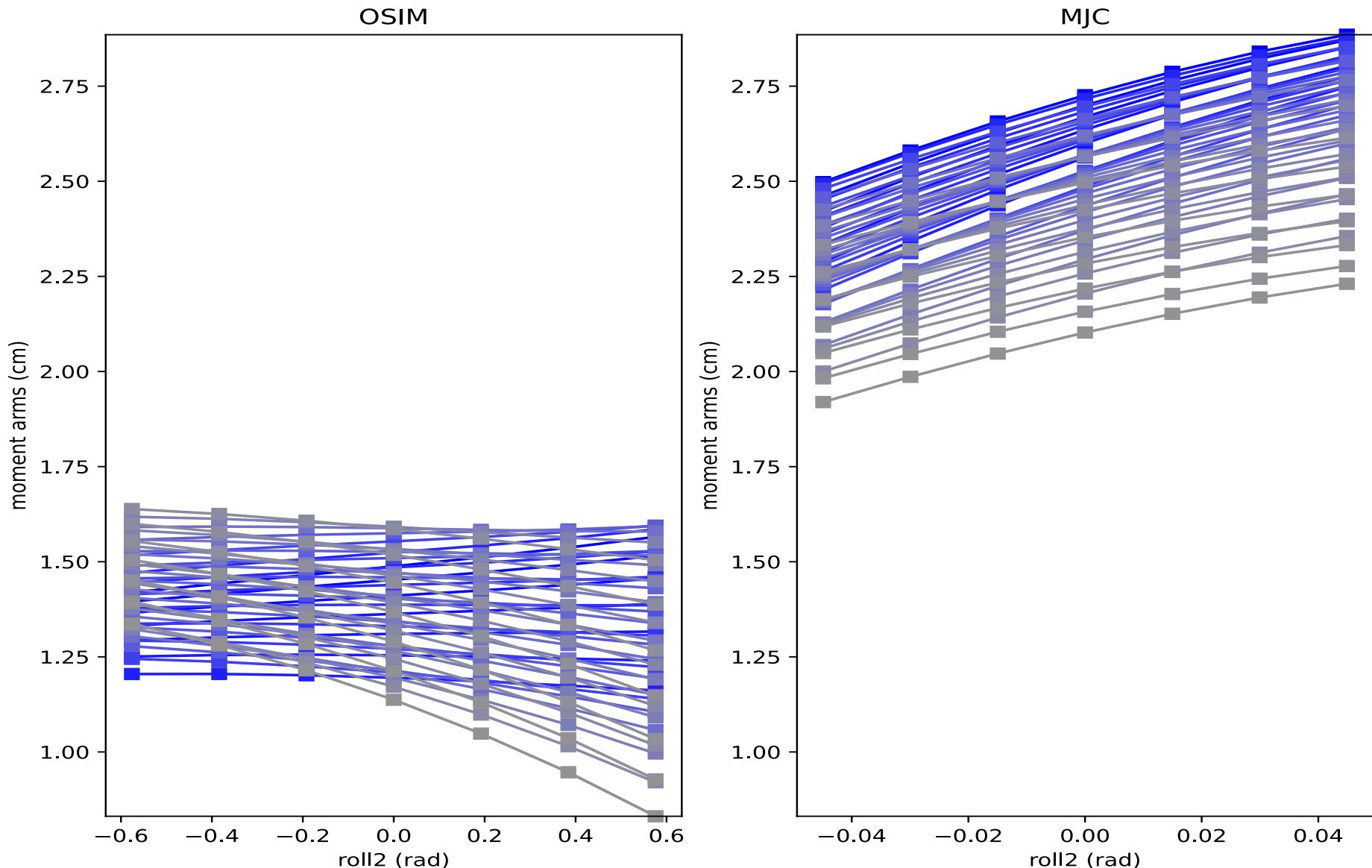
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib_L - pitch2 - roll2 - yaw2



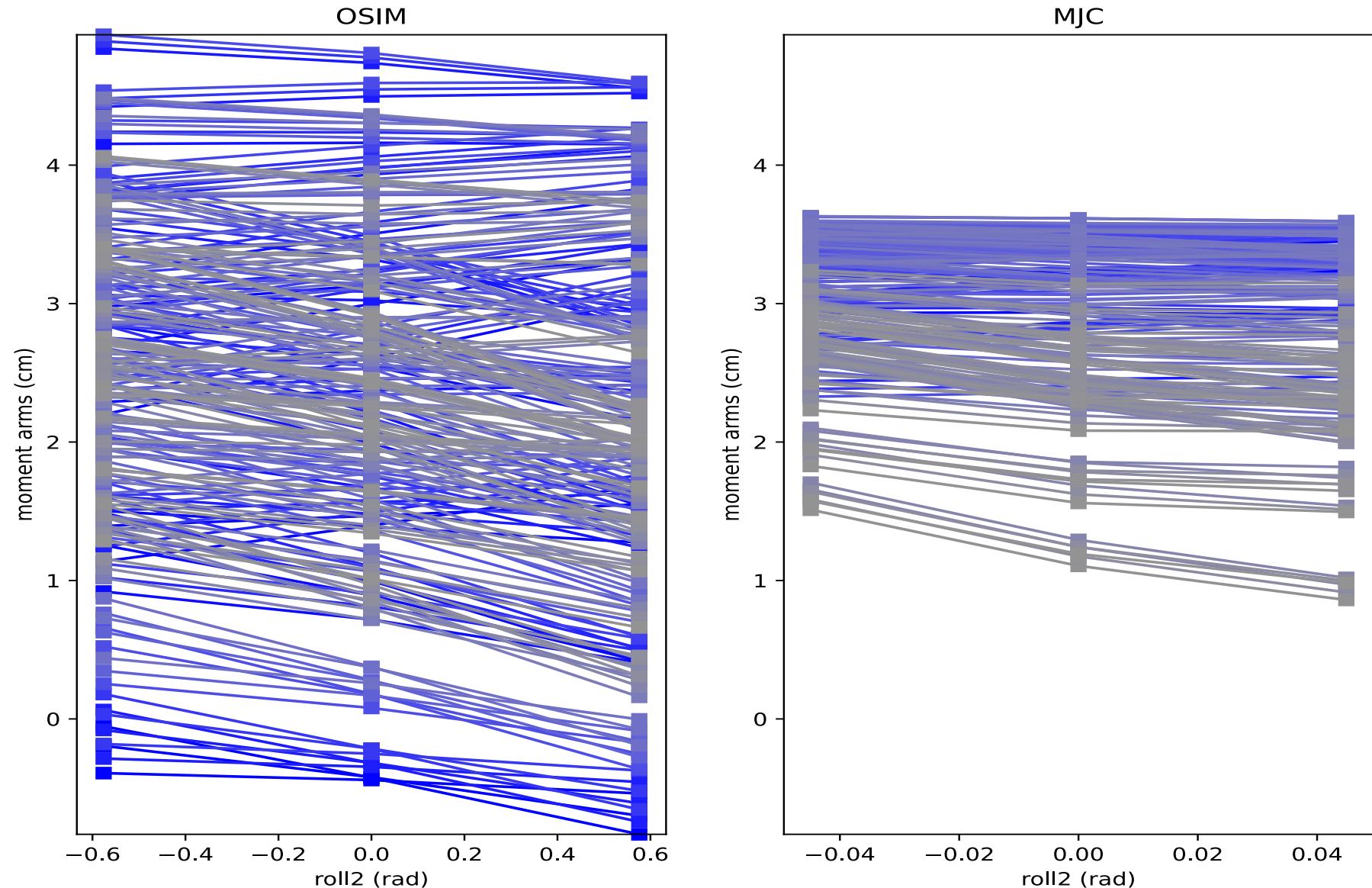
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx - pitch2 - roll2 - yaw2



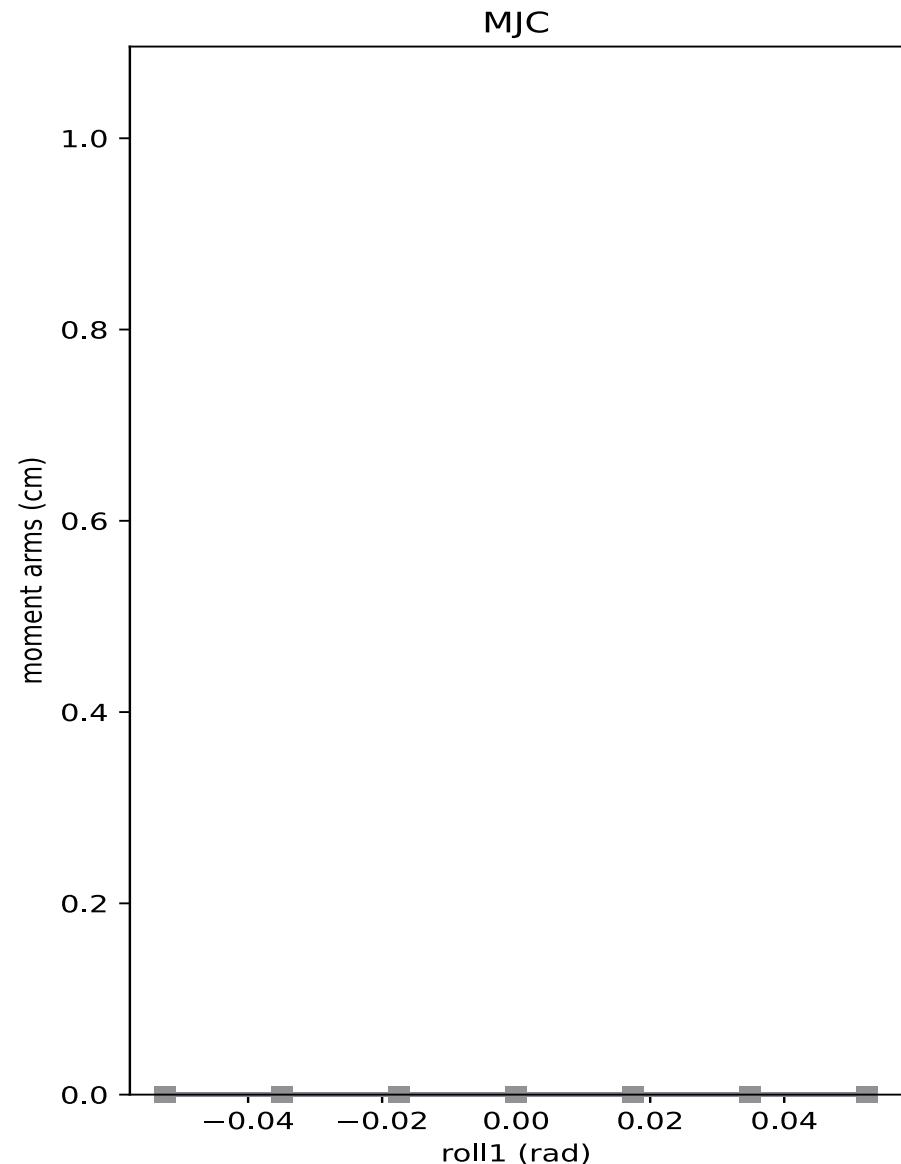
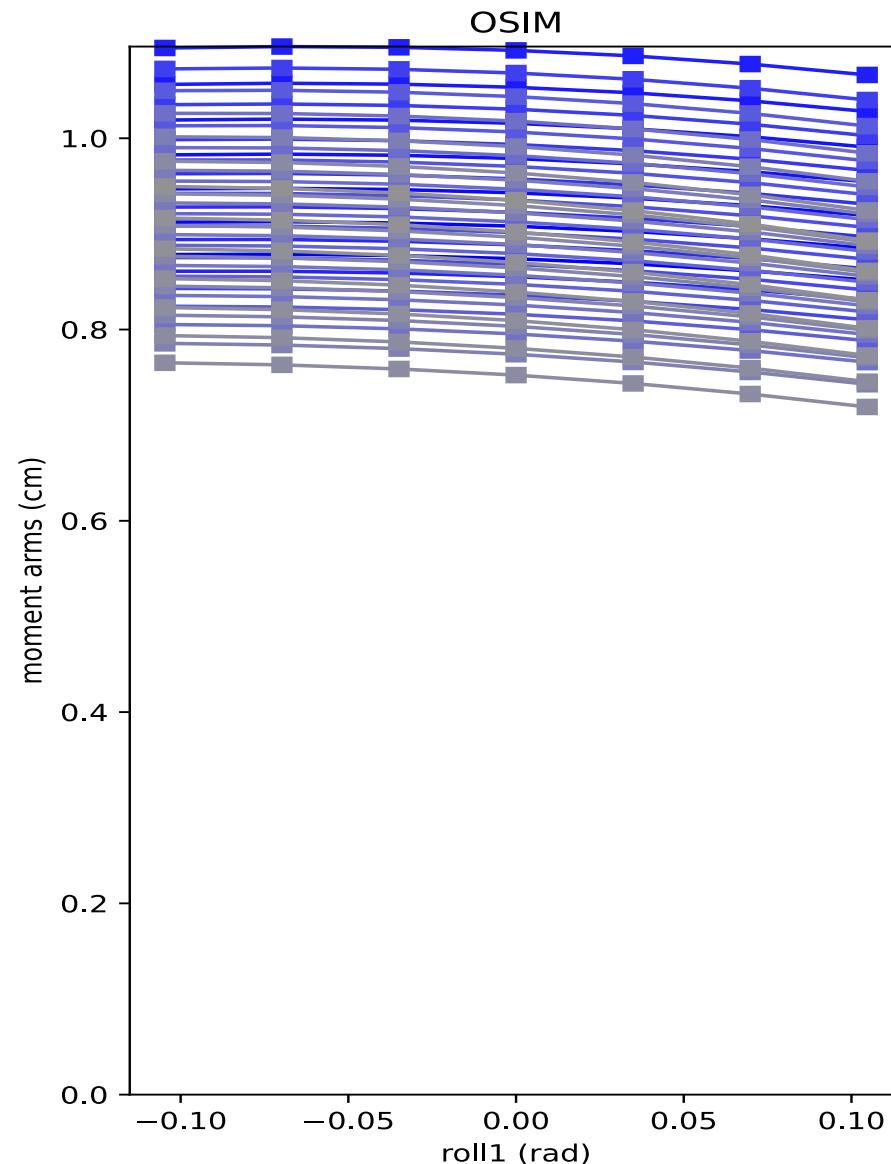
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



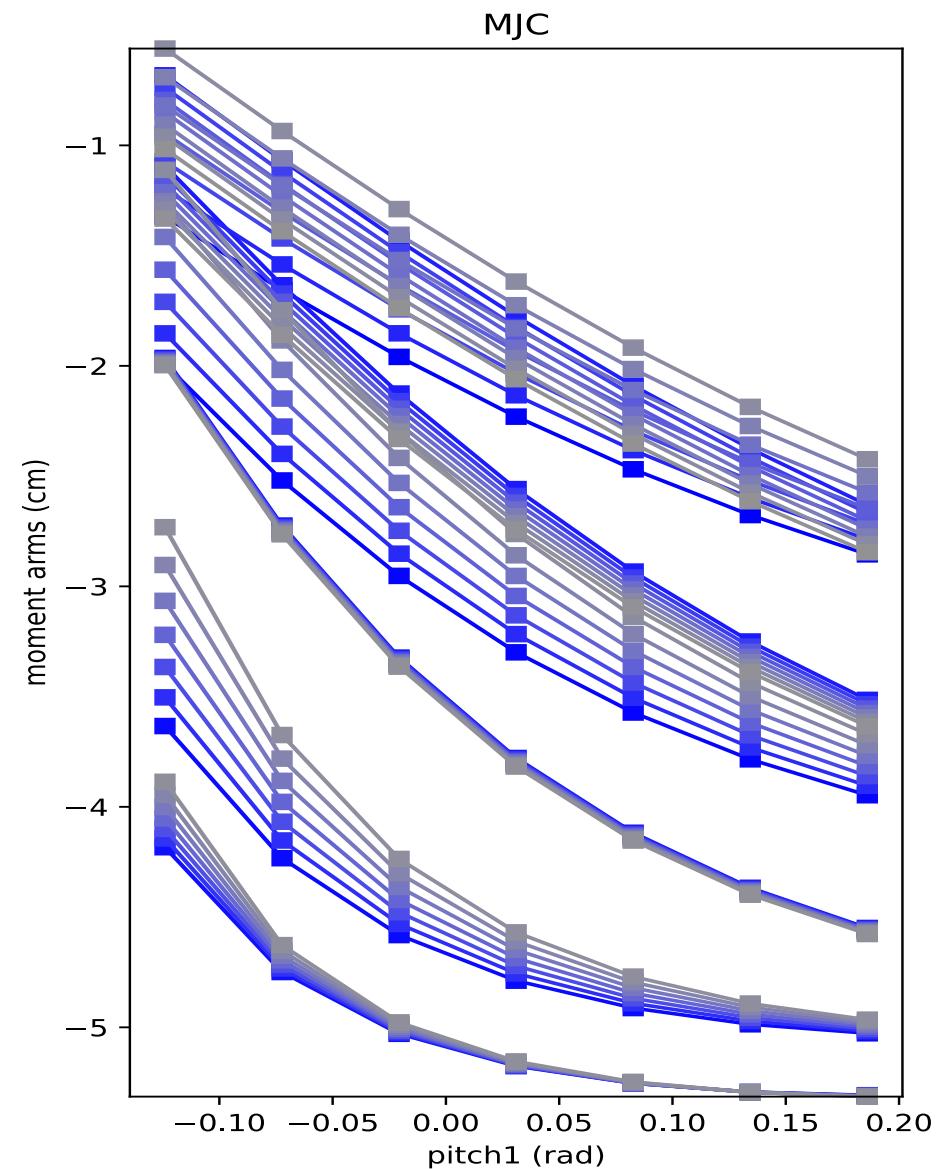
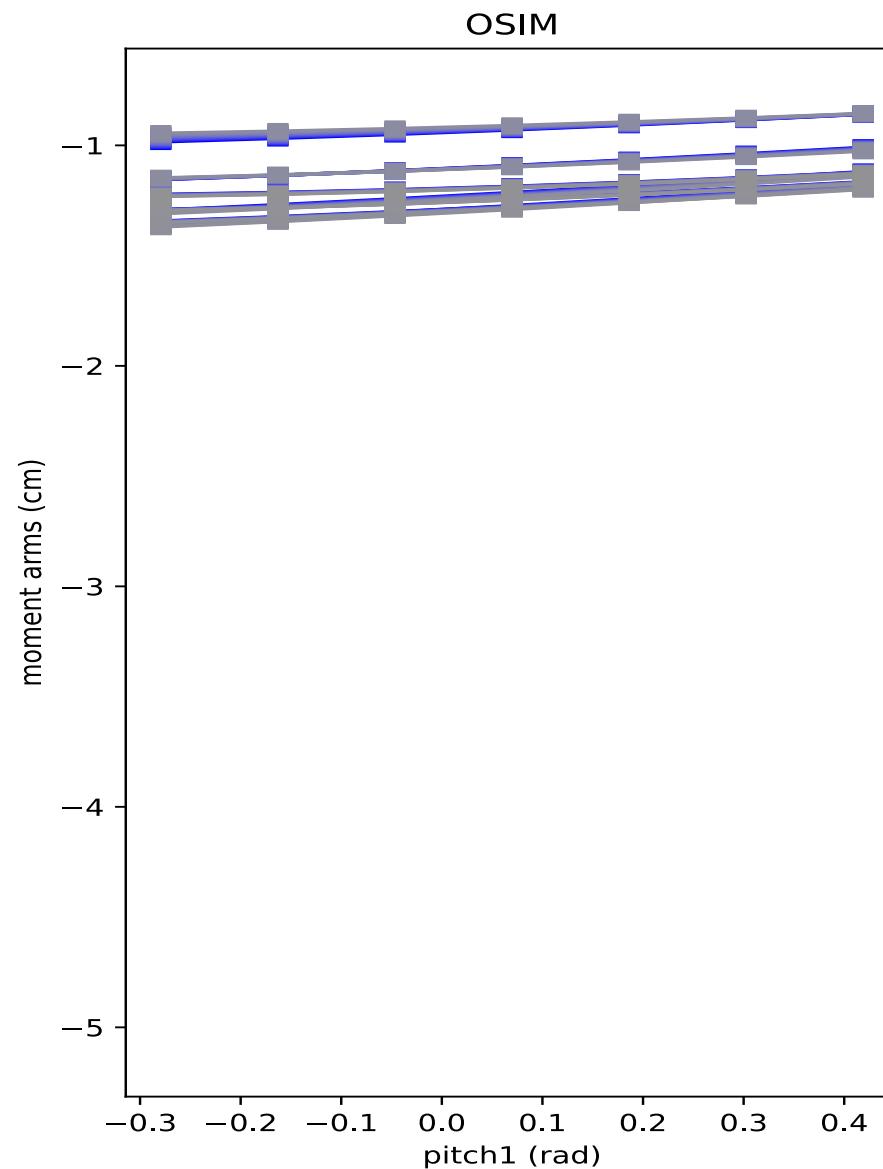
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup - pitch1 - roll1 - yaw1



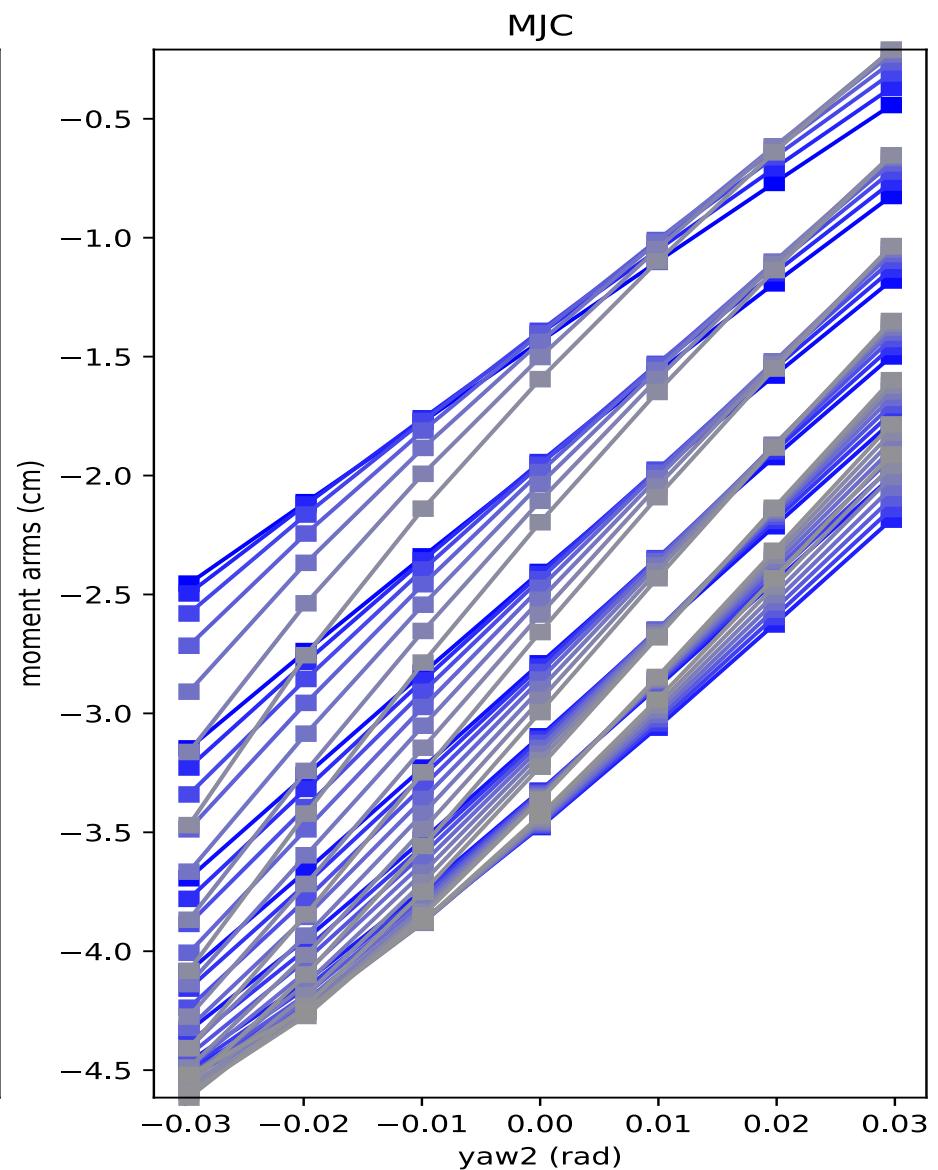
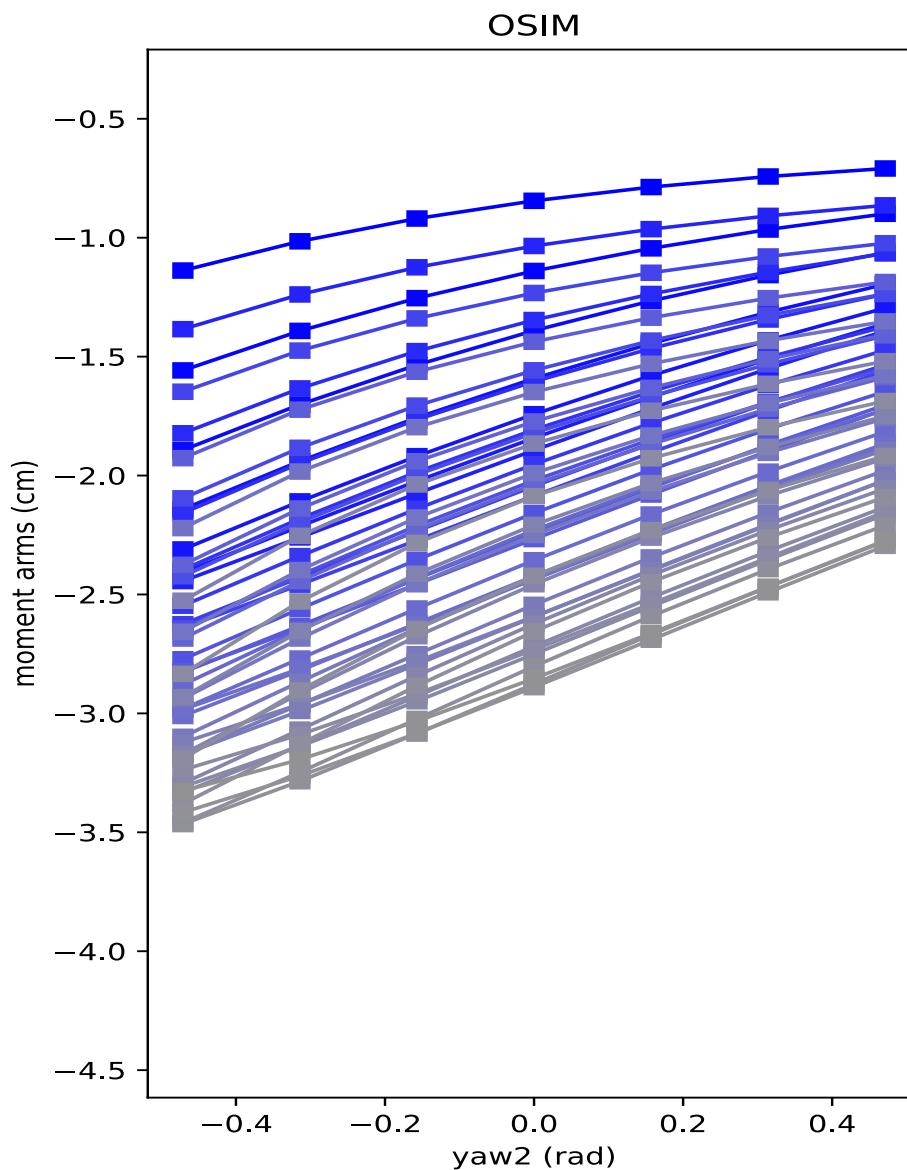
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch1 - roll1 - yaw1



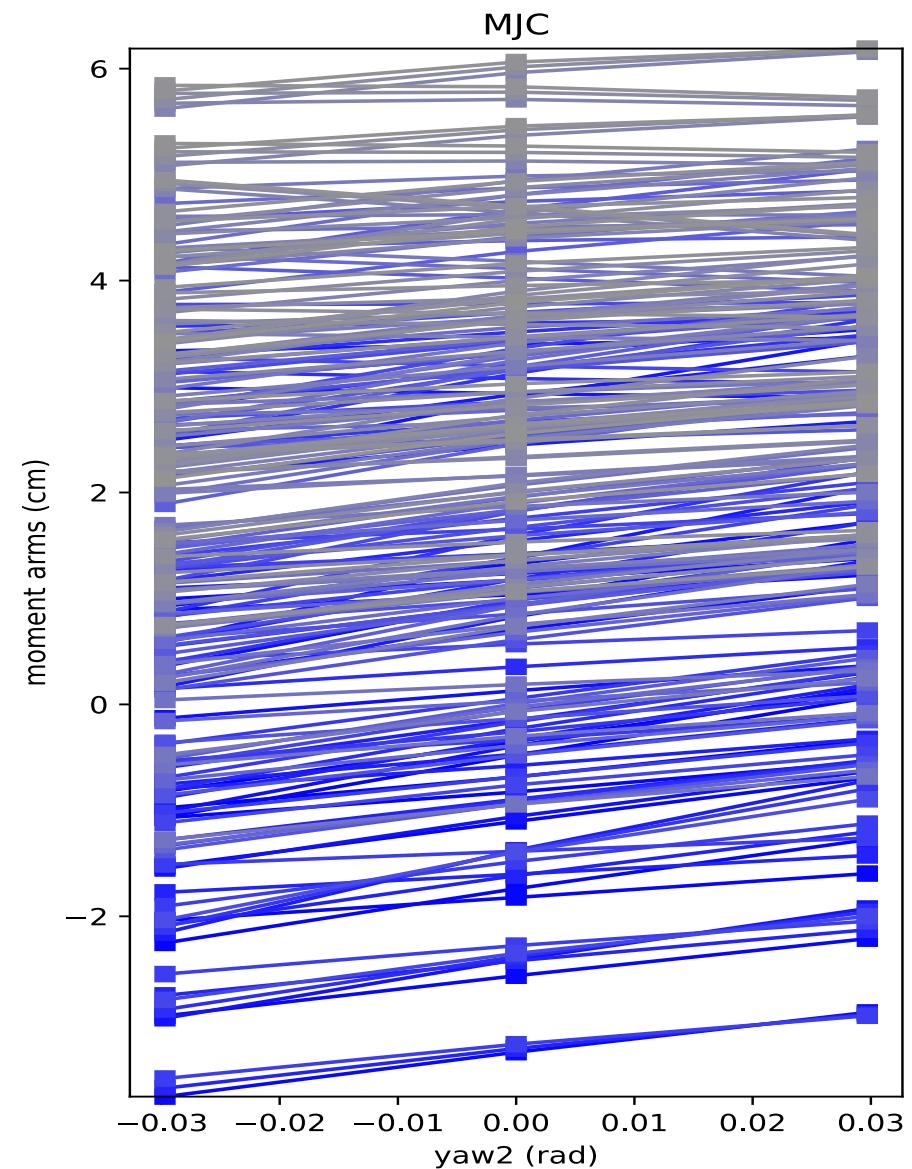
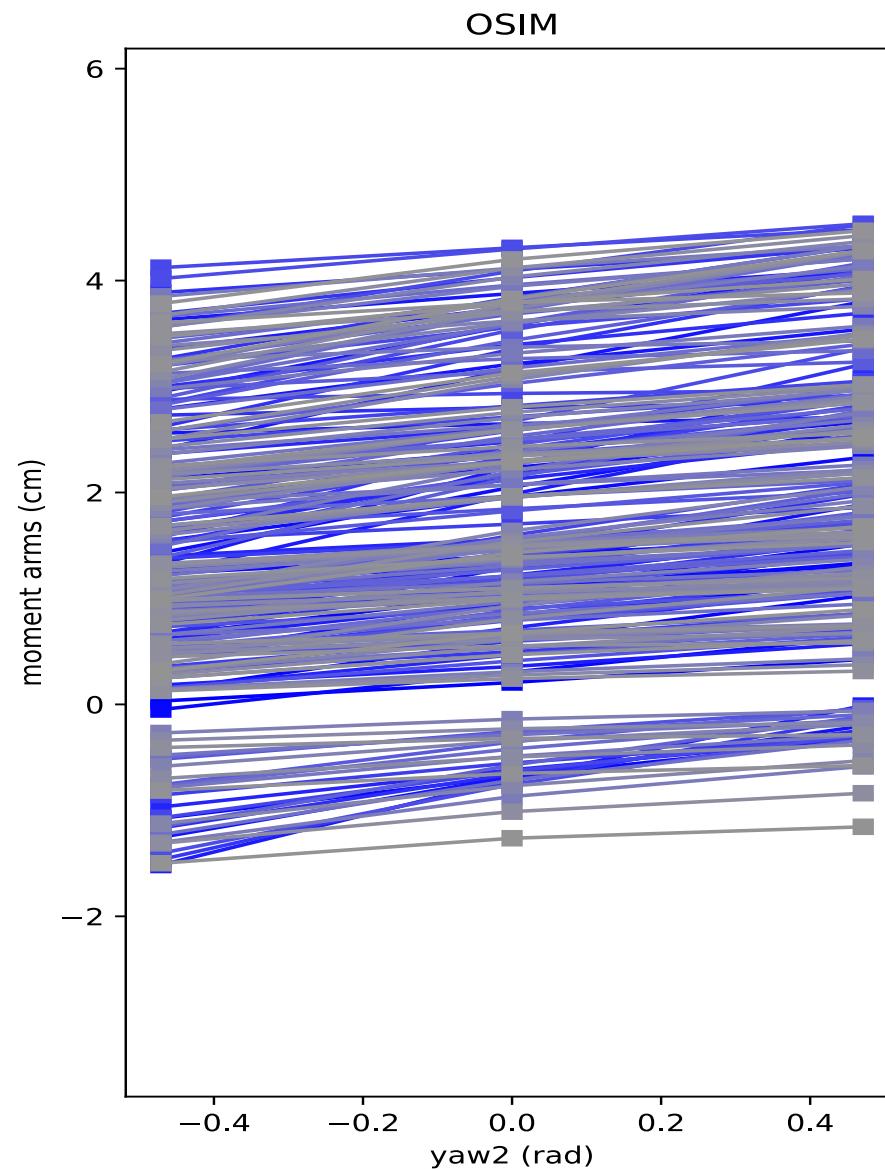
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyoid - pitch2 - roll2 - yaw2



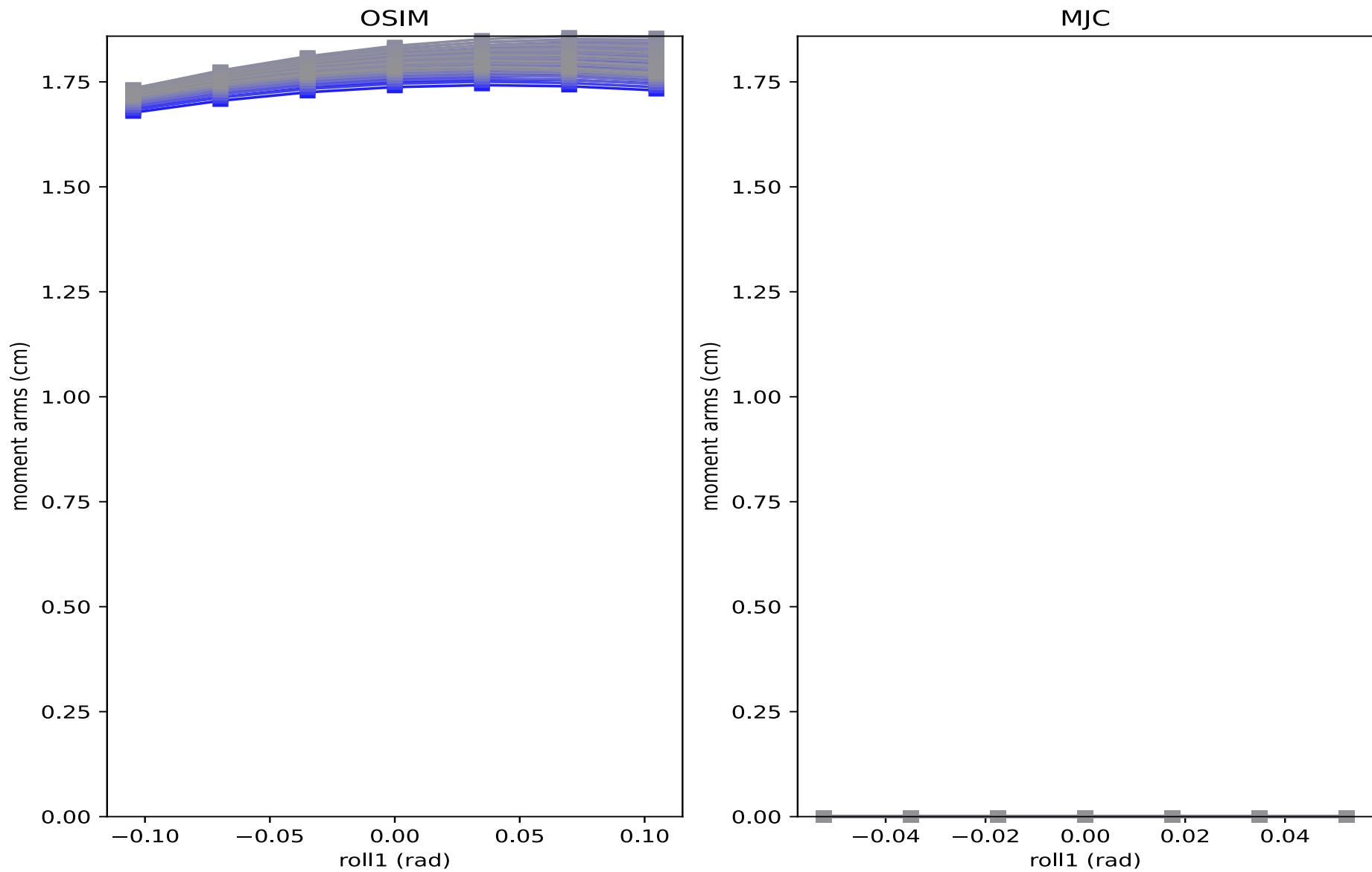
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



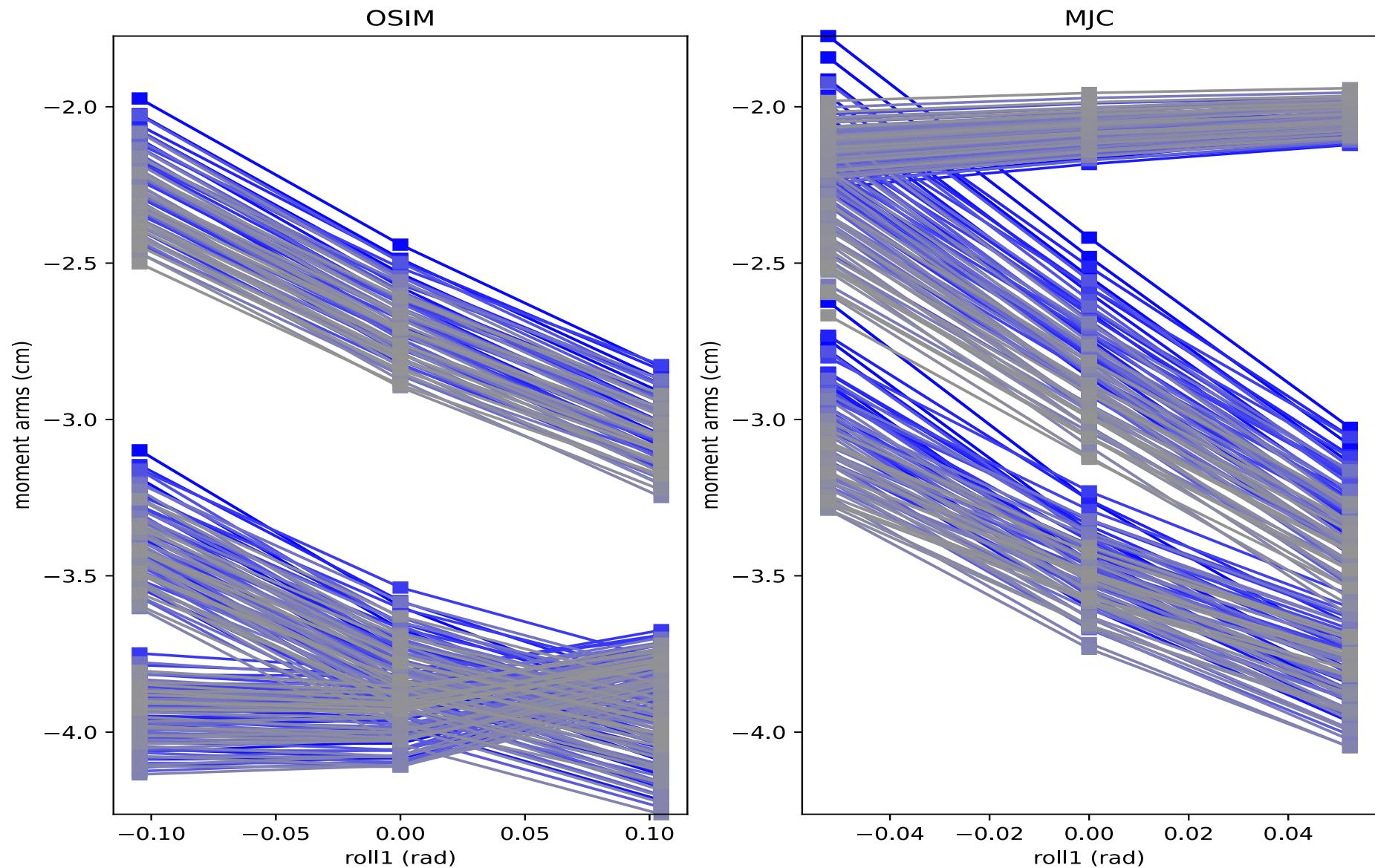
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med - pitch1 - roll1 - yaw1



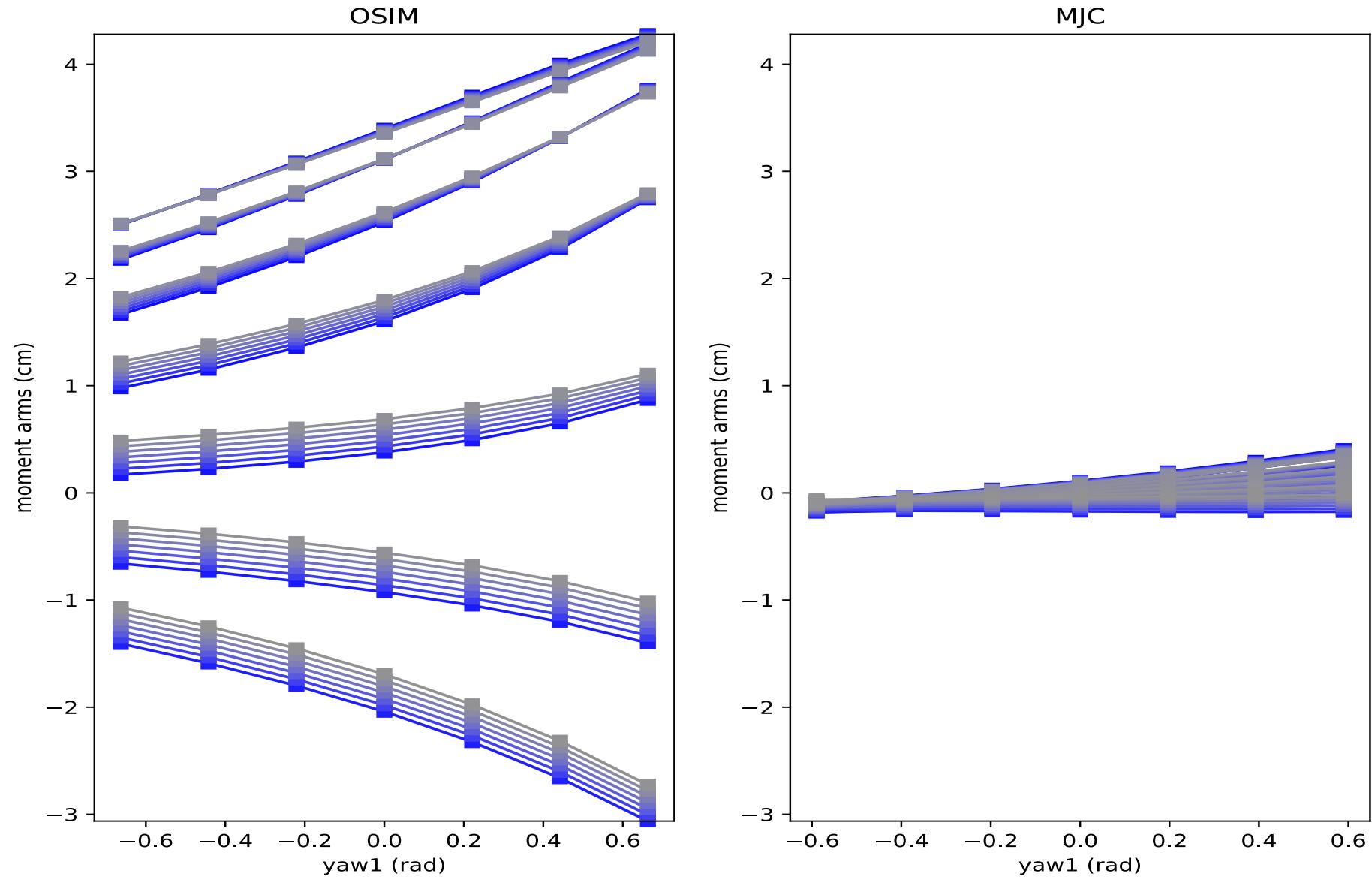
Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



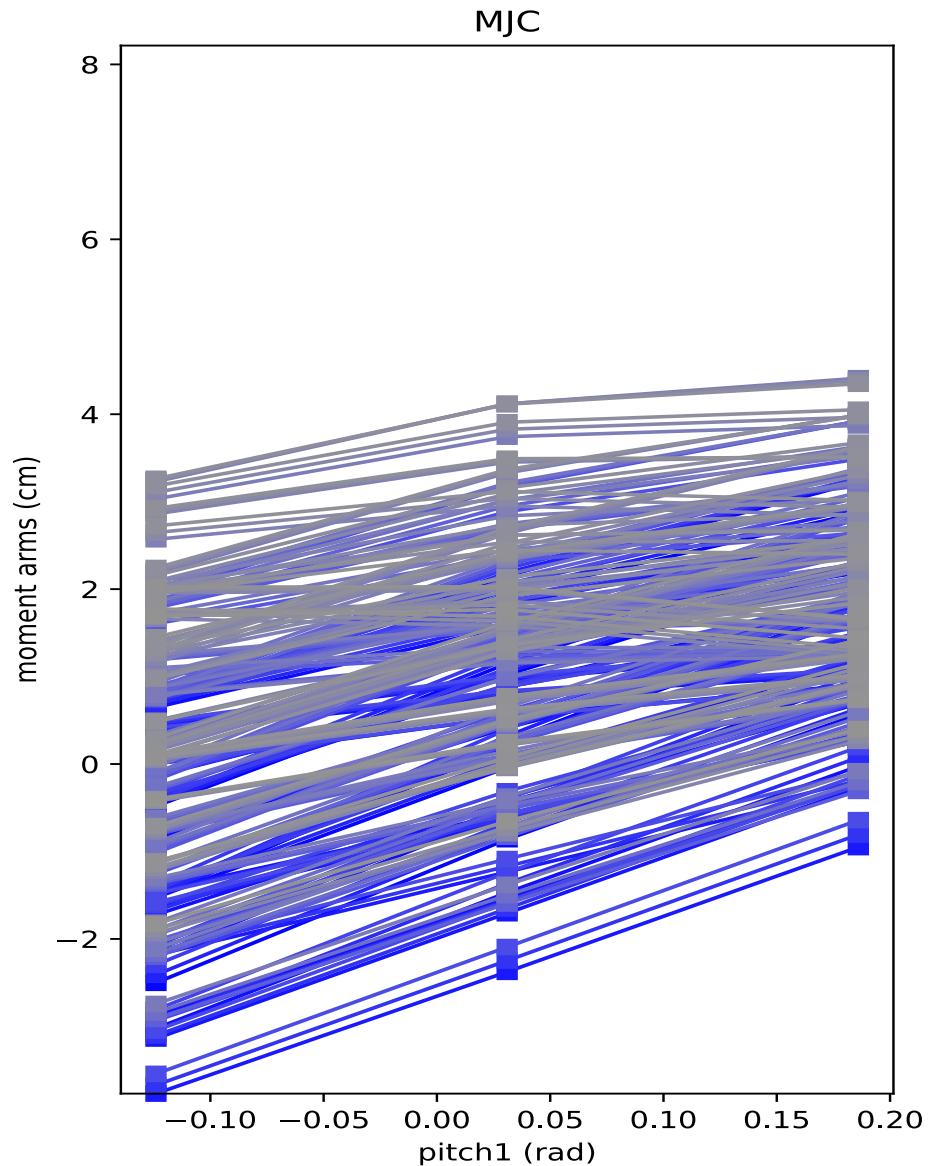
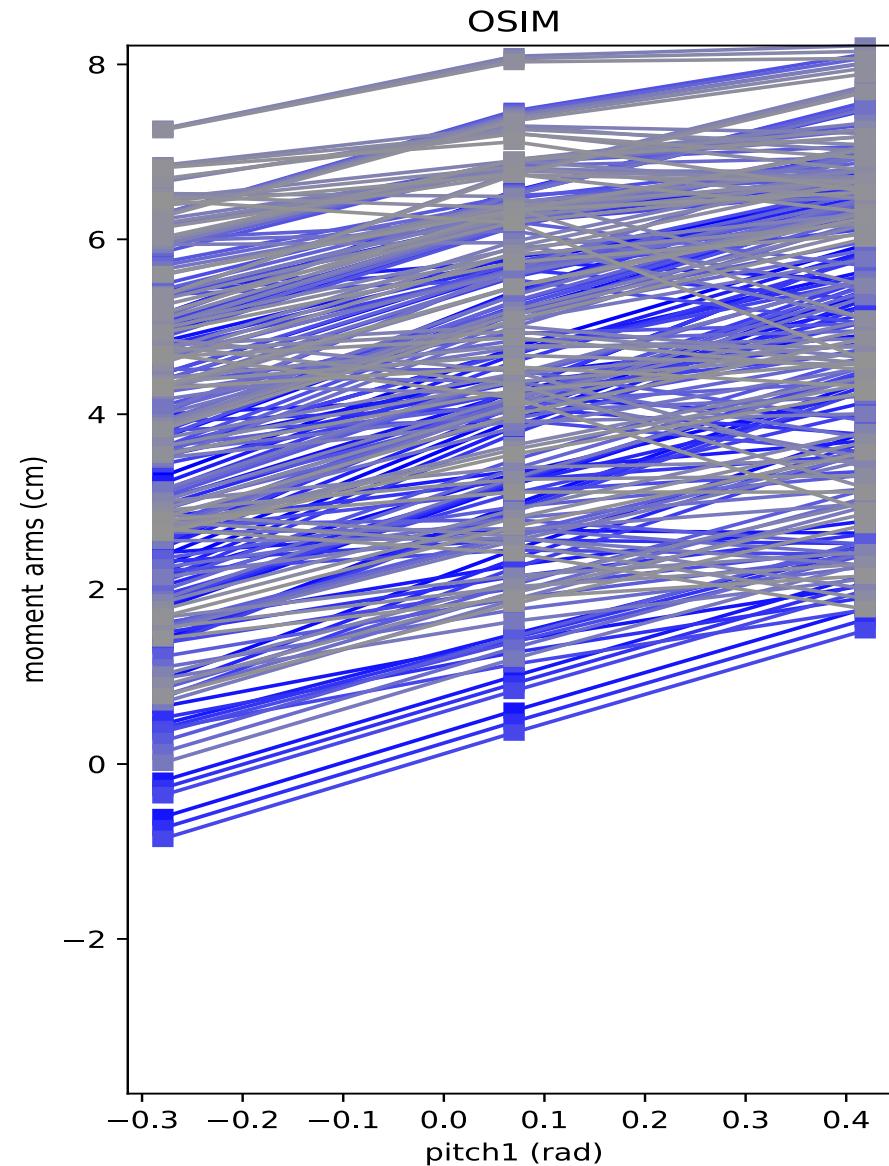
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj_L - pitch1 - roll1 - yaw1



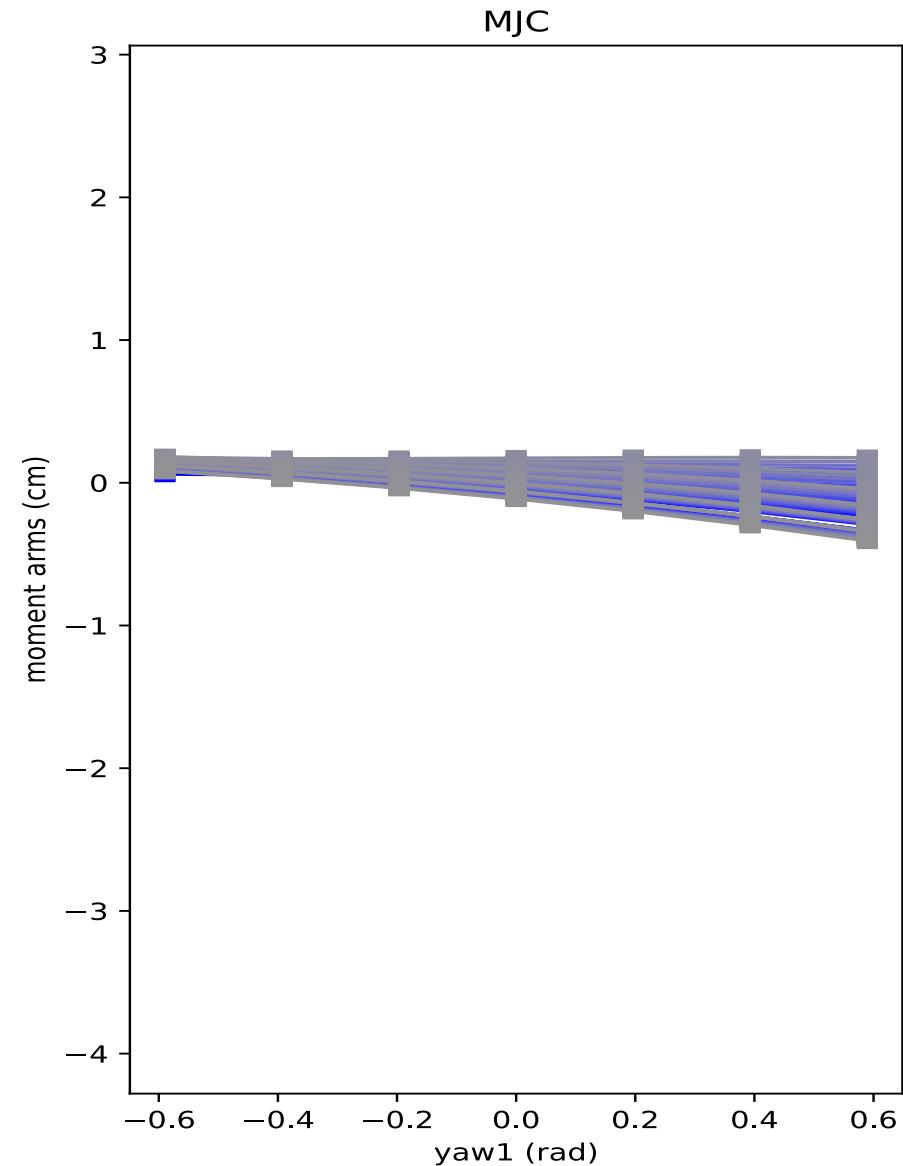
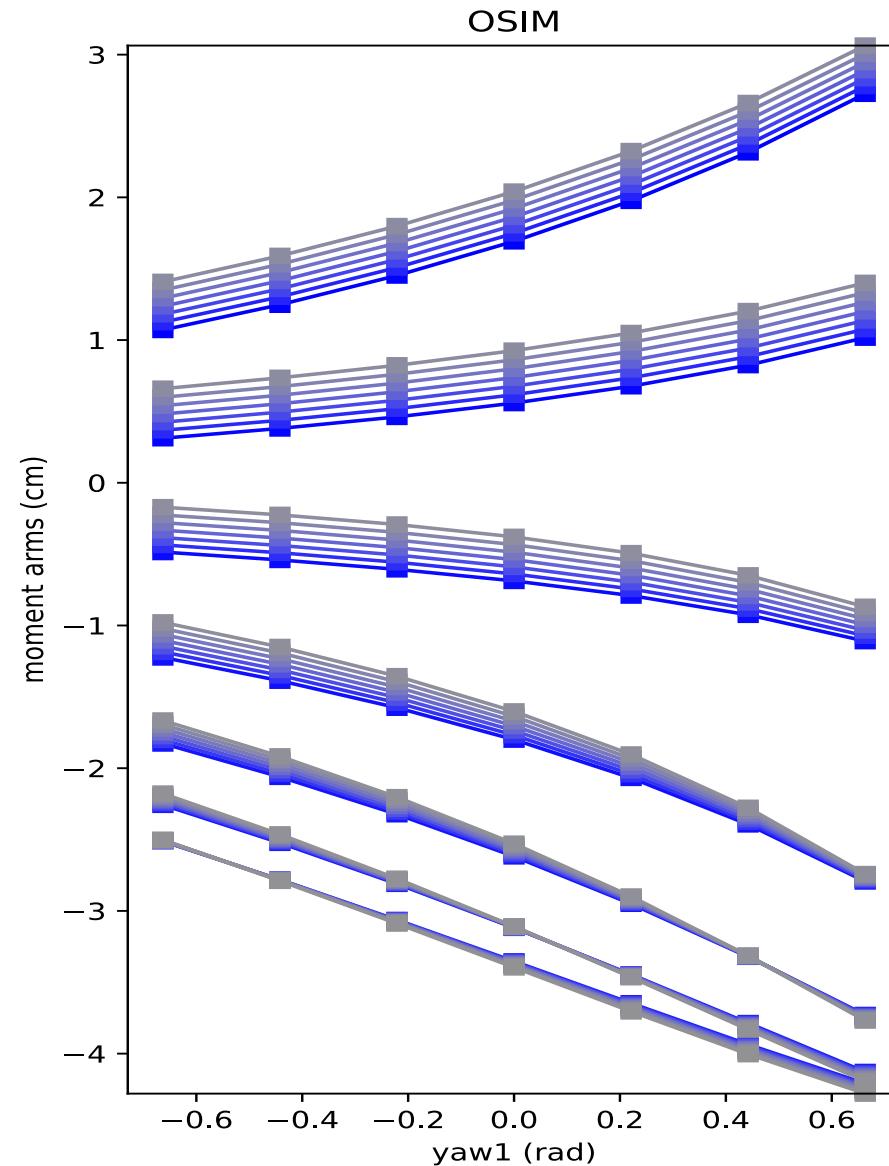
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



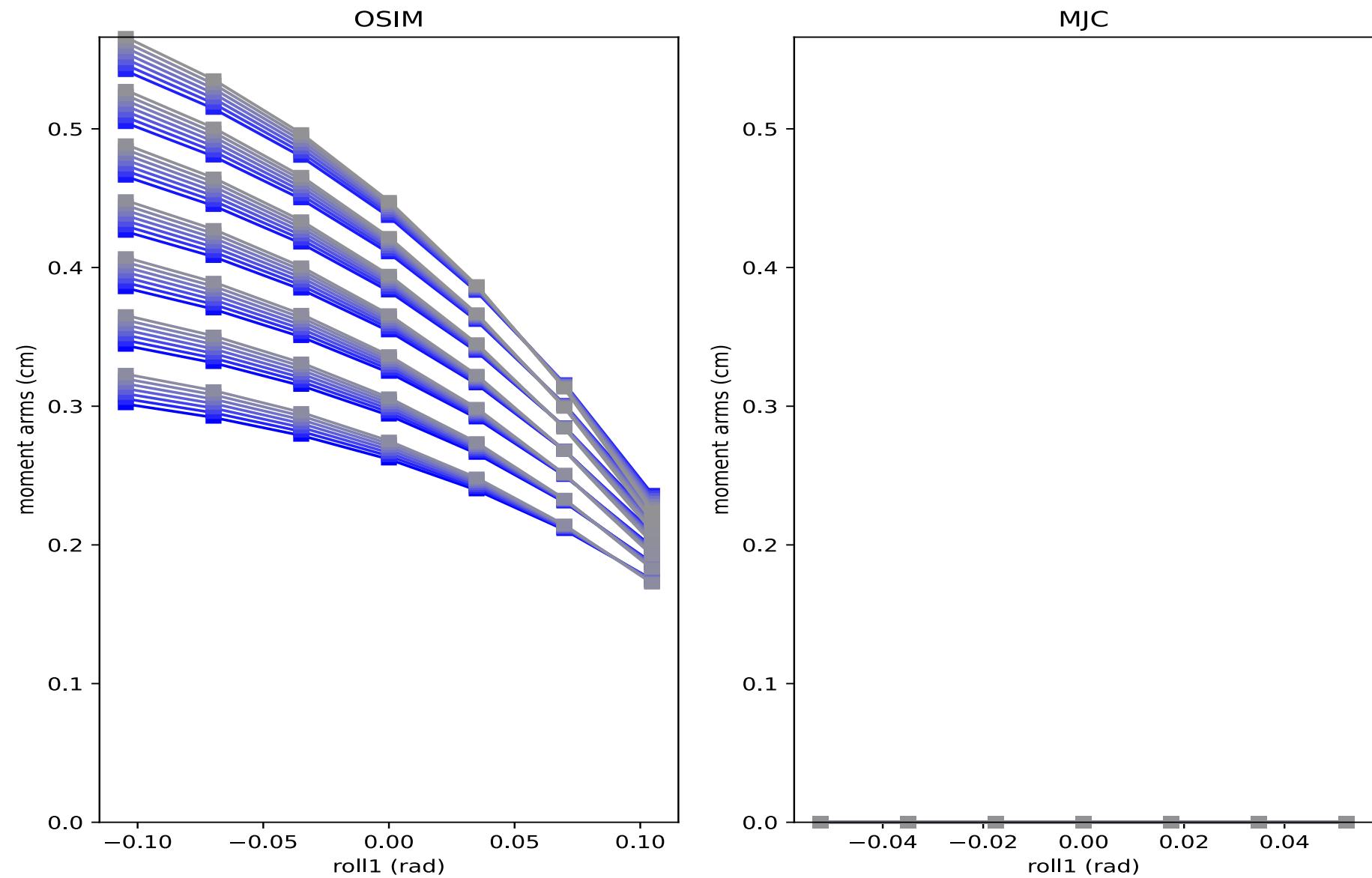
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj - pitch1 - roll1 - yaw1



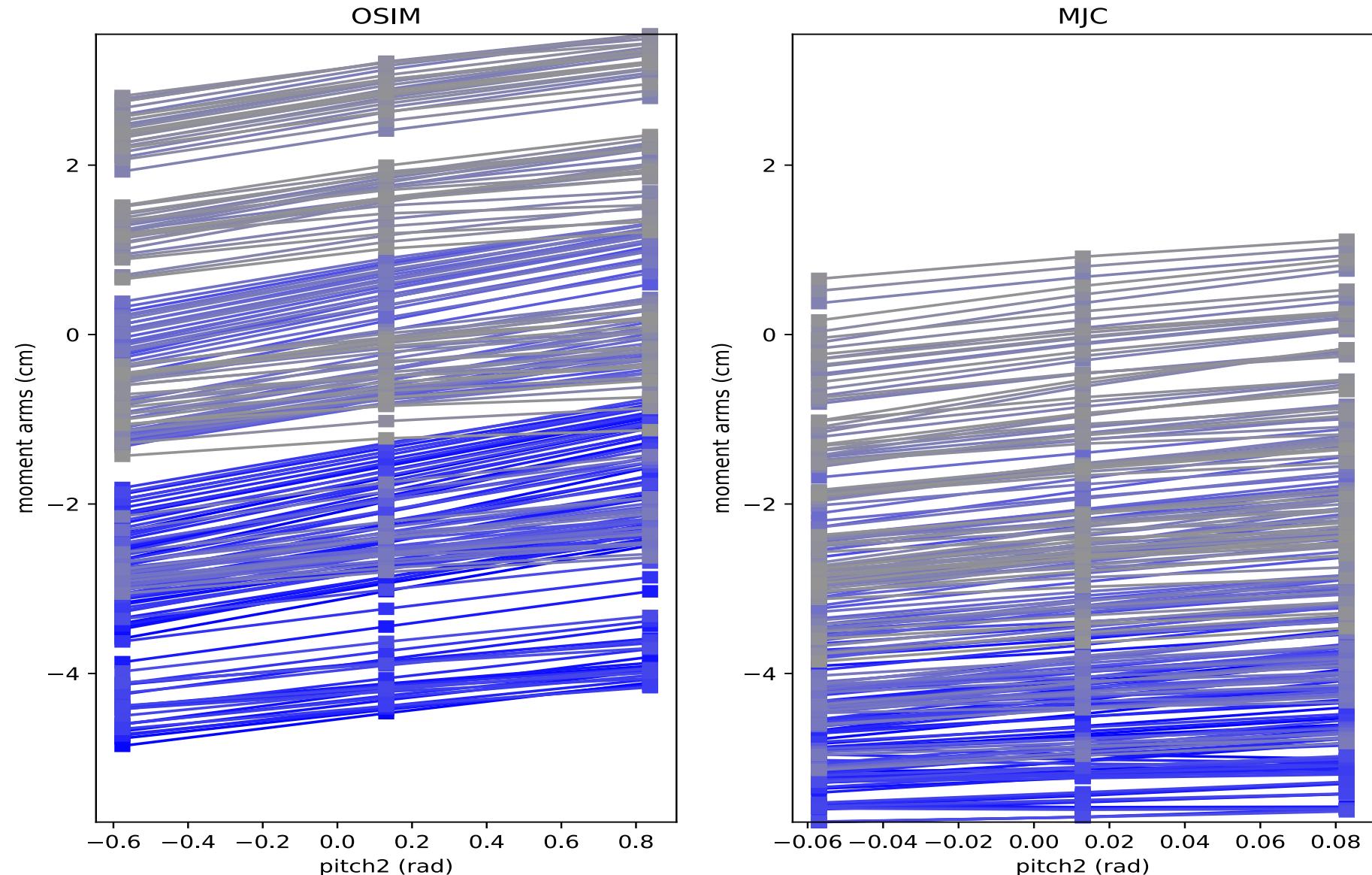
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min - pitch1 - roll1 - yaw1



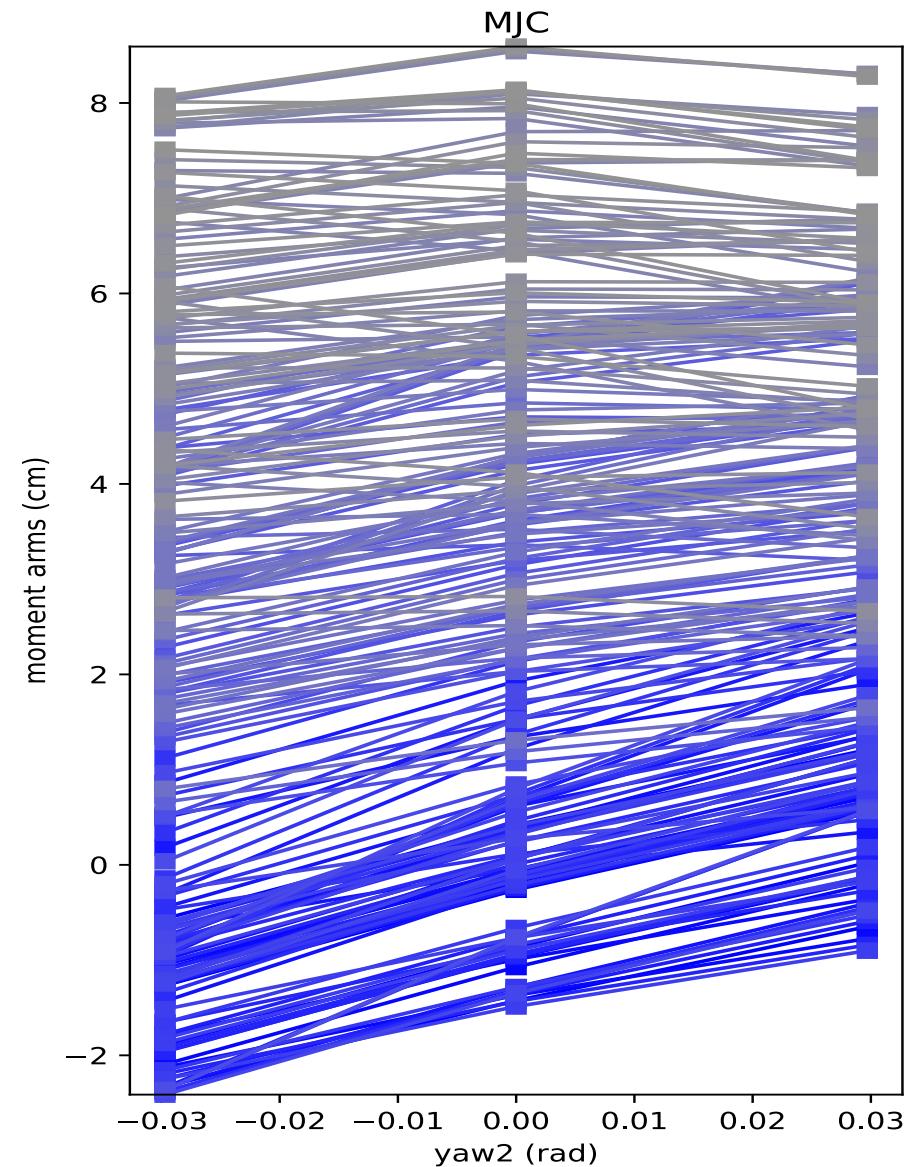
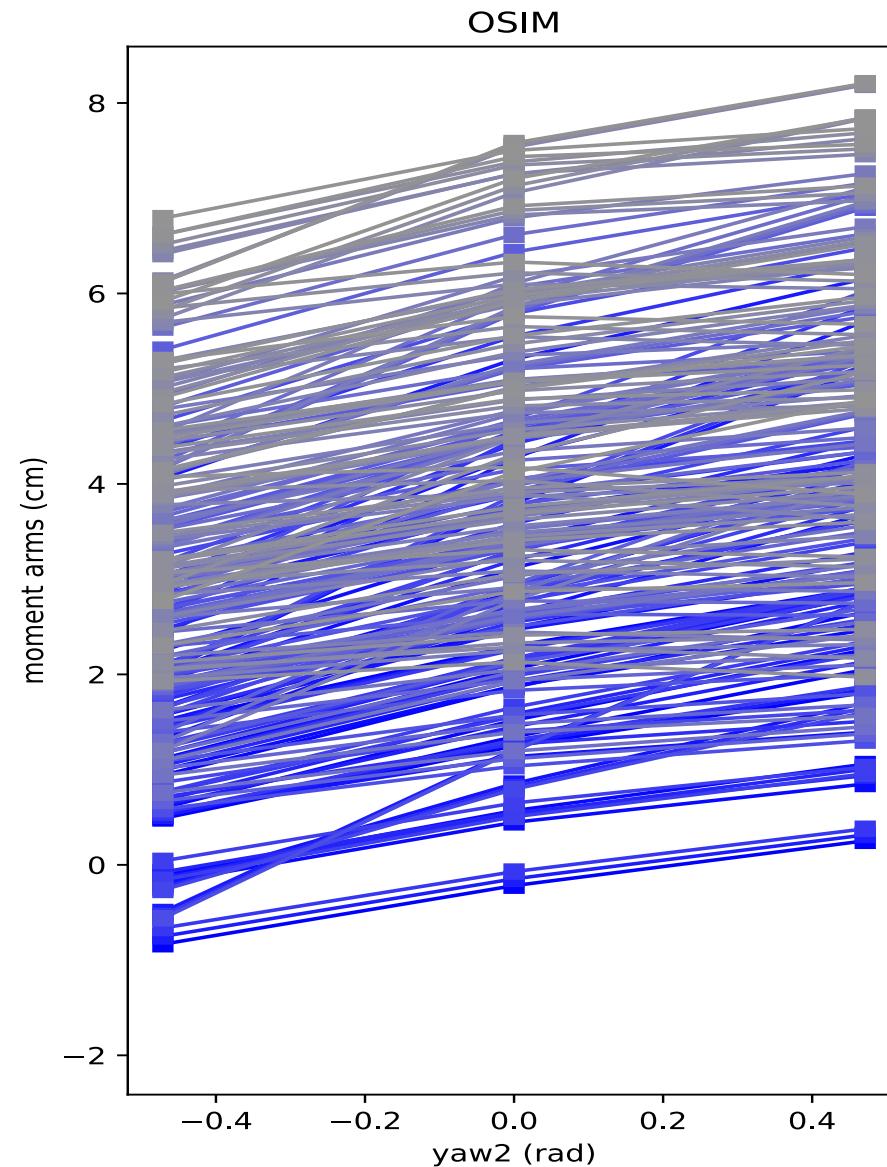
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



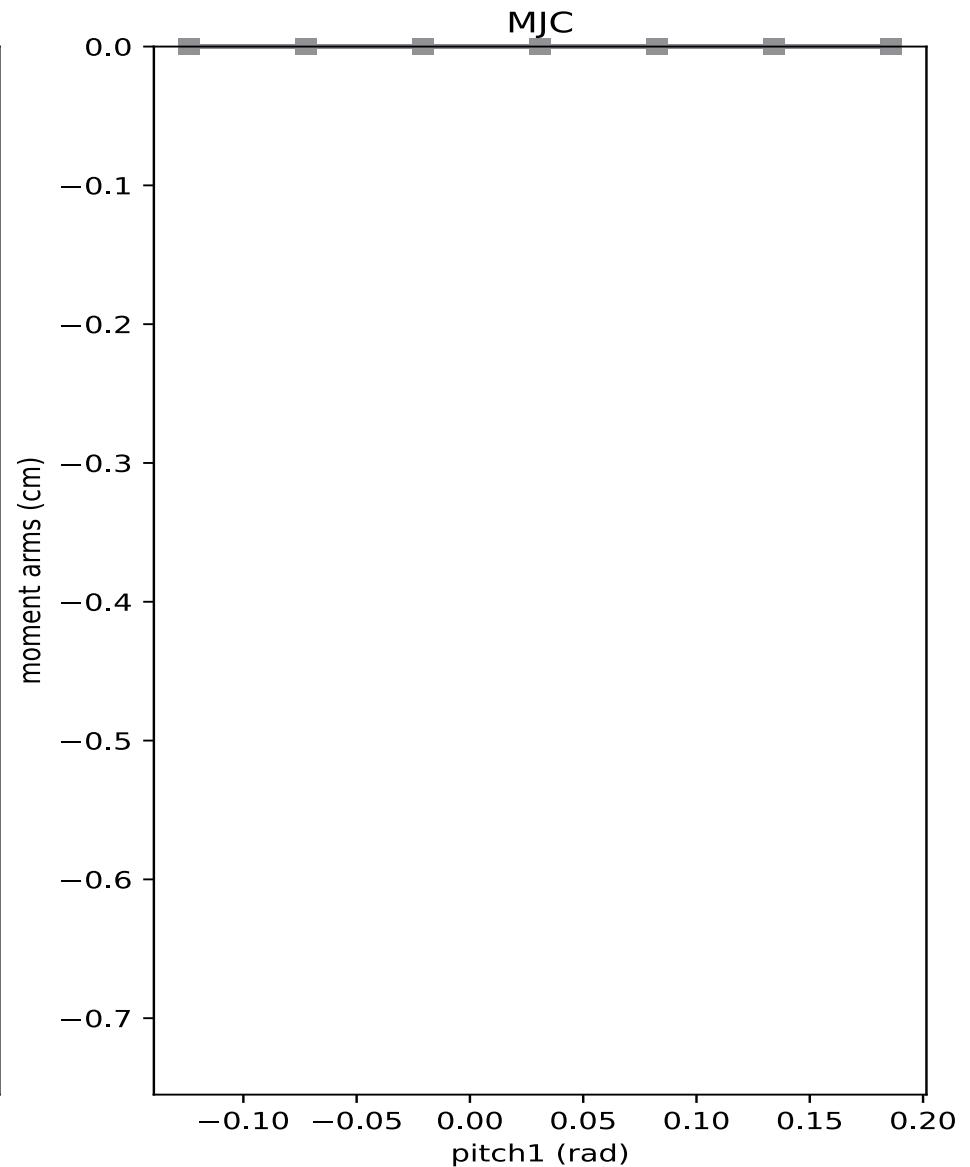
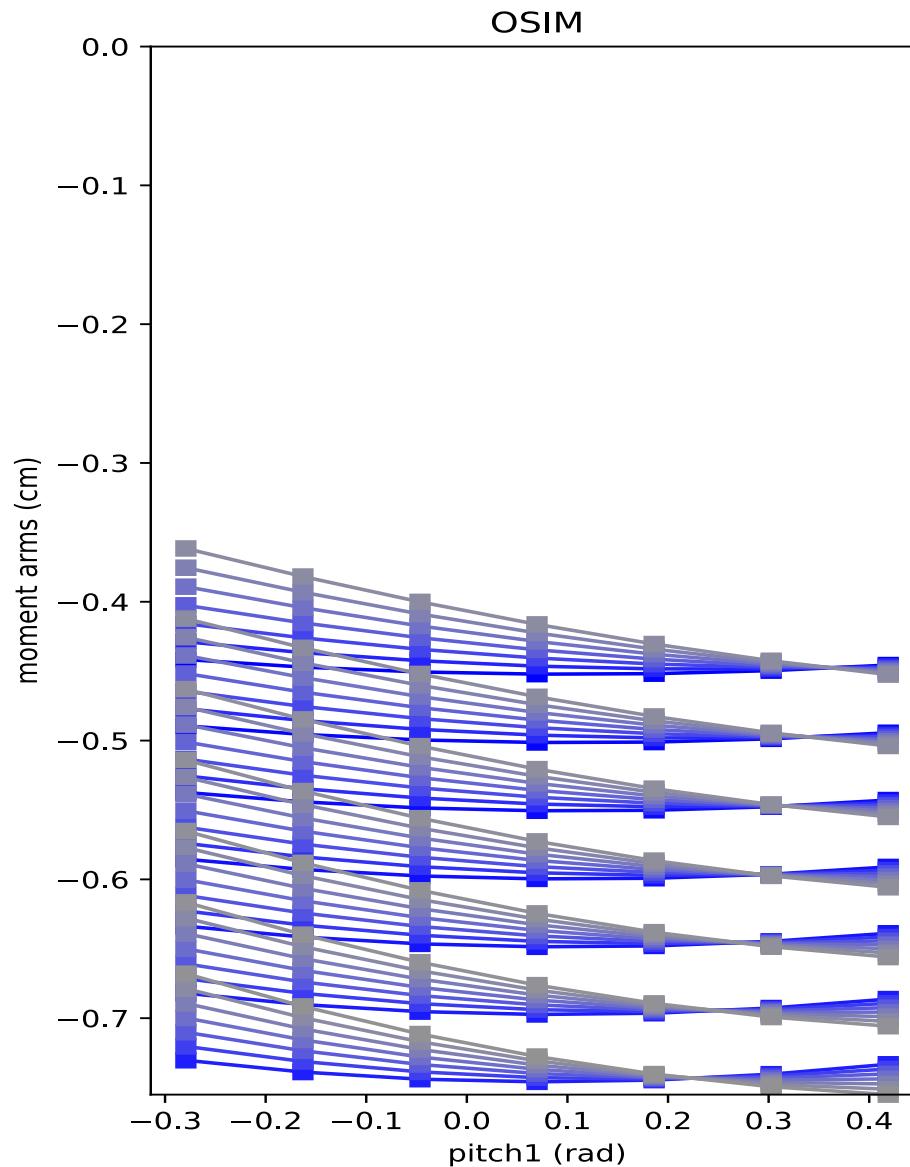
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



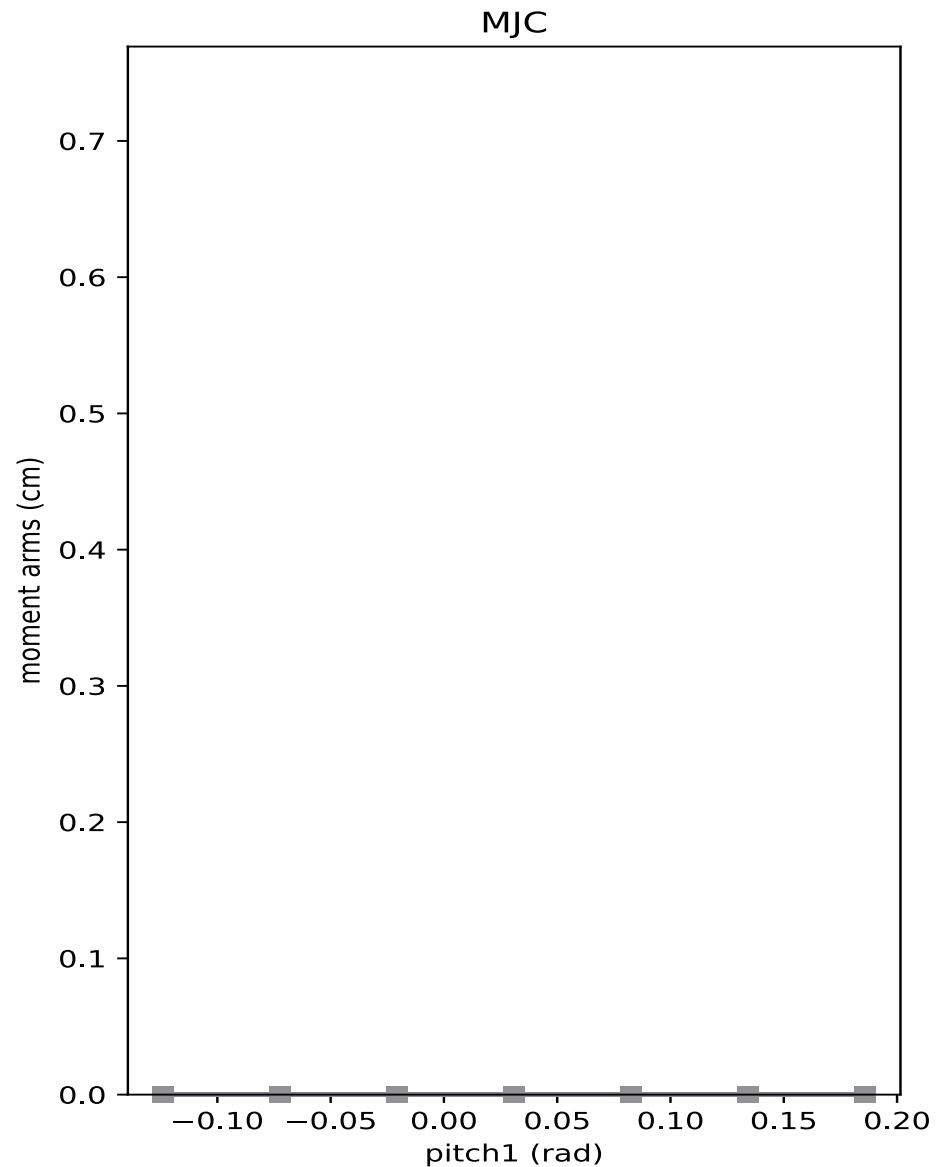
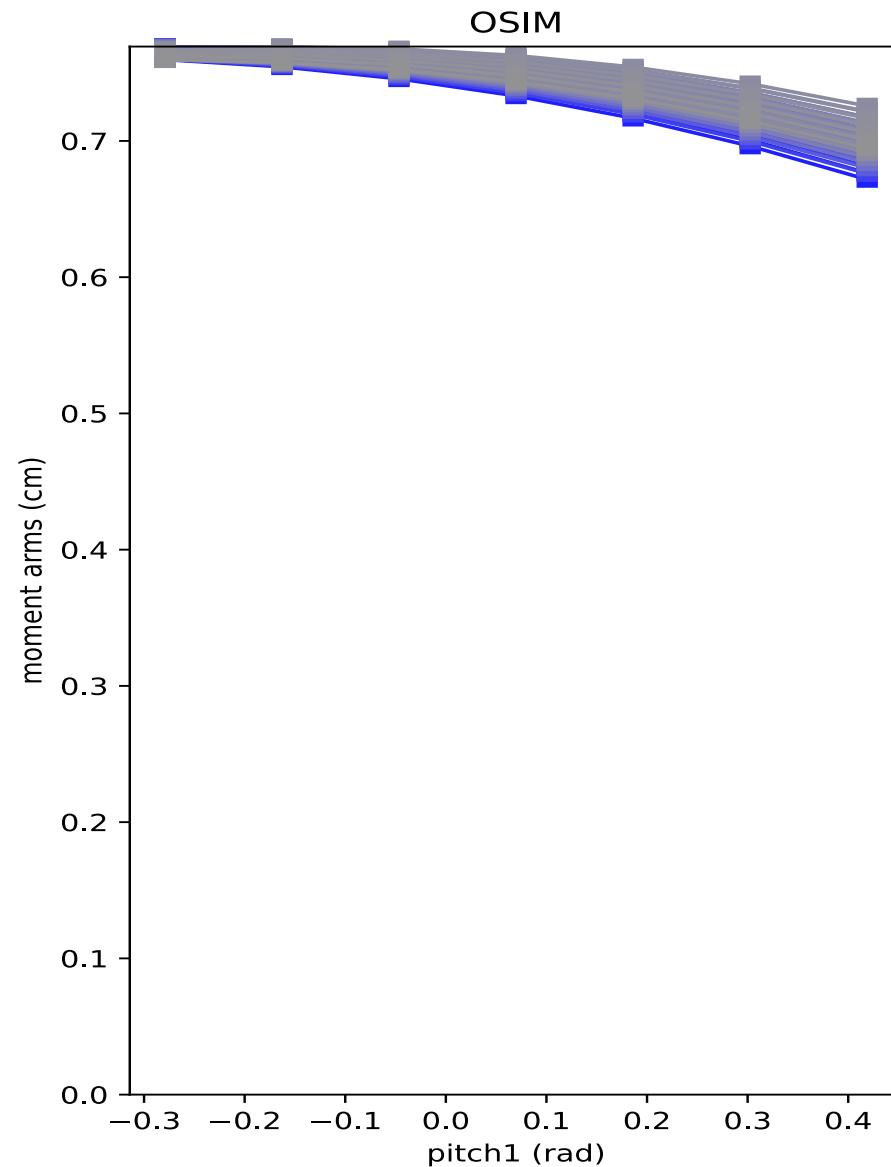
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat - pitch1 - roll1 - yaw1



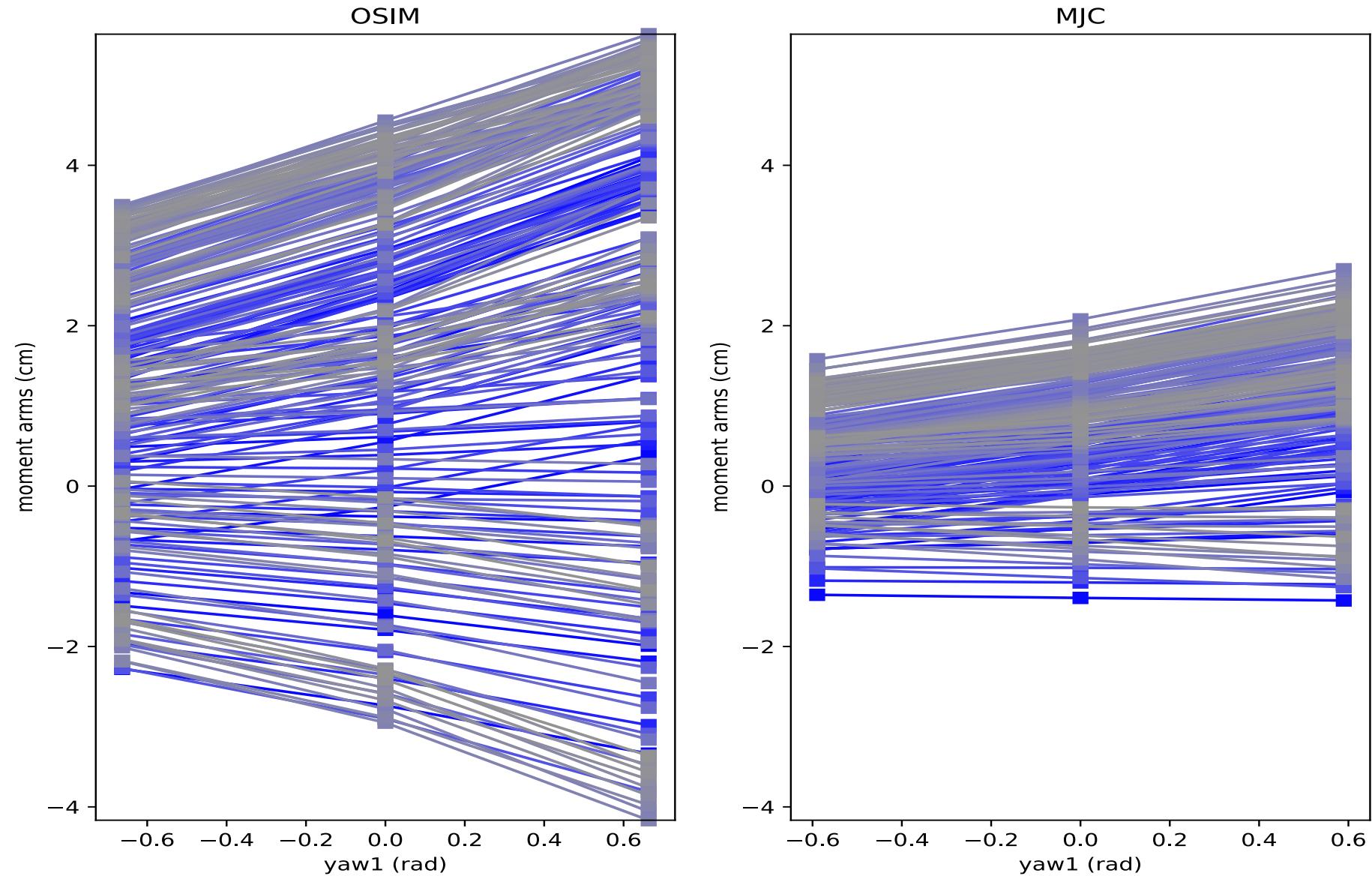
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup_L - pitch1 - roll1 - yaw1



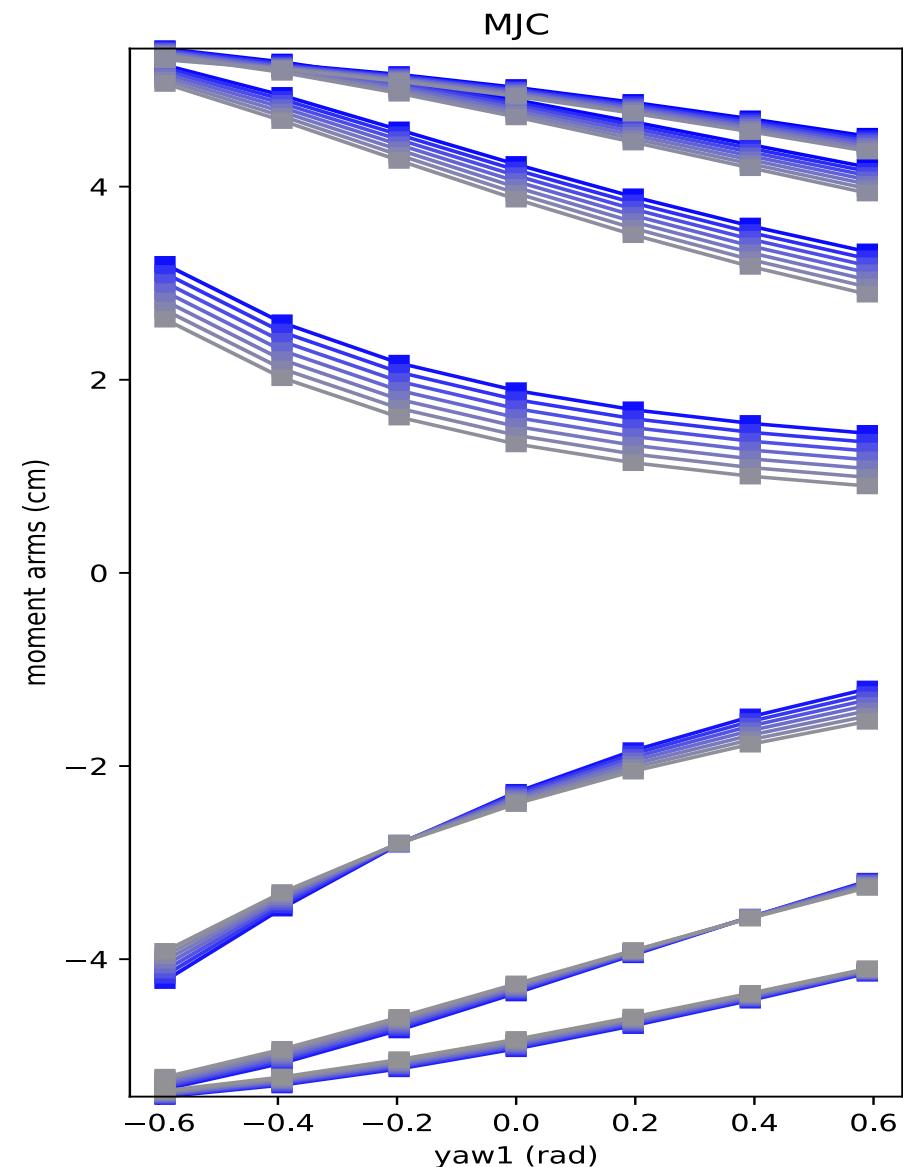
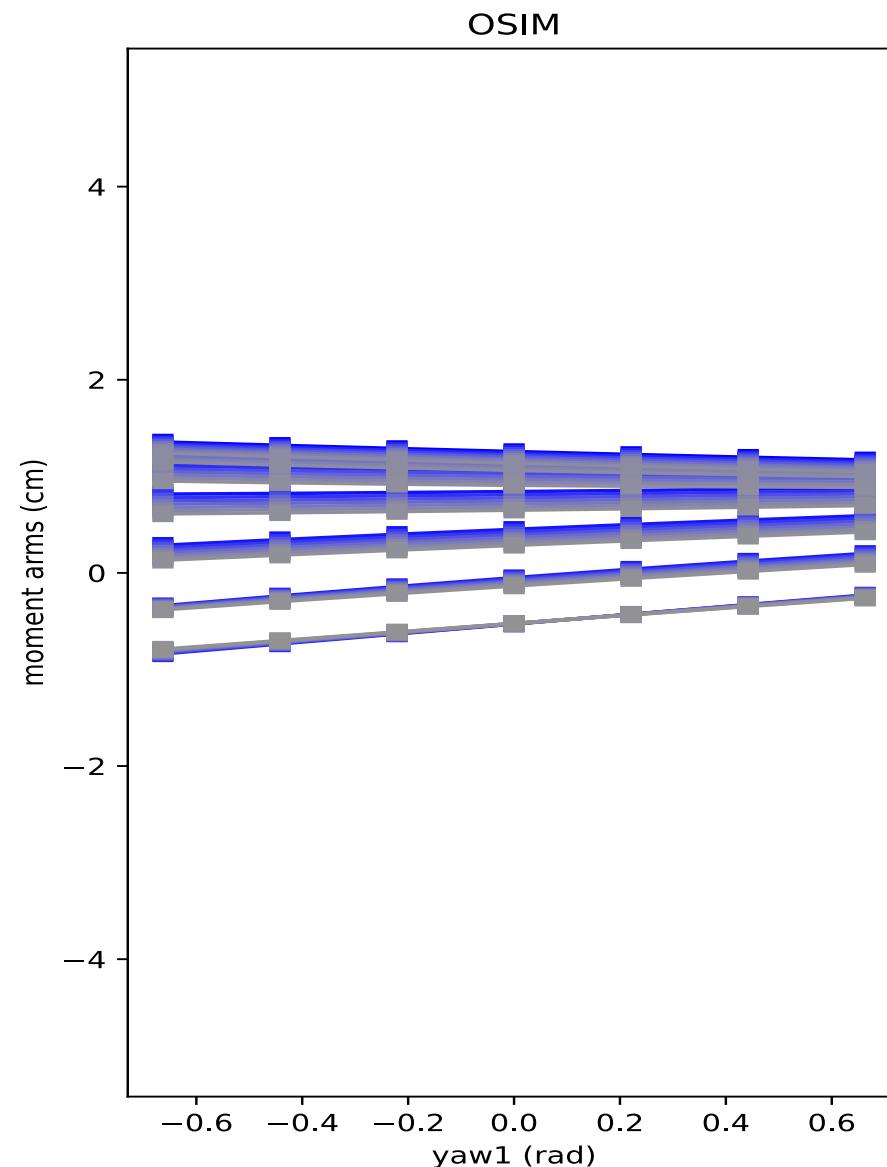
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



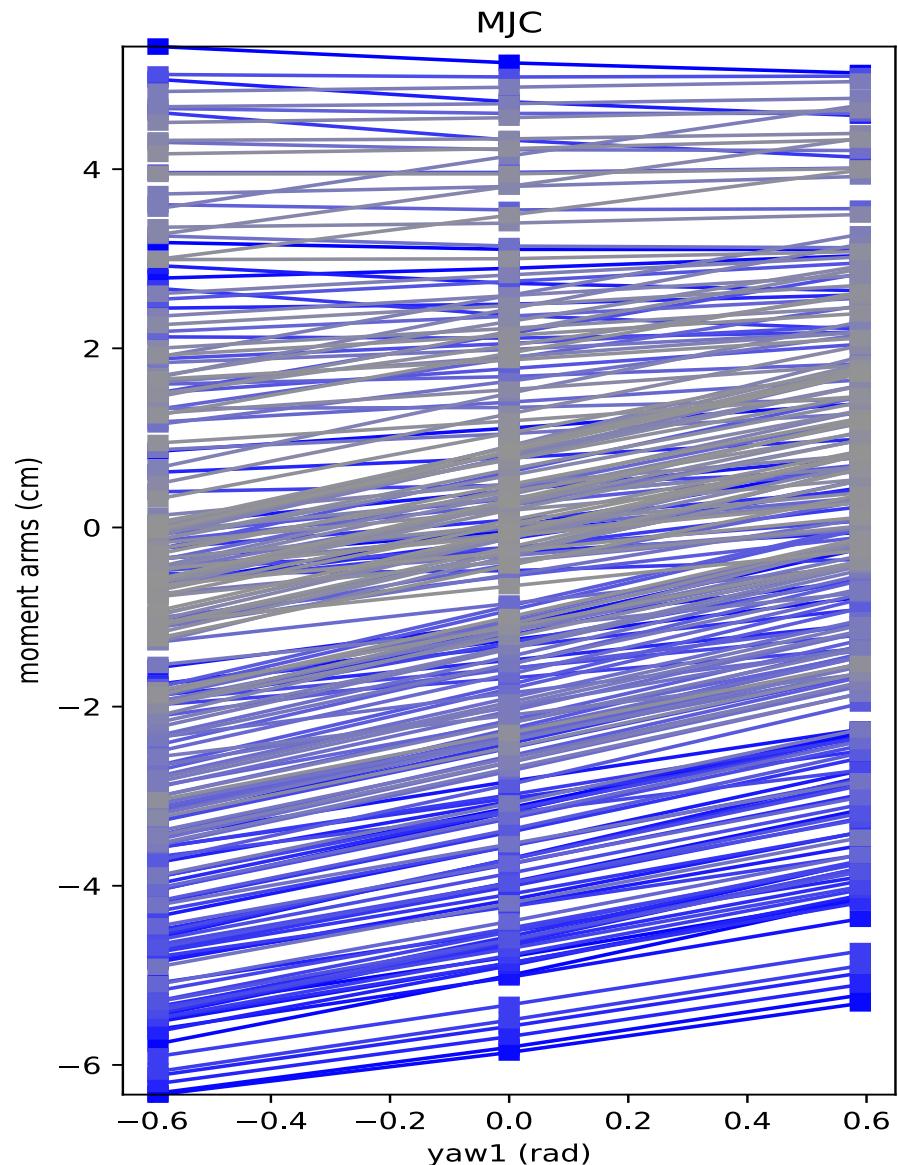
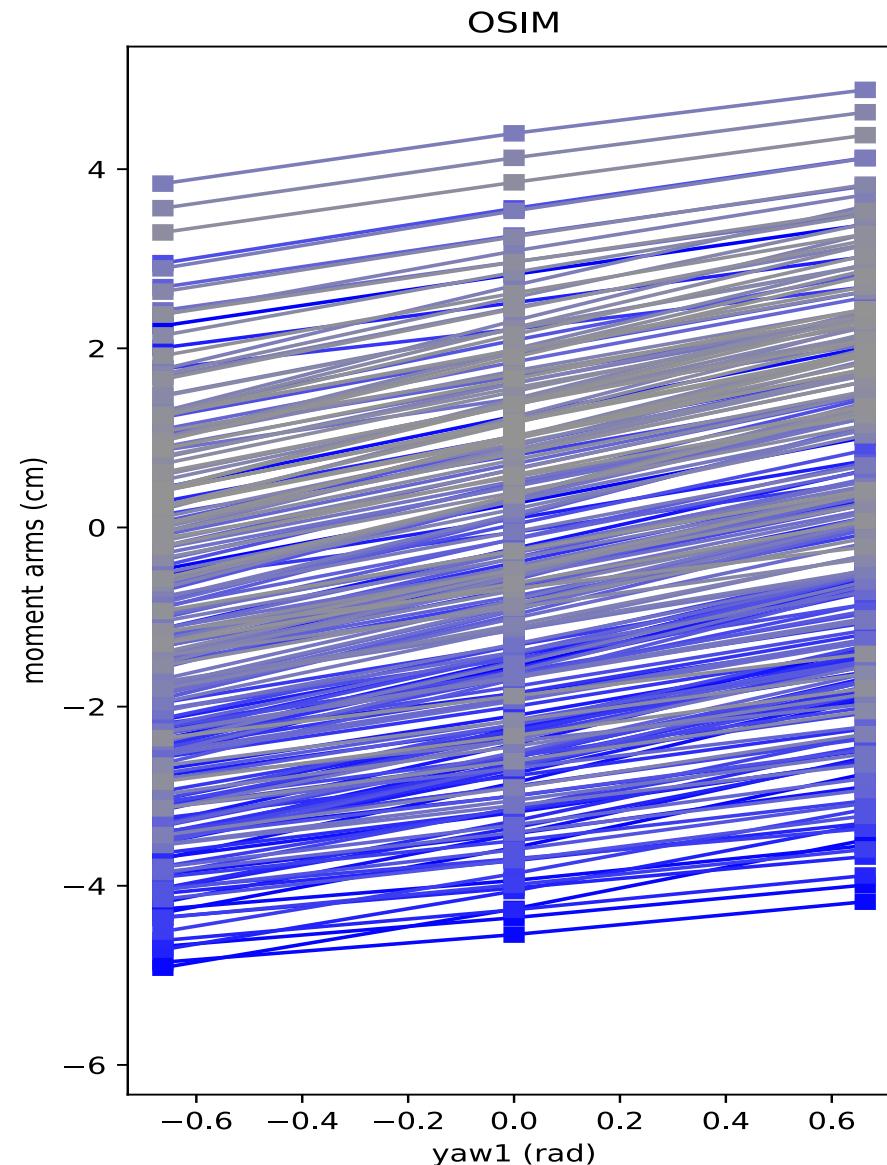
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4_L - pitch1 - roll1 - yaw1



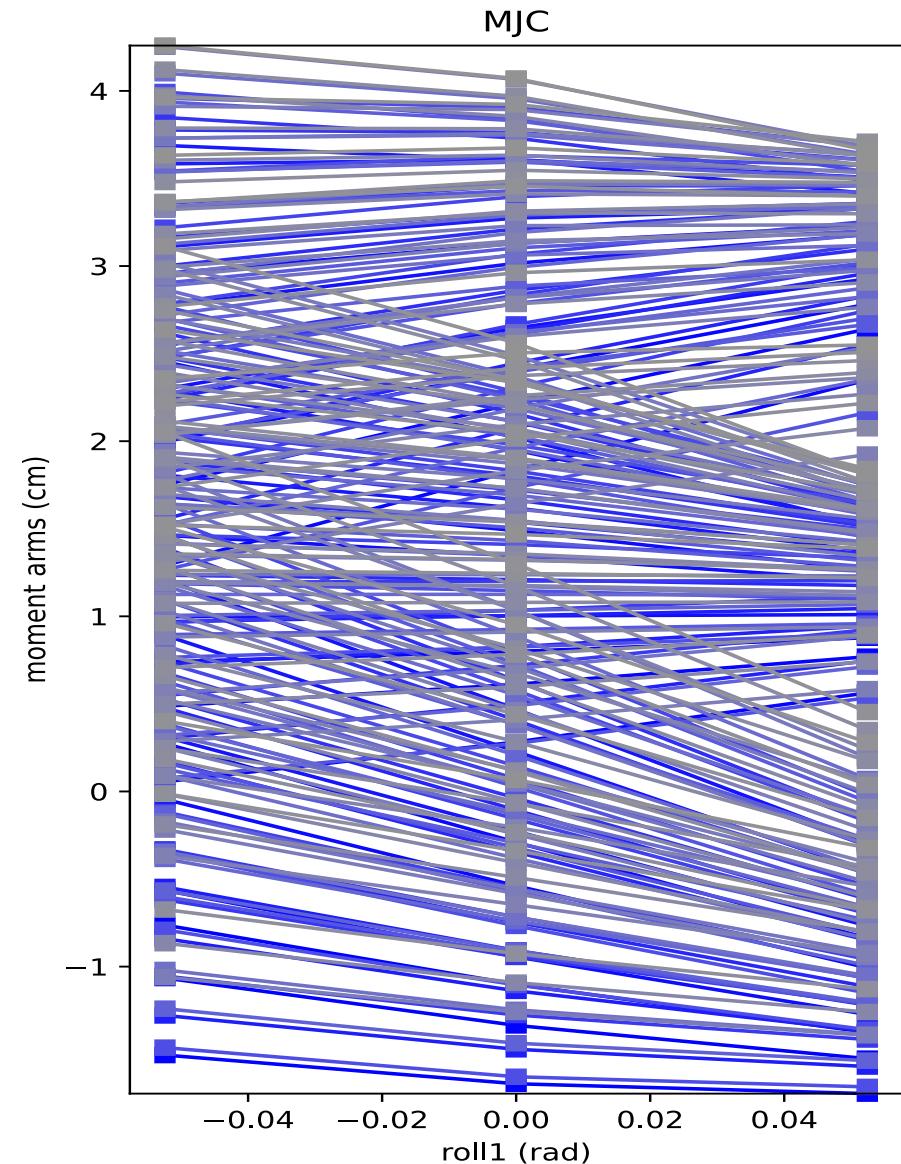
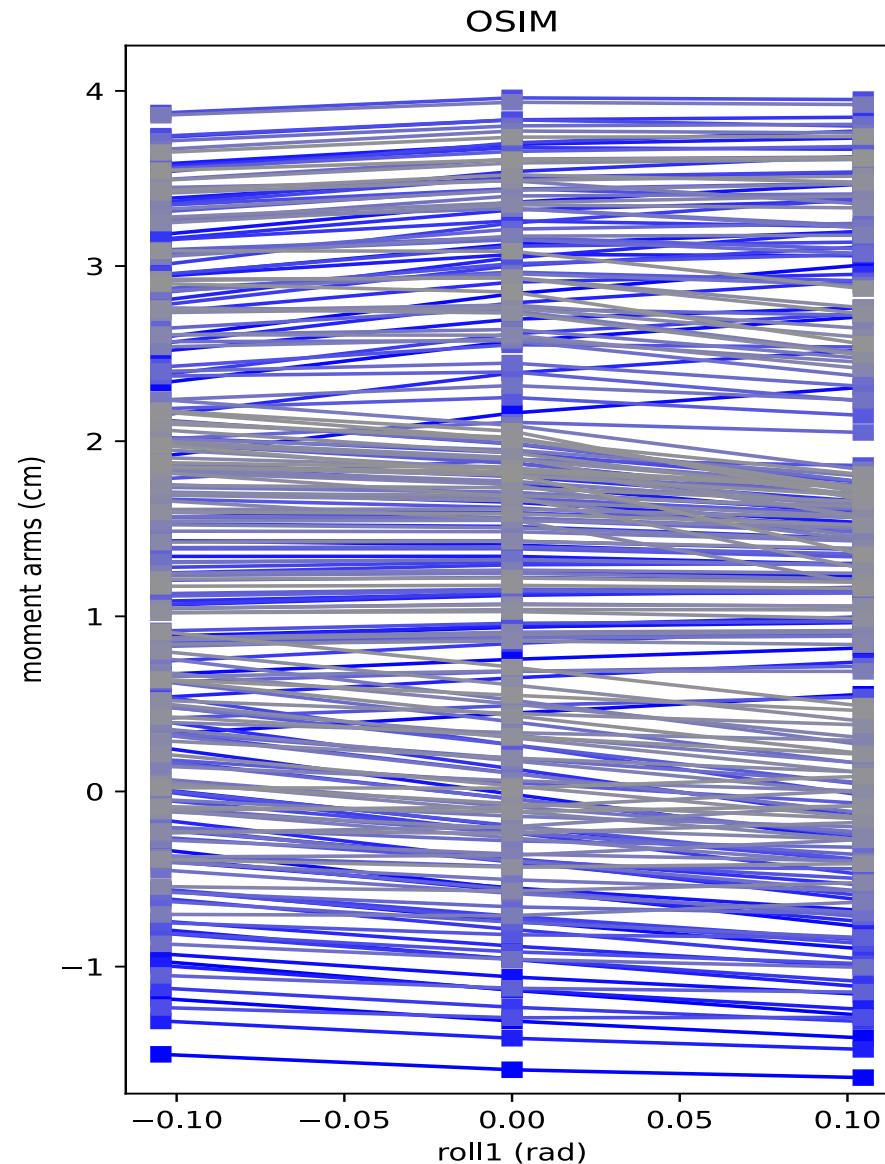
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



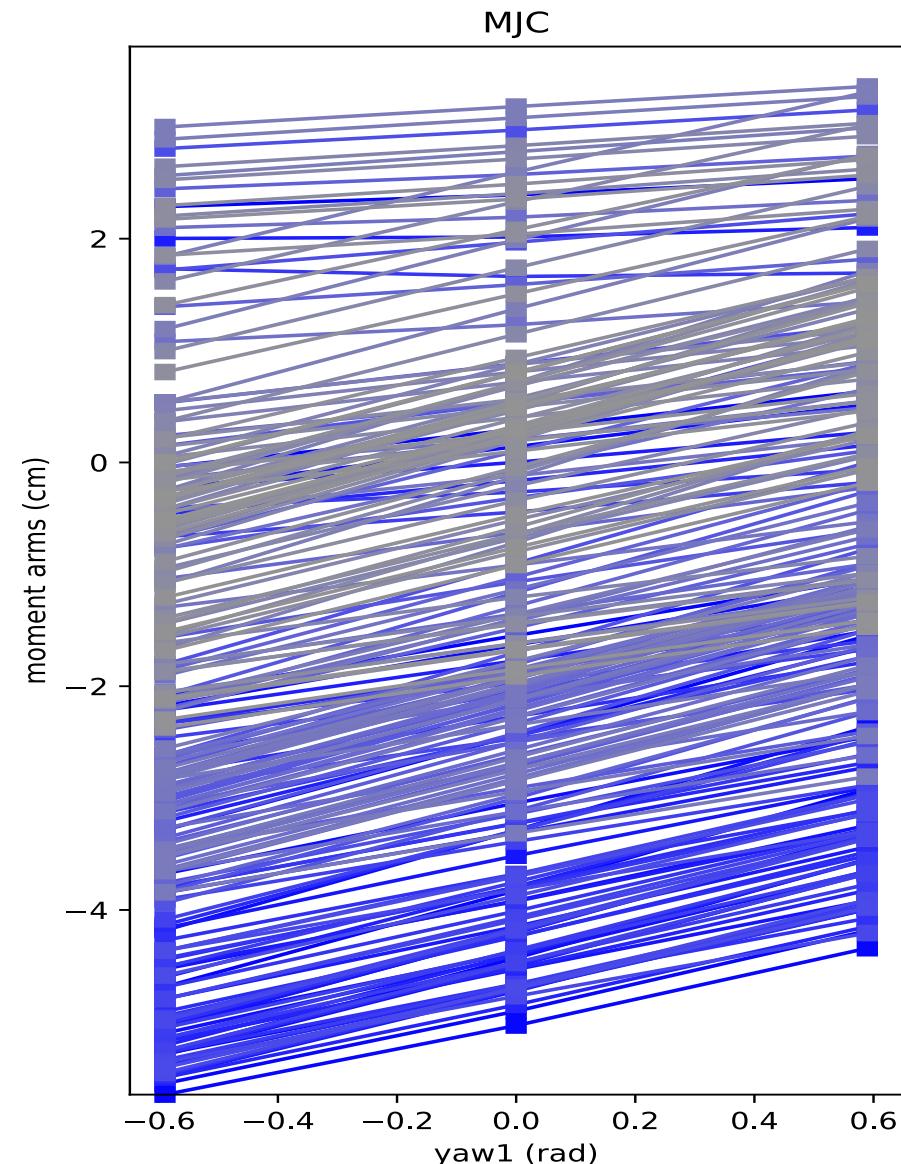
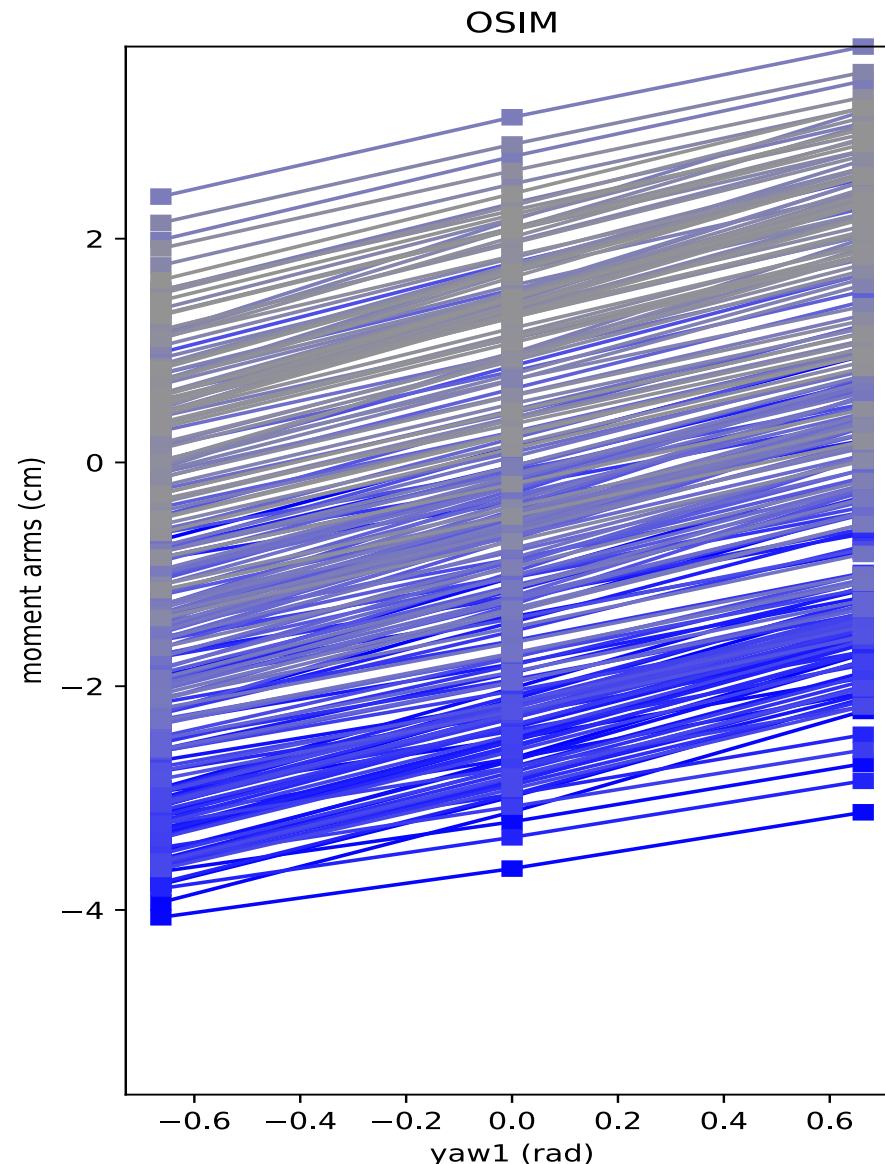
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



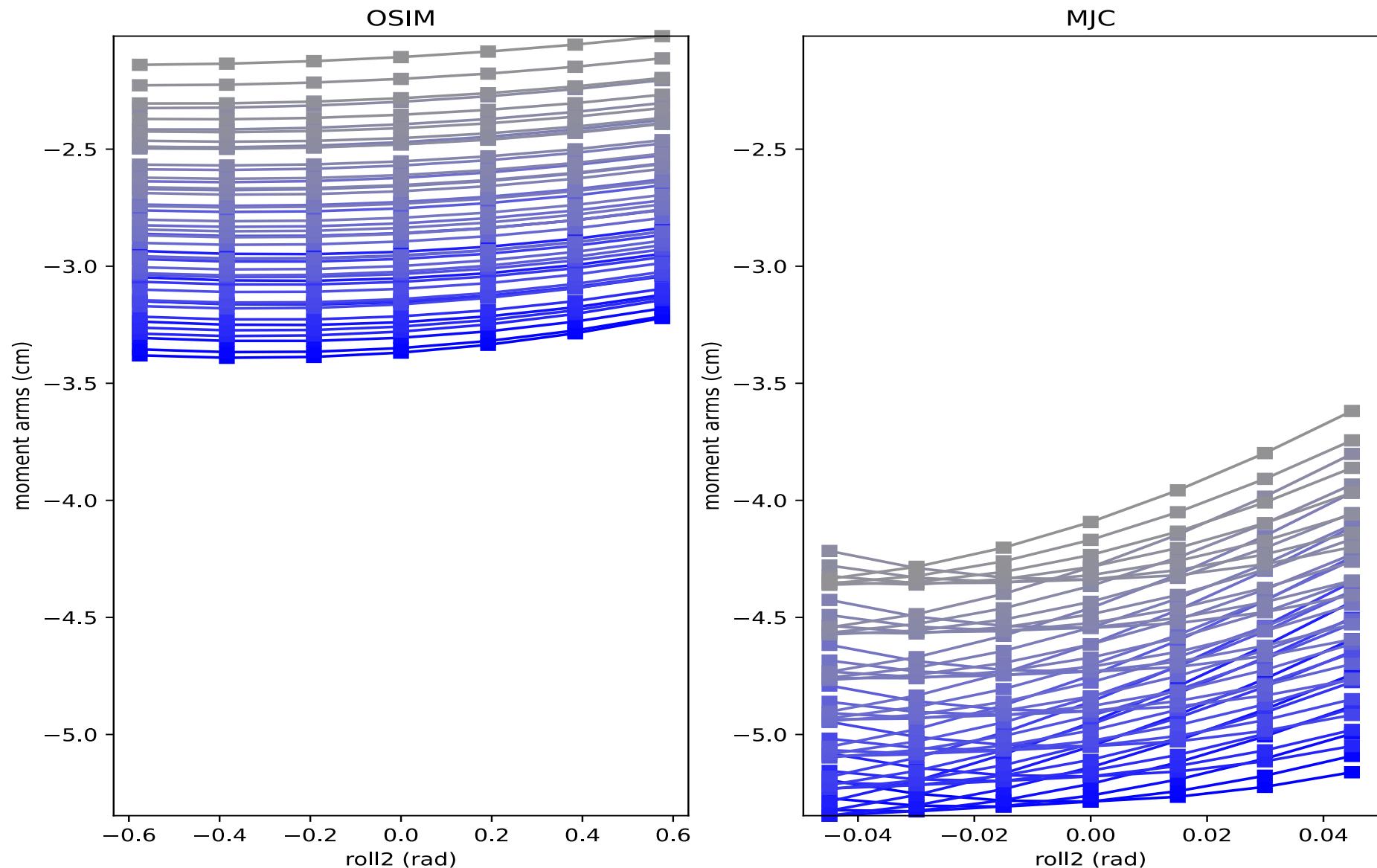
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



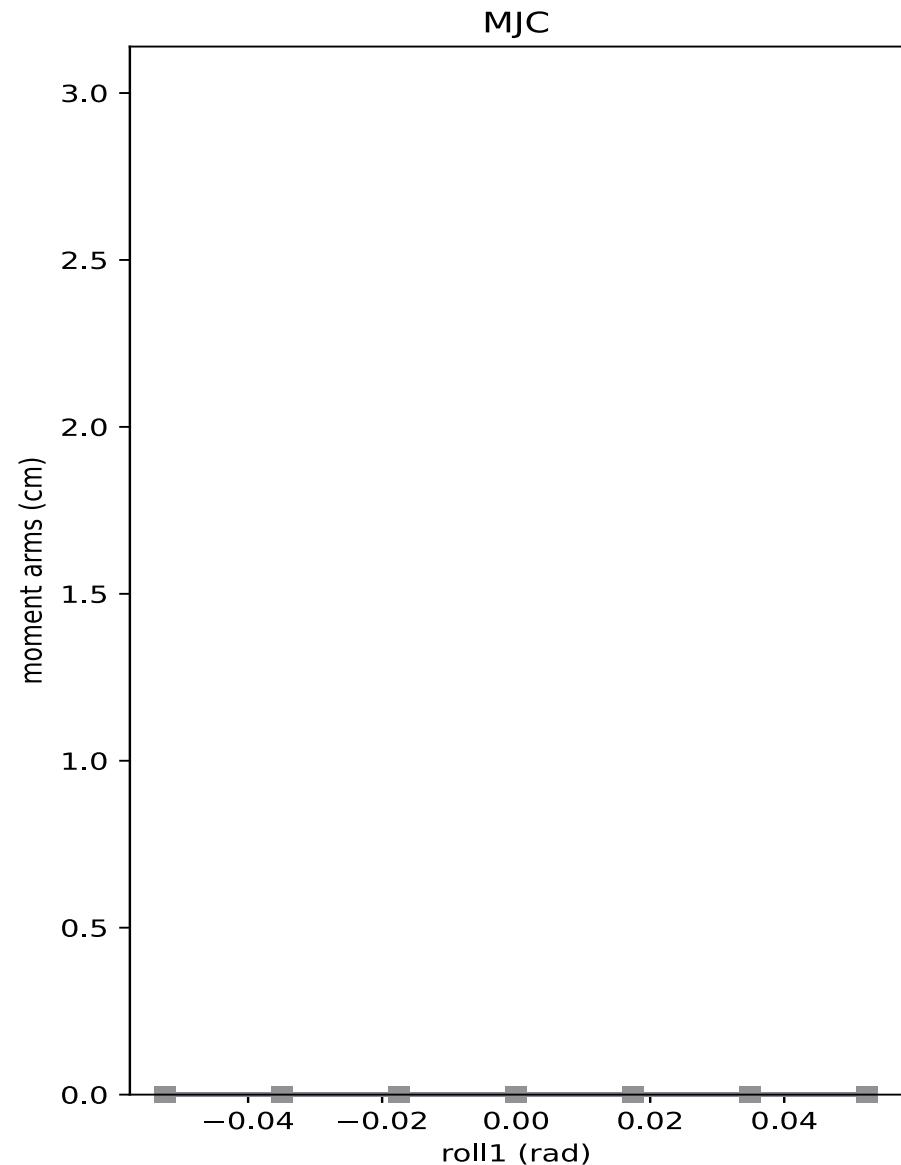
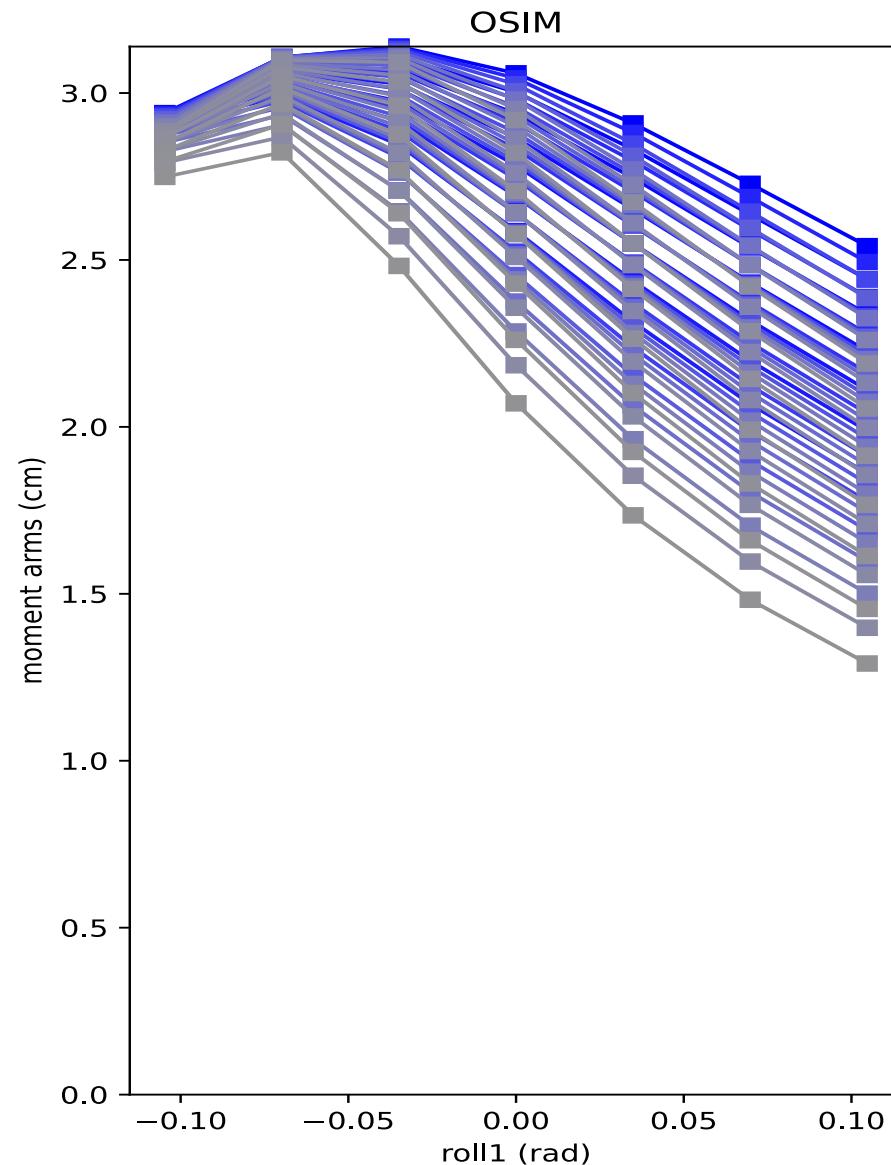
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med_L - pitch2 - roll2 - yaw2



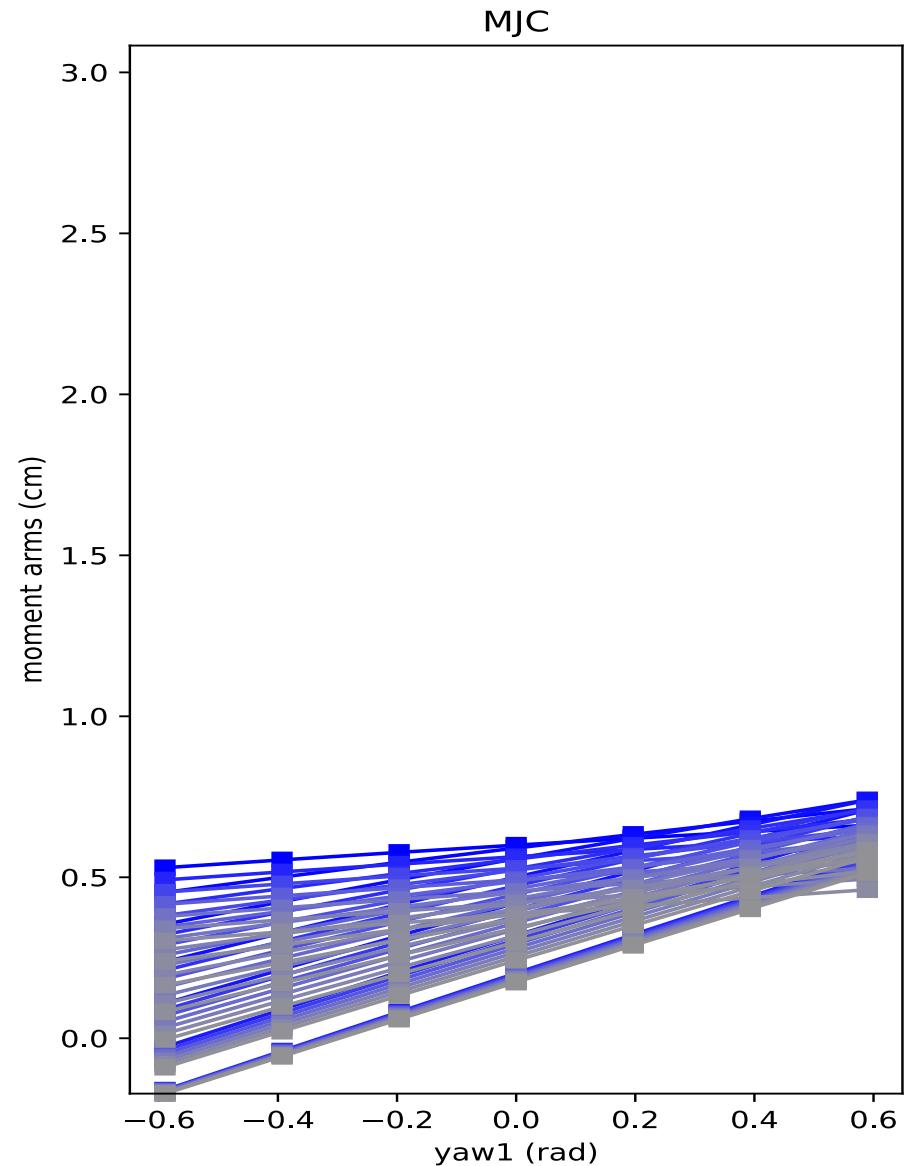
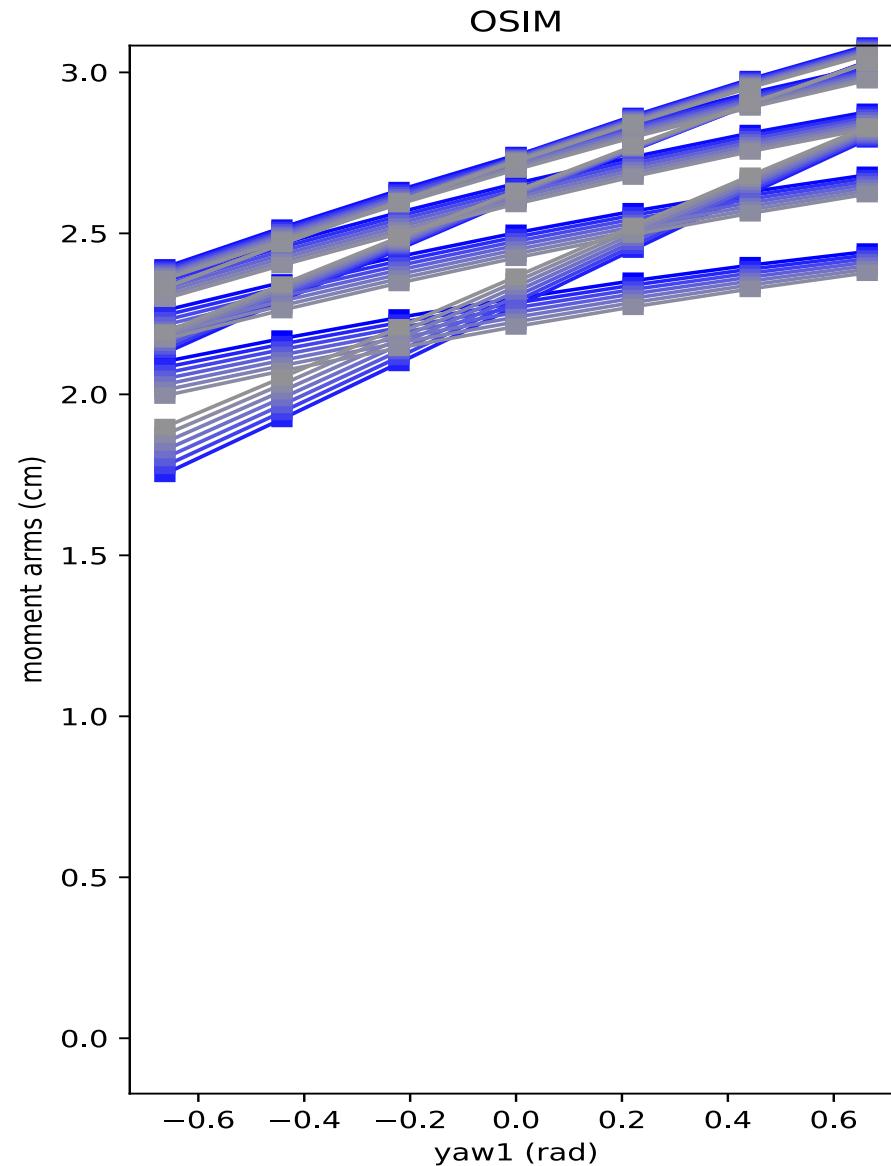
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant - pitch1 - roll1 - yaw1



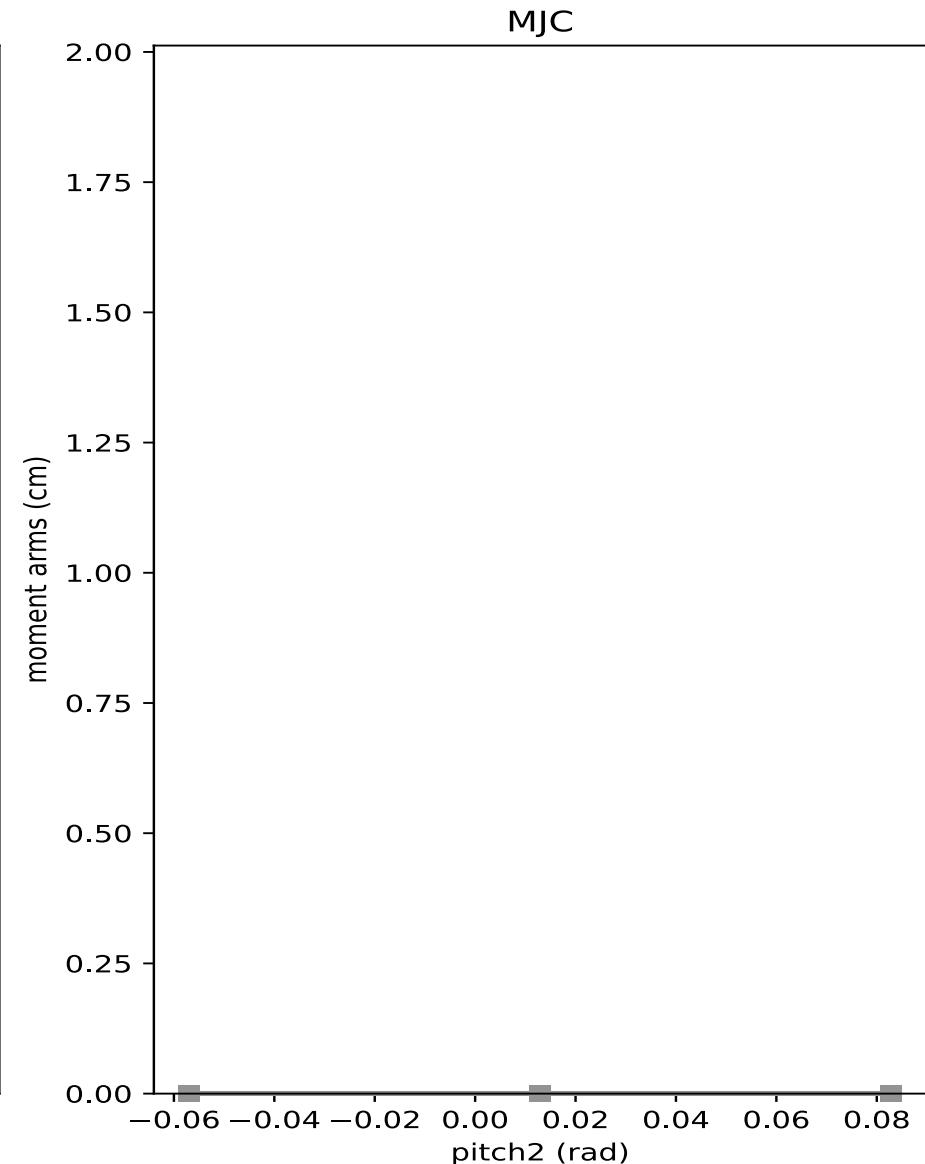
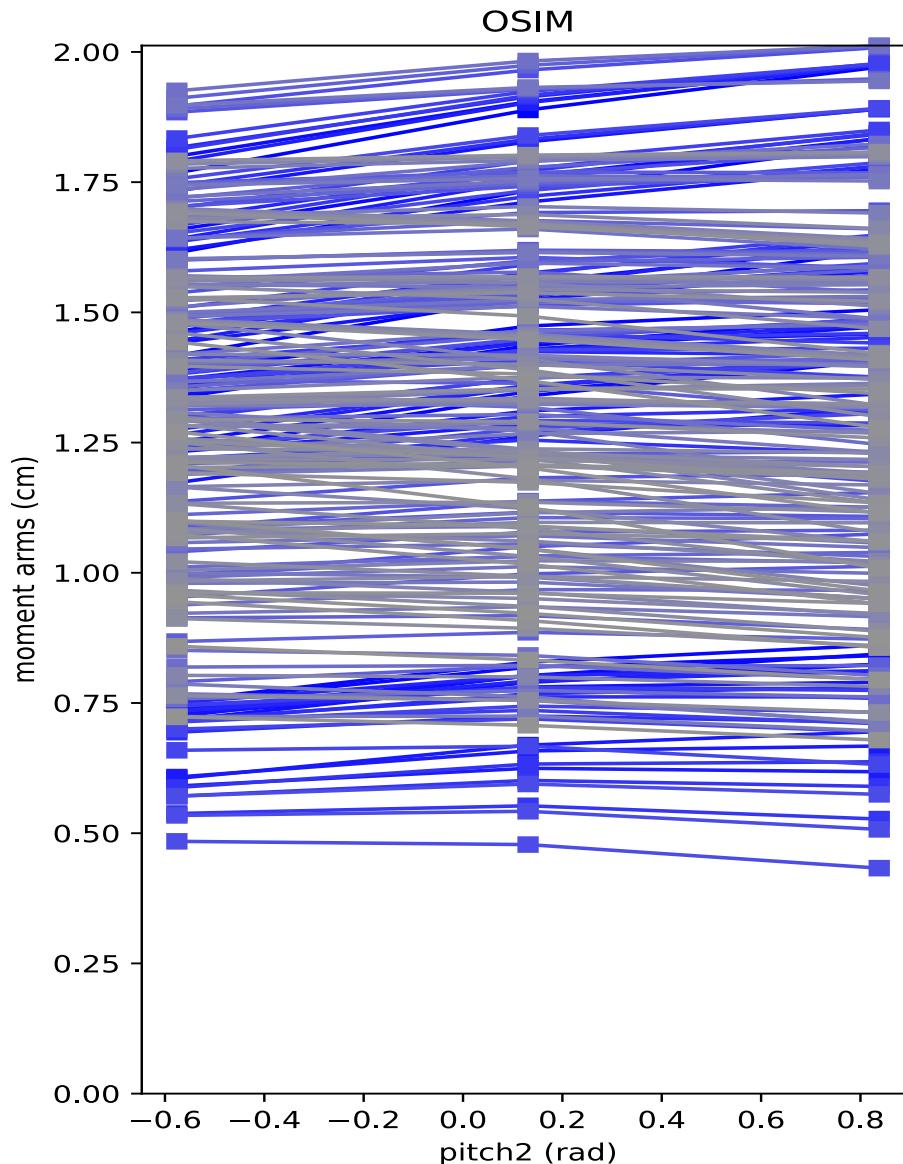
Muscle specific moment arm comparison with Osim model after optimization

obi_cap_inf_L - pitch1 - roll1 - yaw1



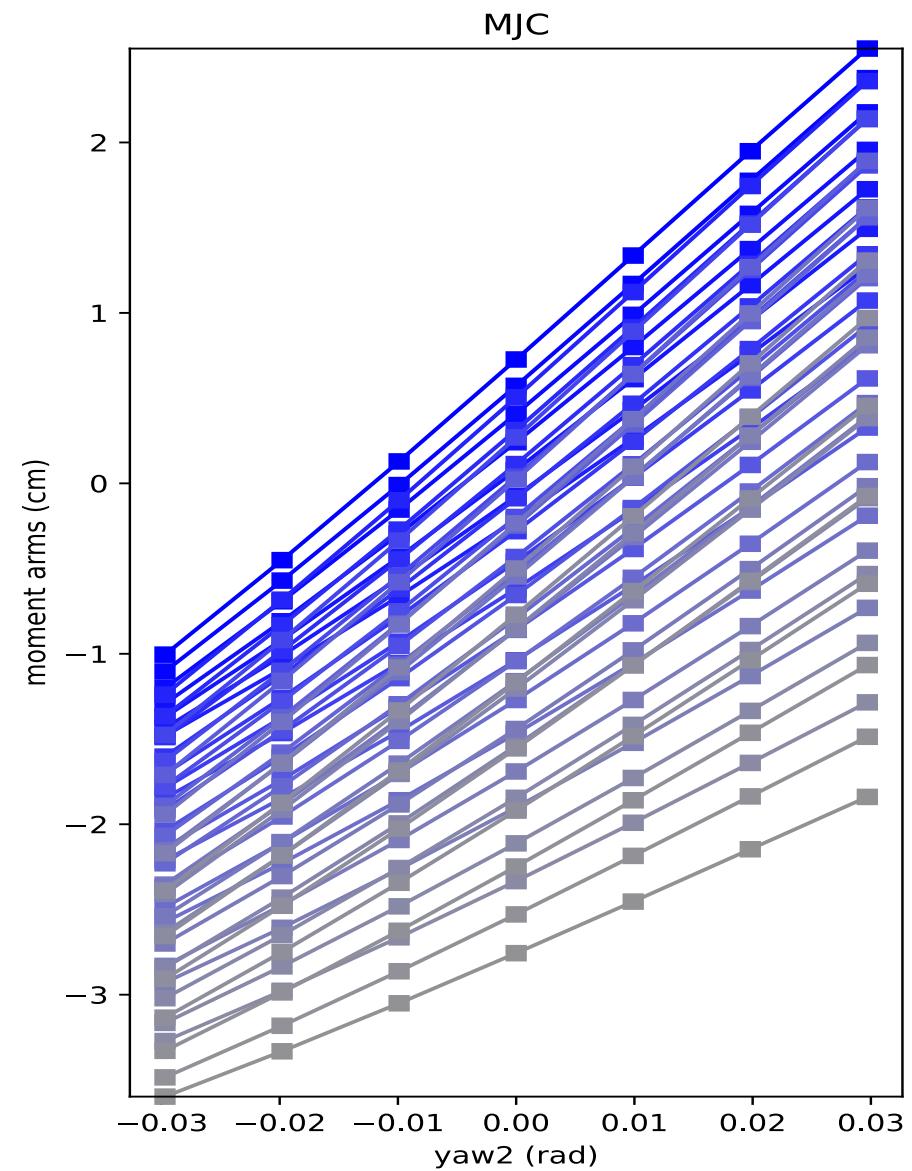
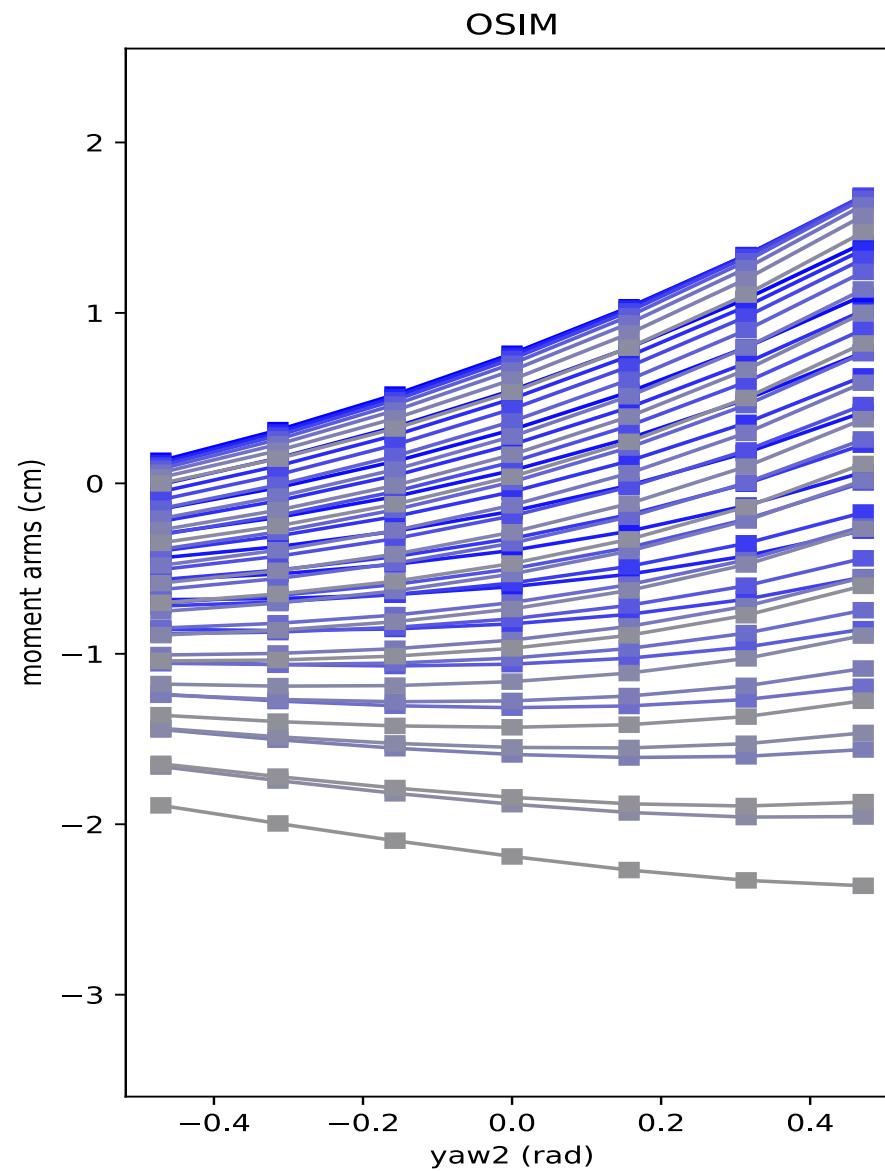
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



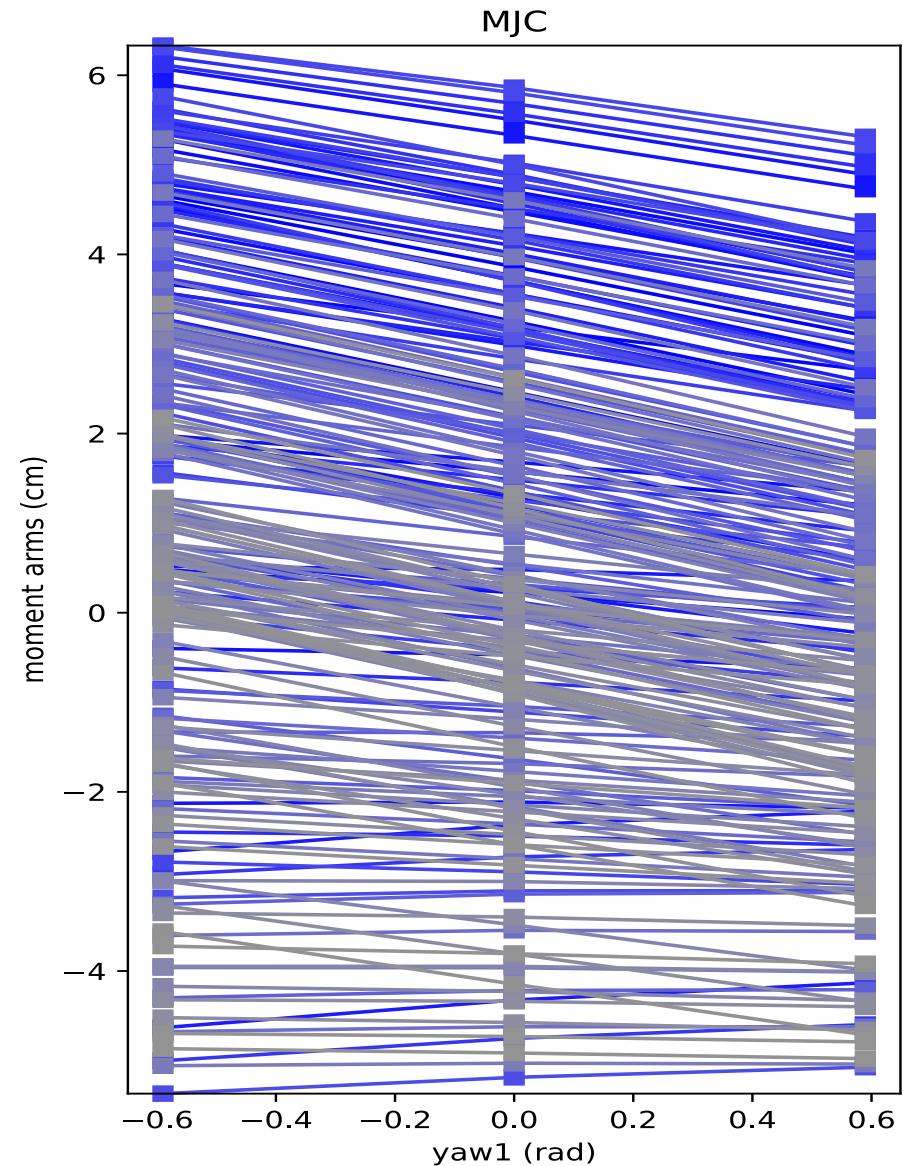
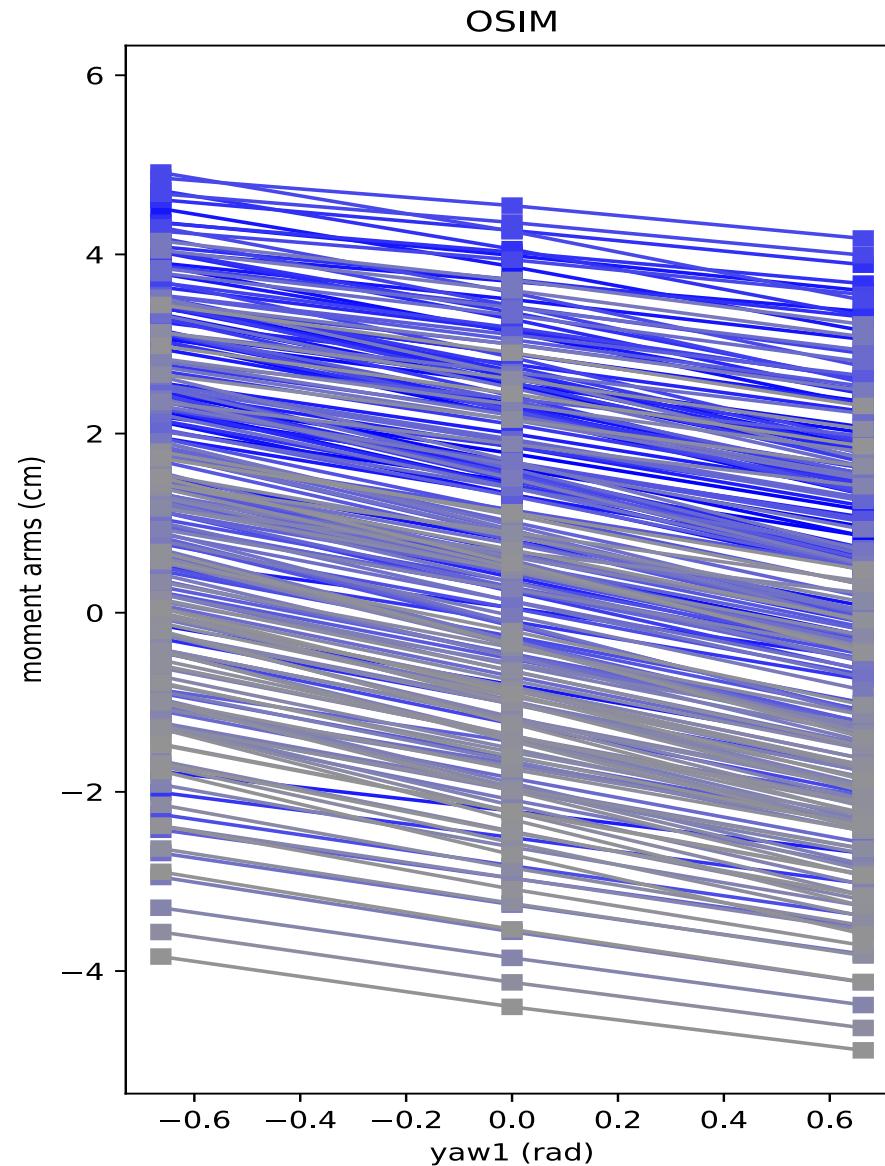
Muscle specific moment arm comparison with Osim model after optimization

Ilevator_scap - pitch2 - roll2 - yaw2



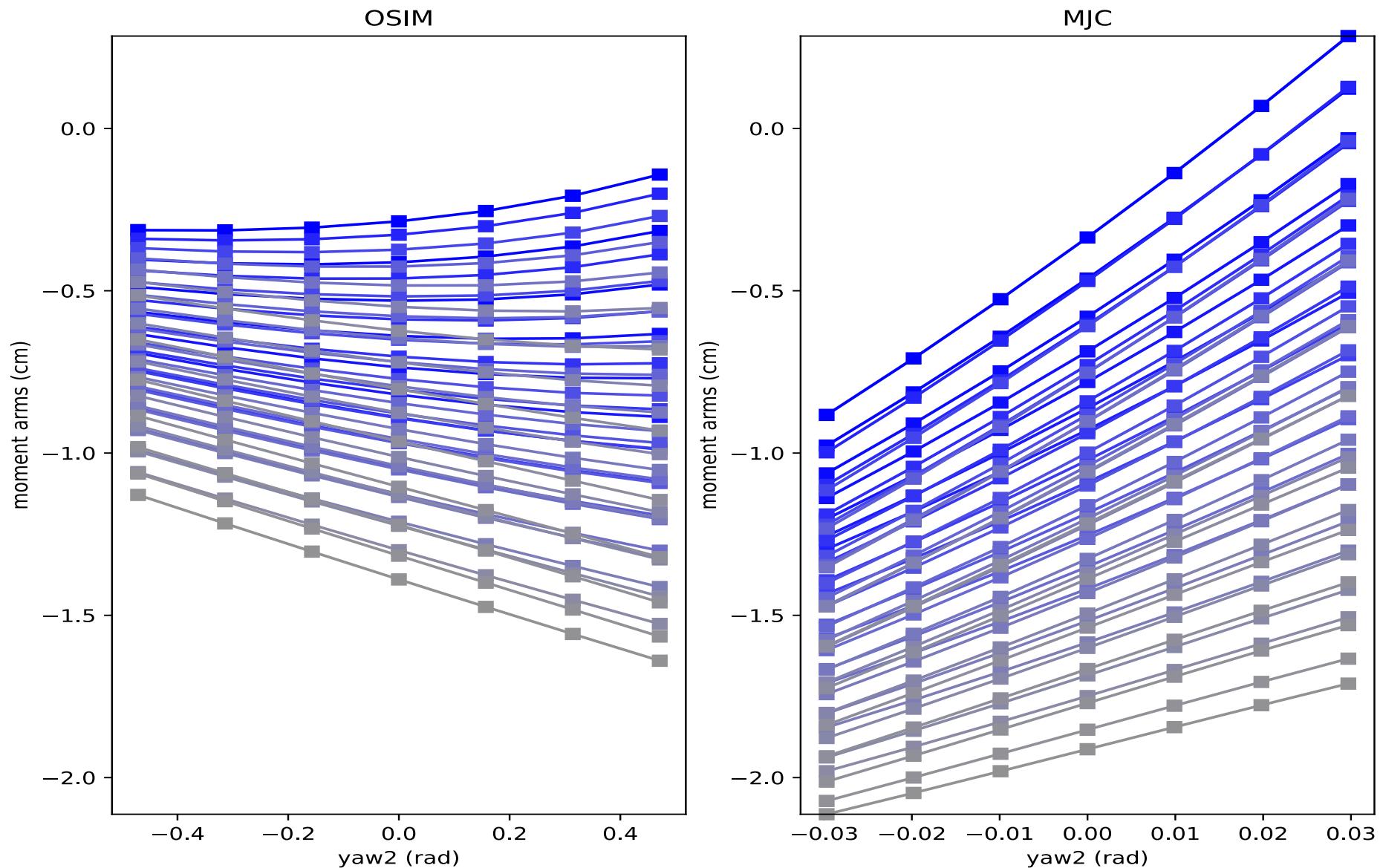
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



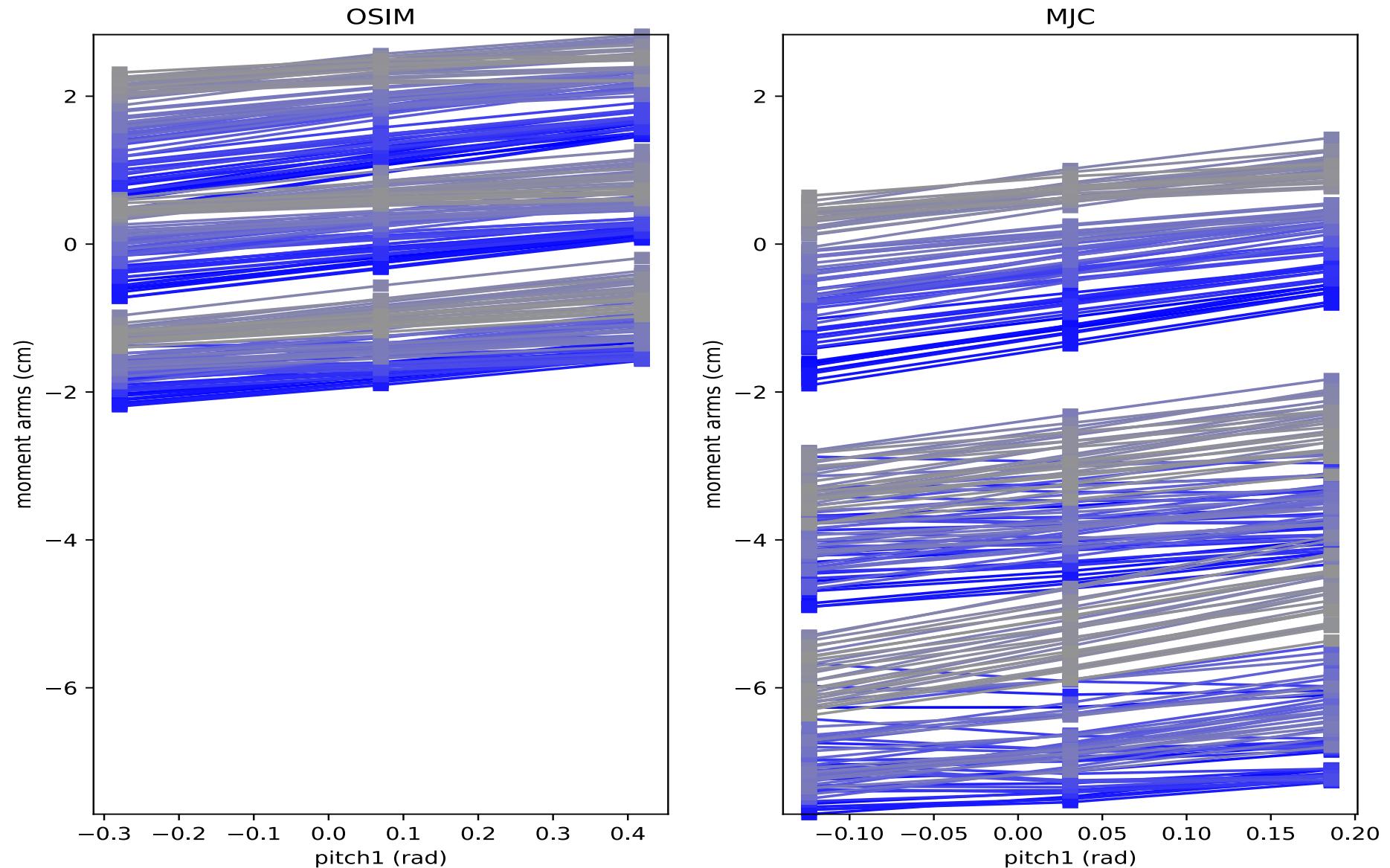
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx - pitch2 - roll2 - yaw2



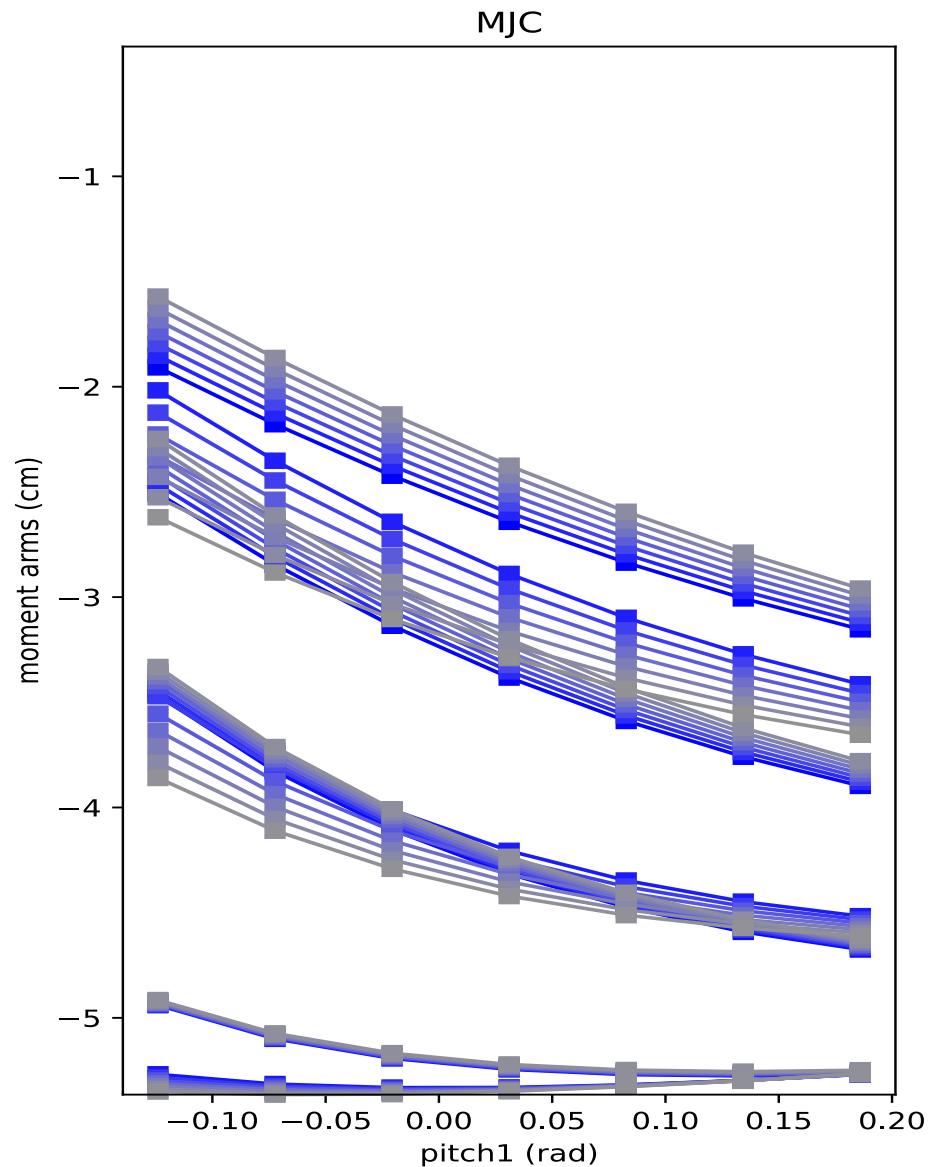
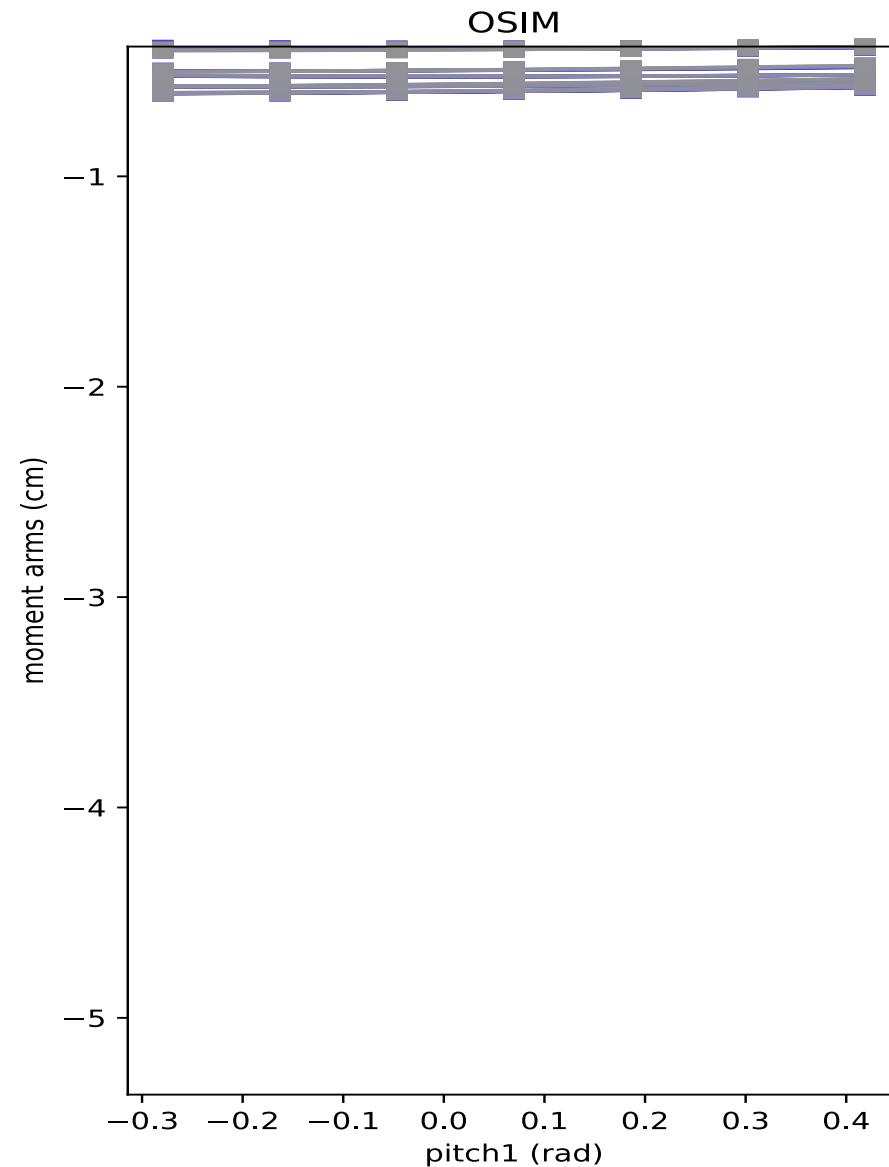
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



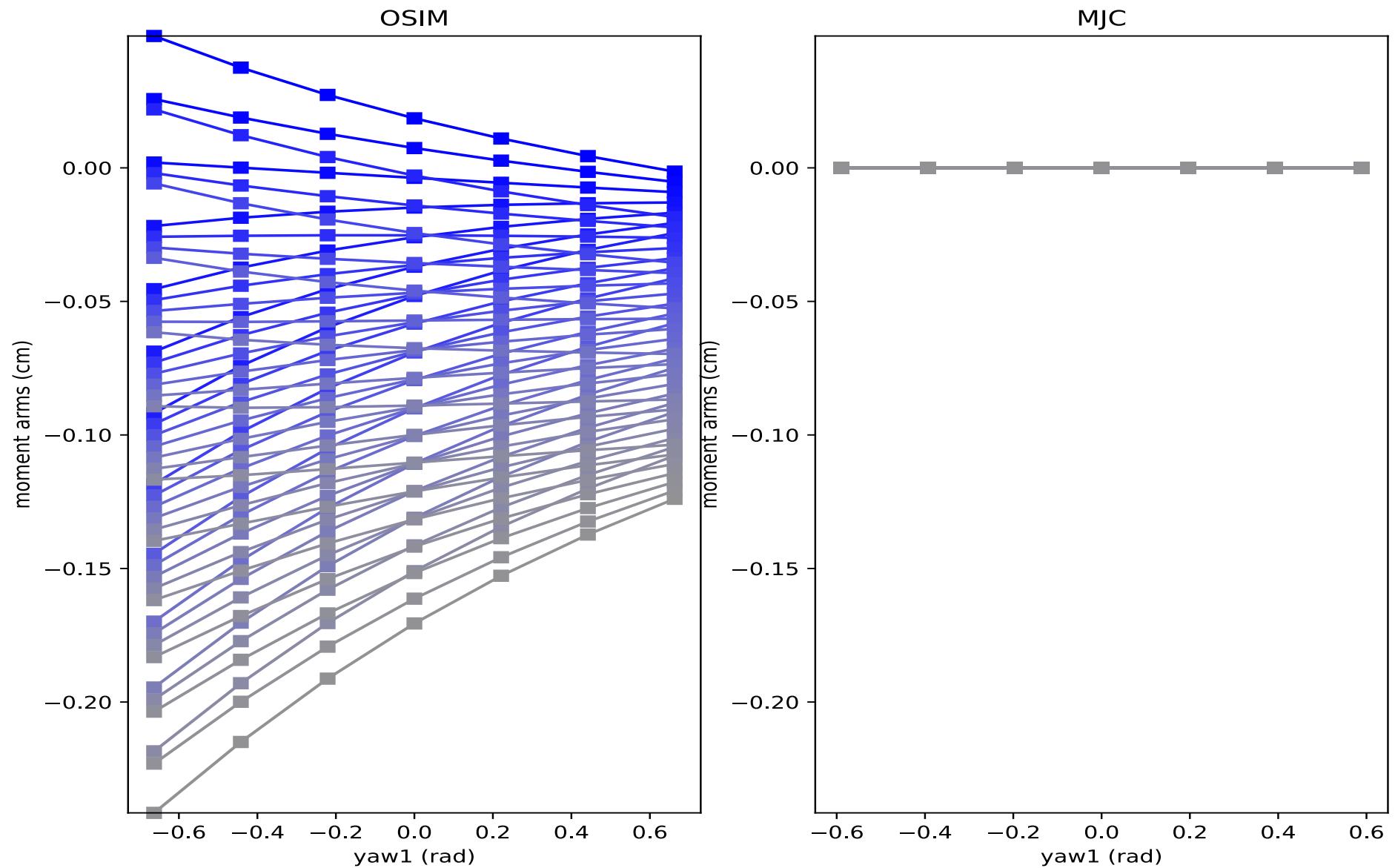
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch1 - roll1 - yaw1



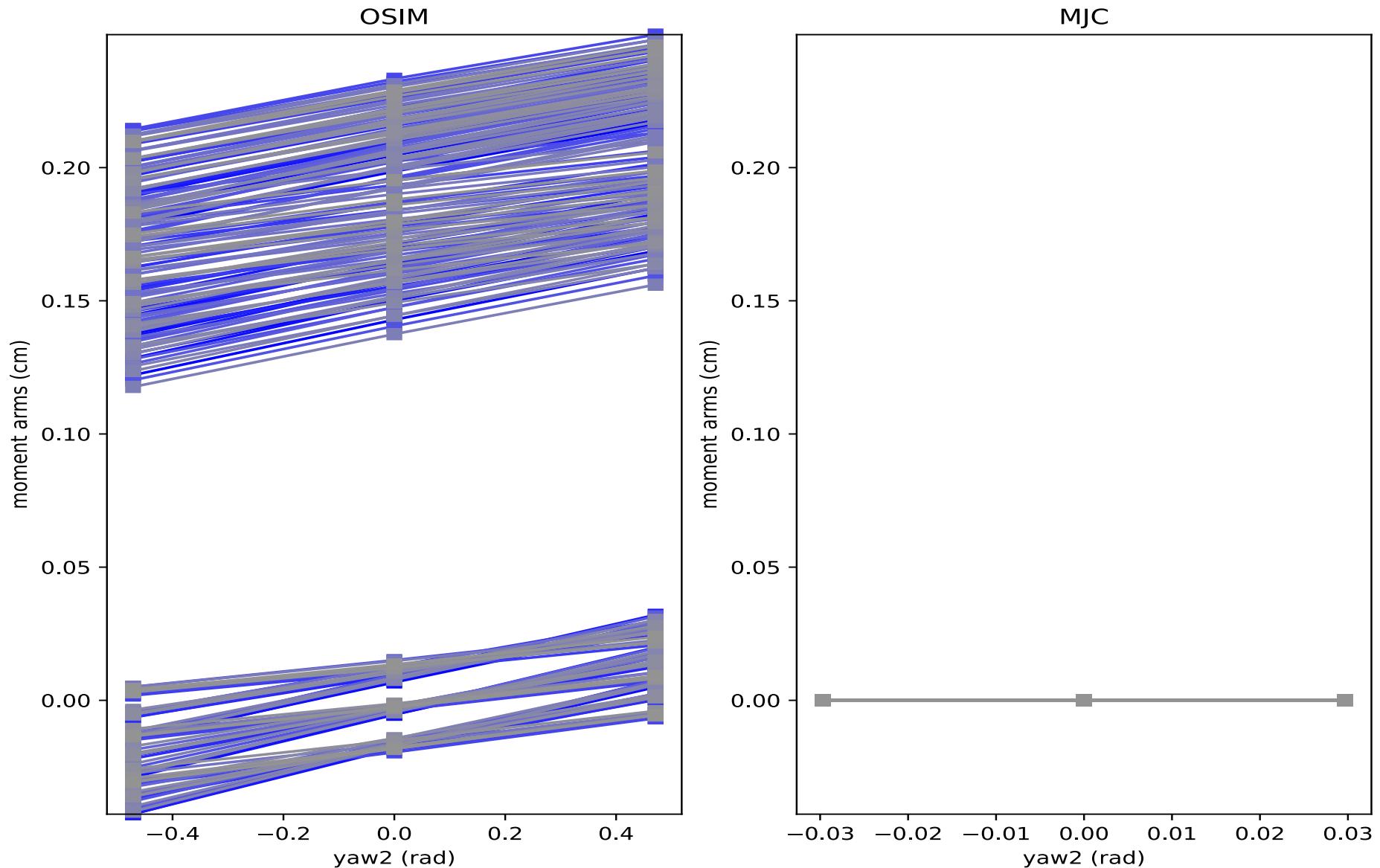
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid - pitch1 - roll1 - yaw1



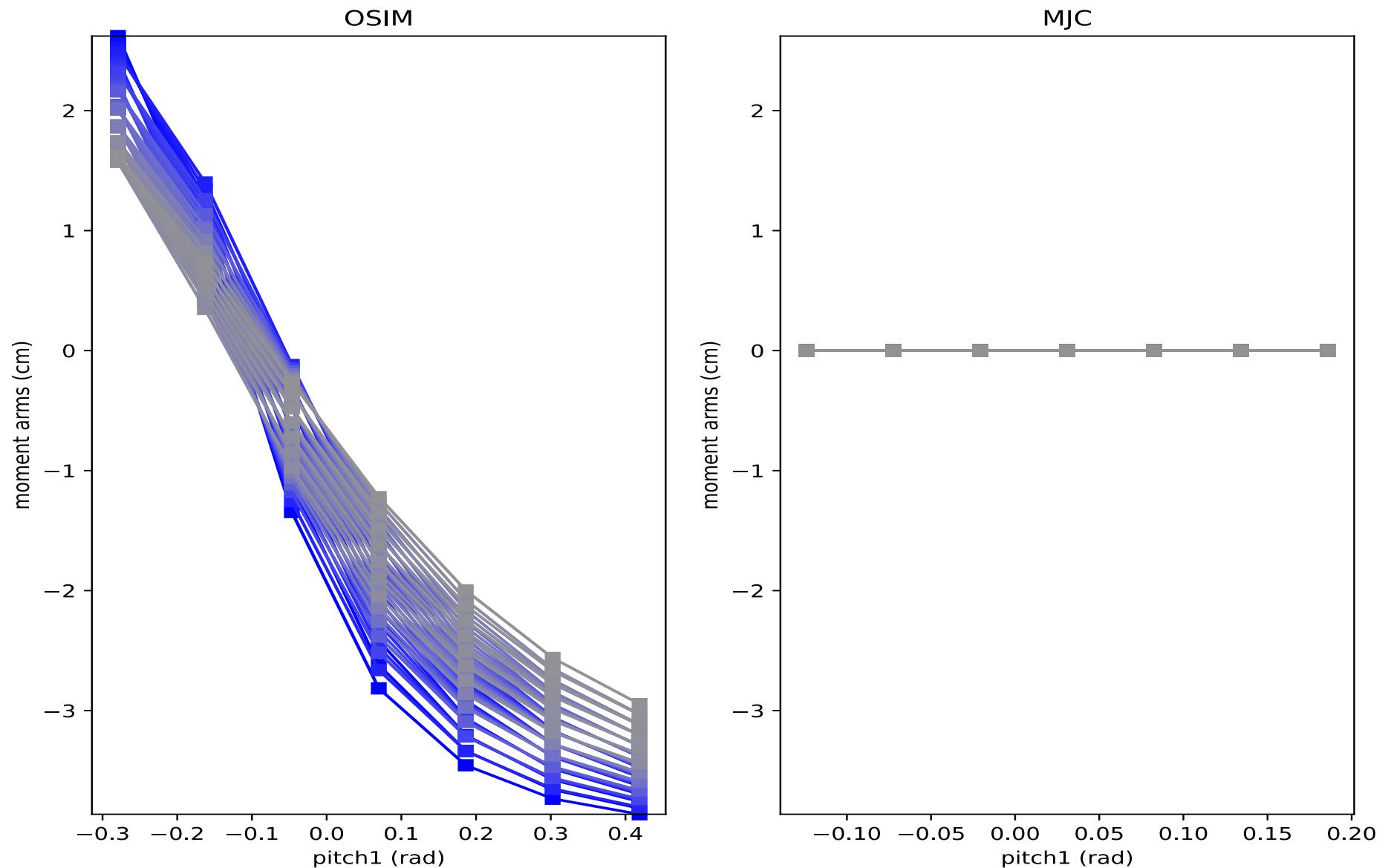
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



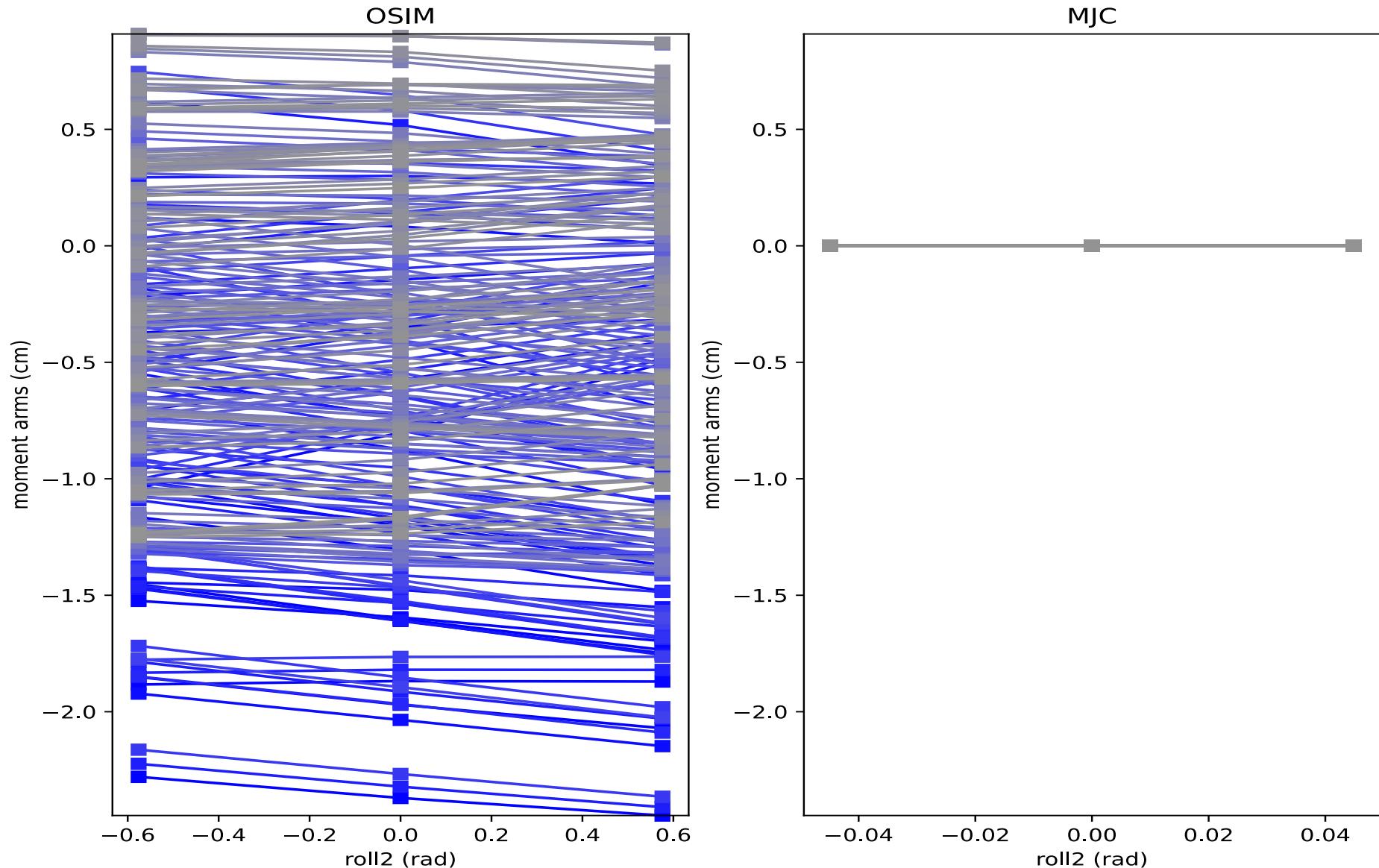
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant_L - pitch1 - roll1 - yaw1



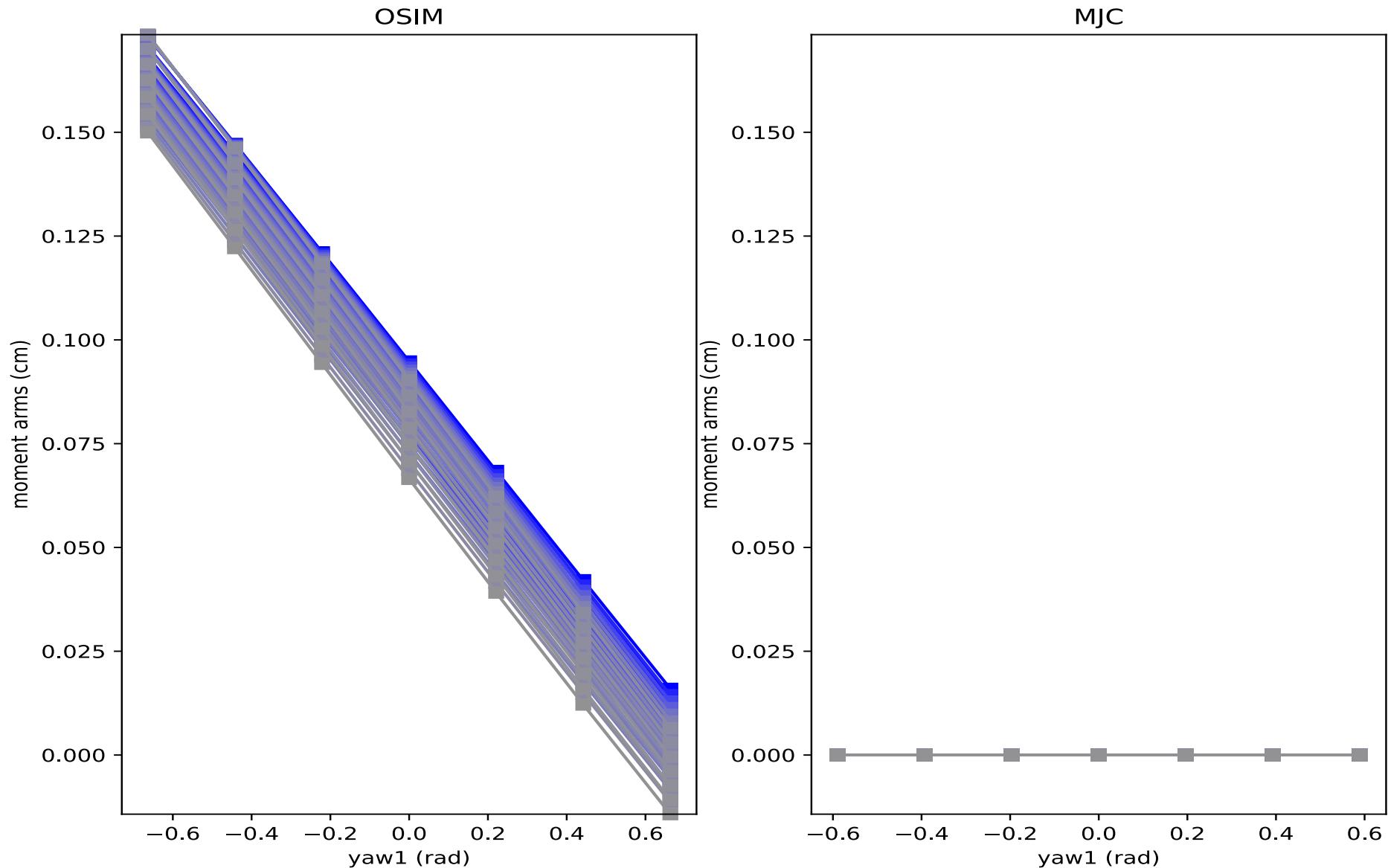
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



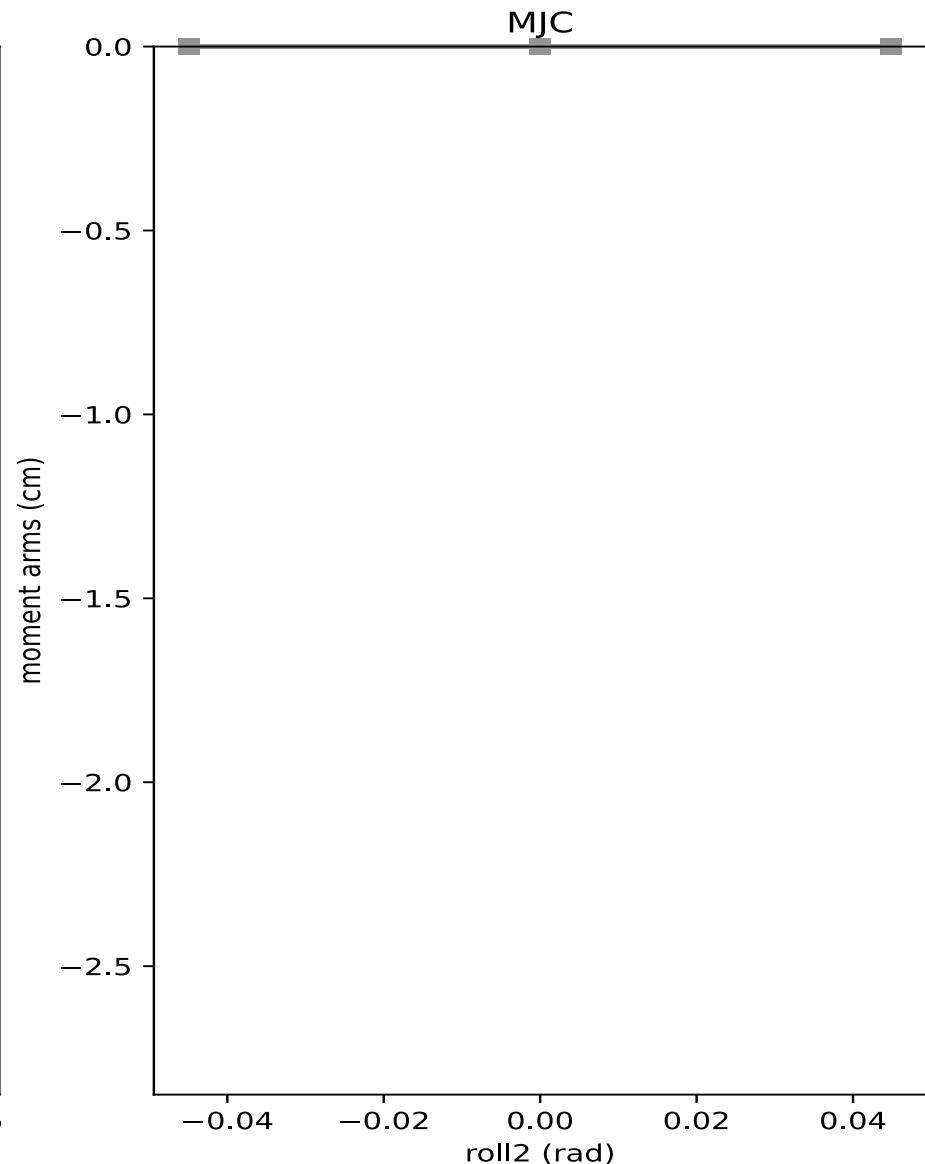
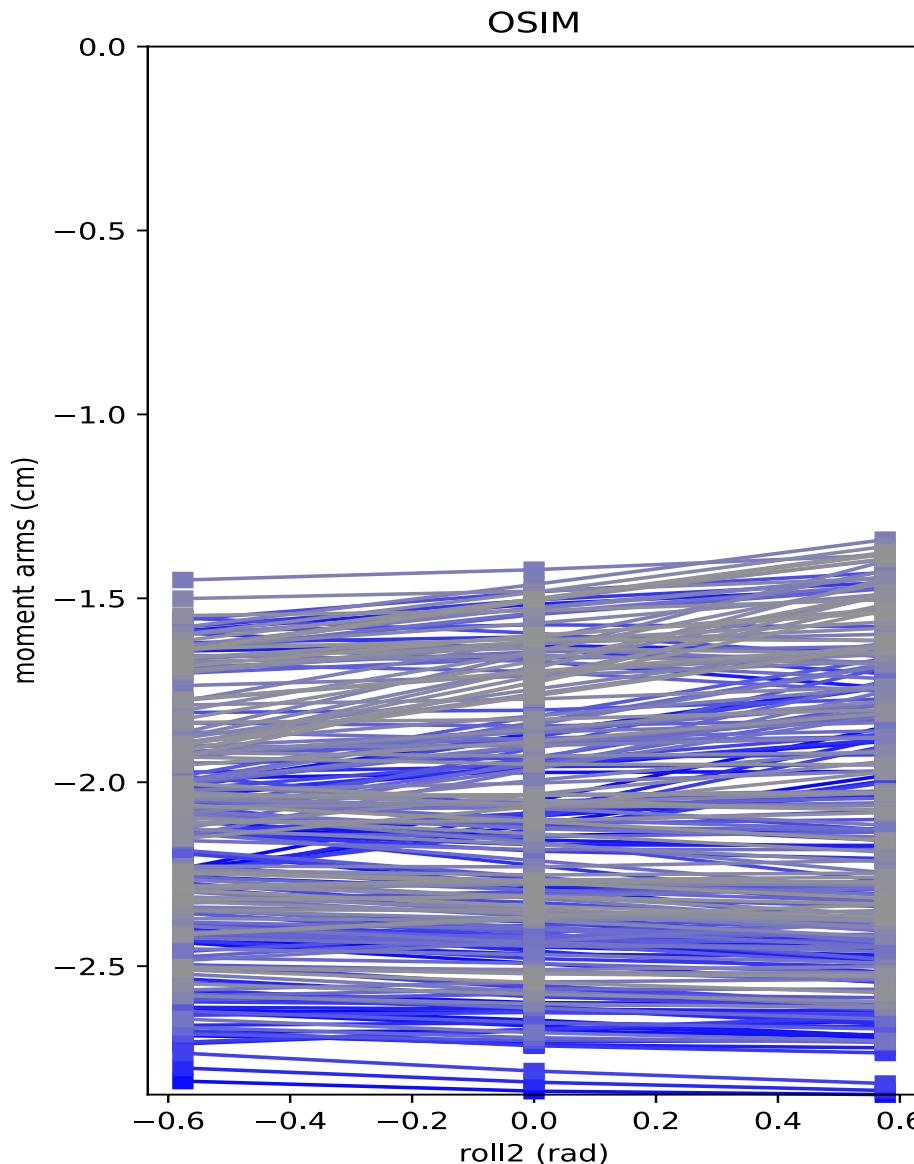
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med - pitch1 - roll1 - yaw1



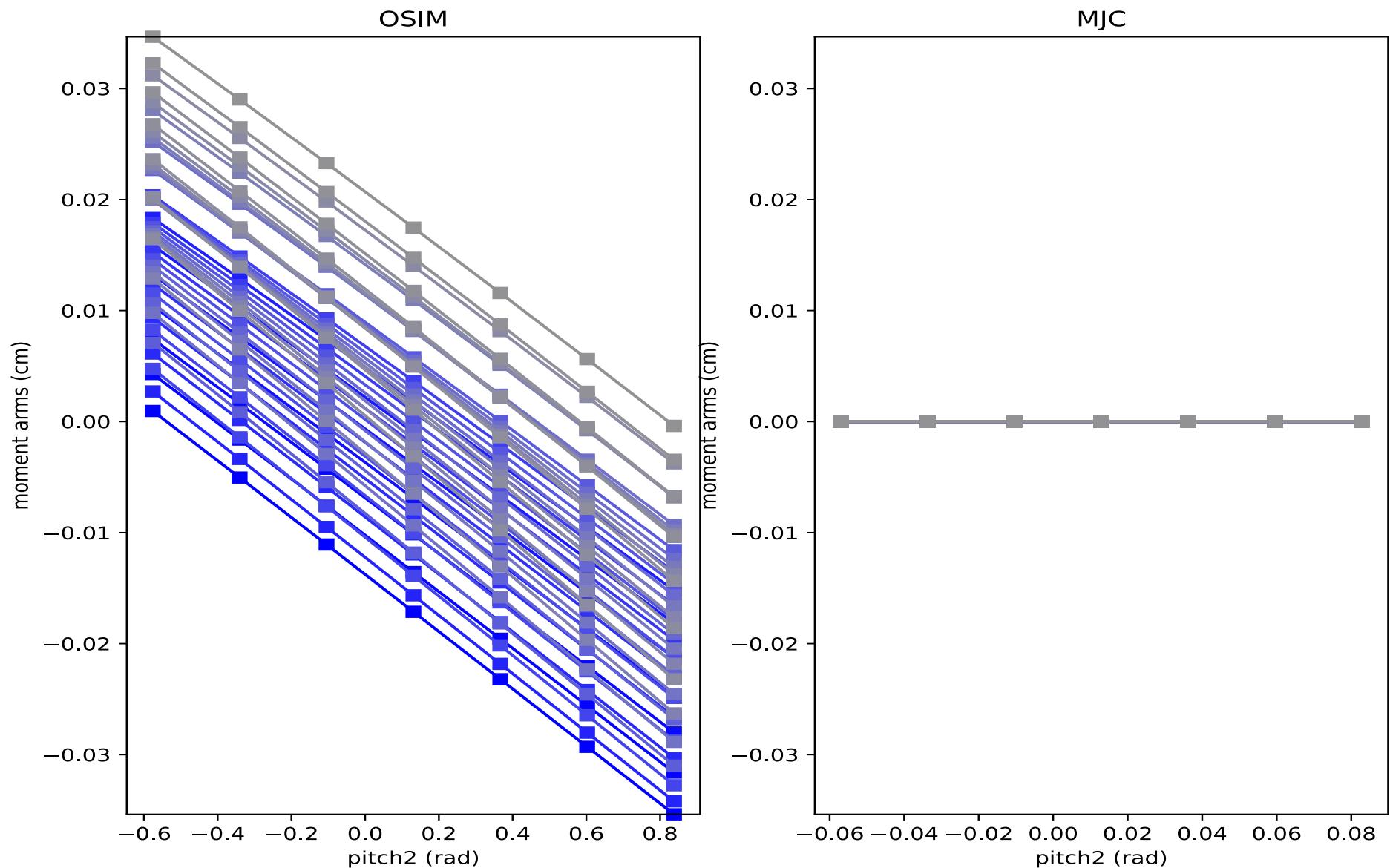
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



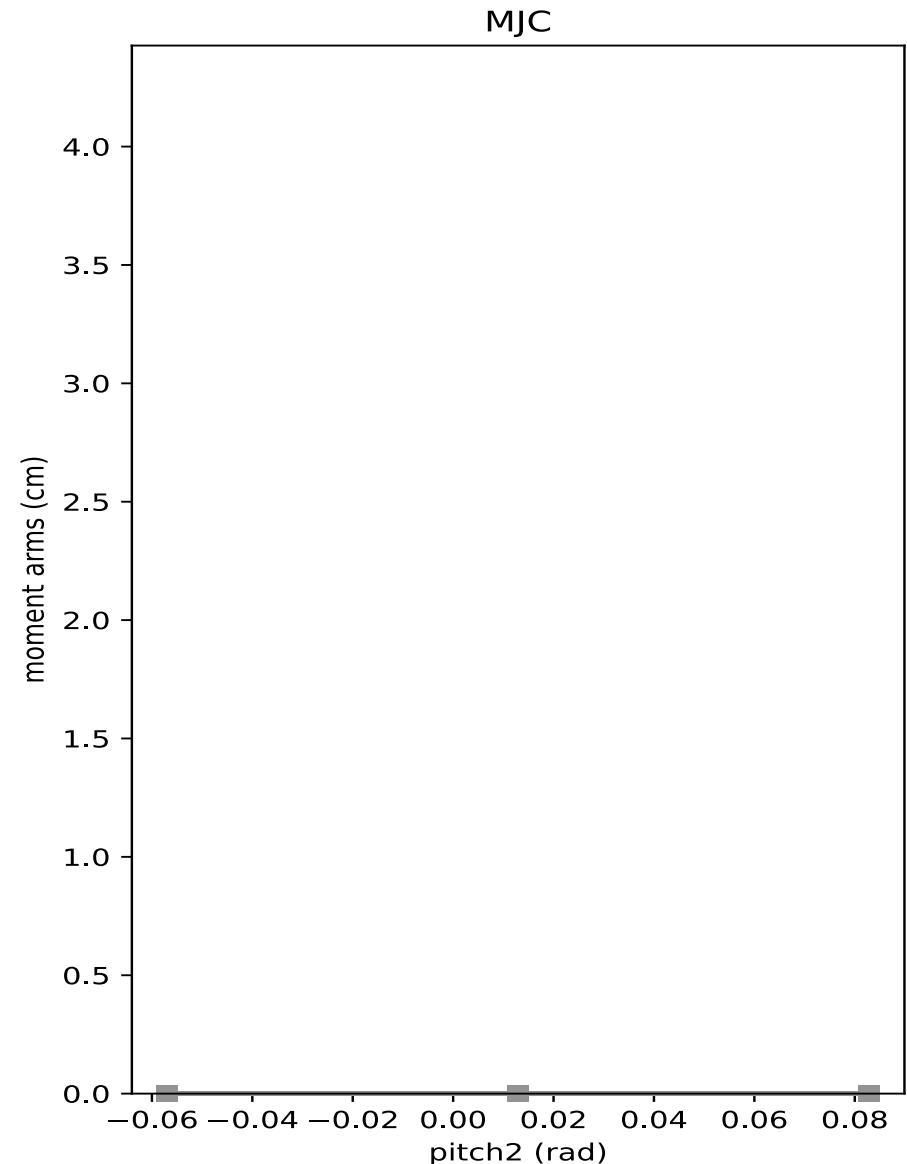
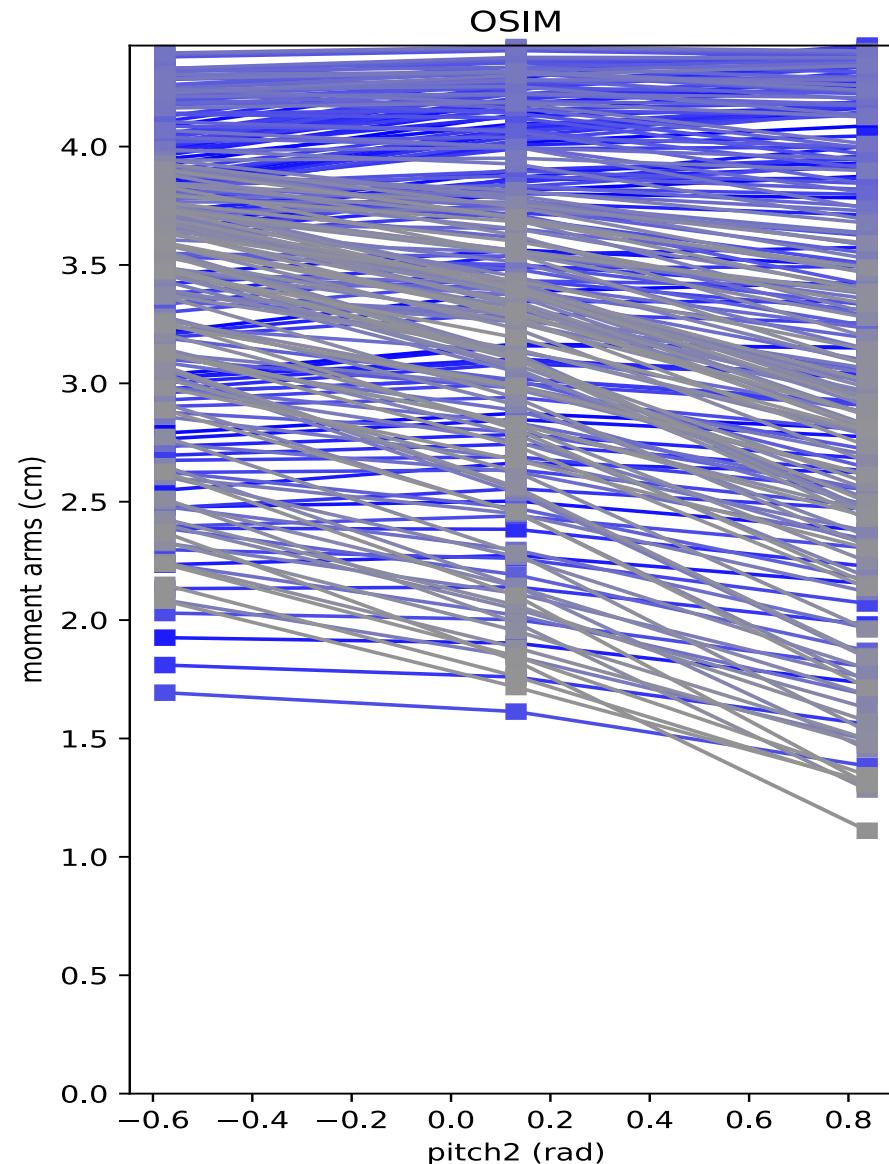
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch2 - roll2 - yaw2



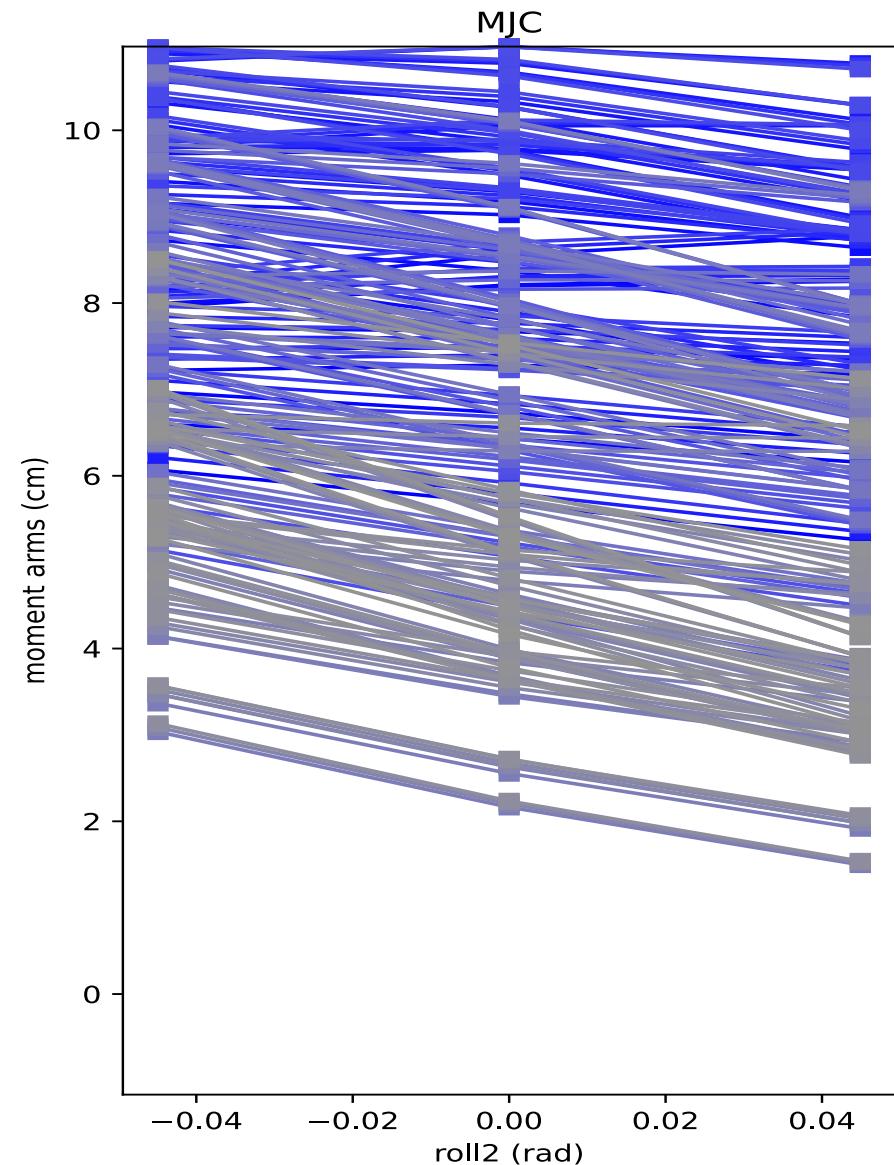
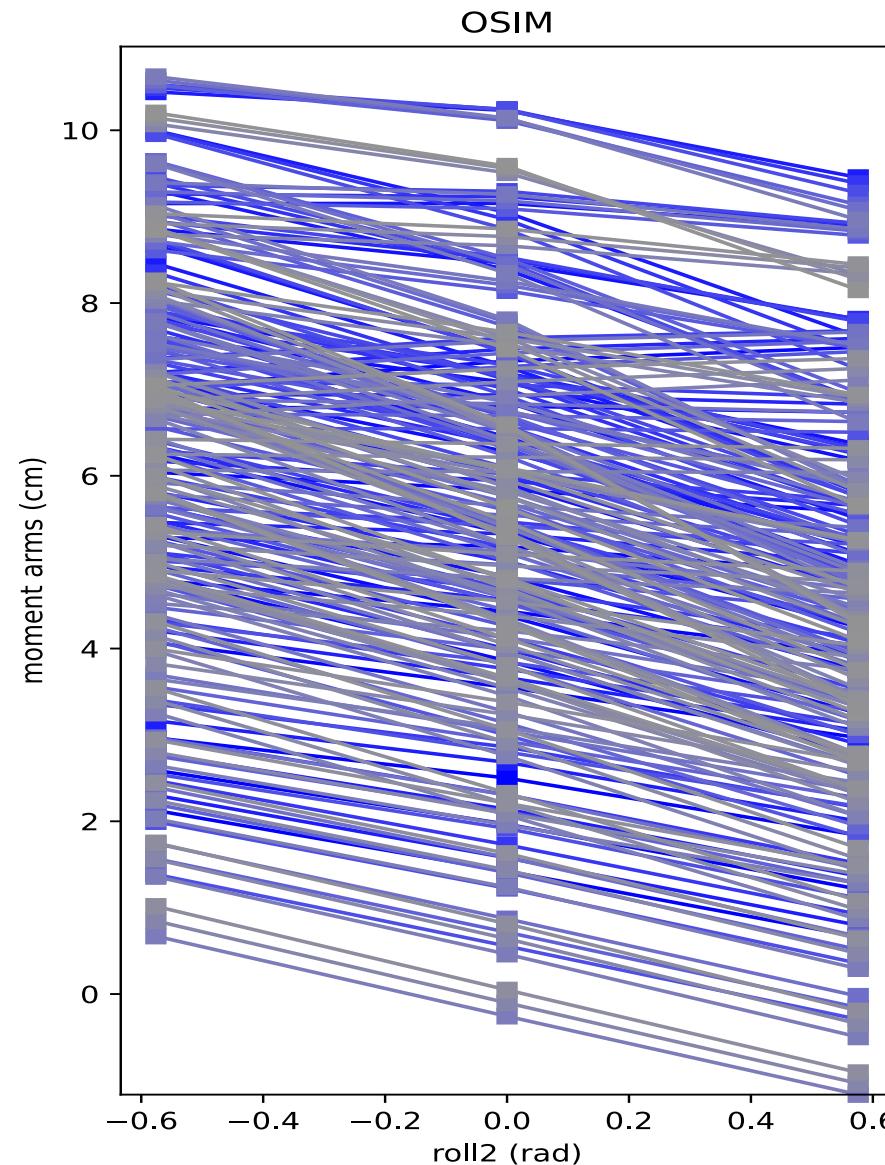
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



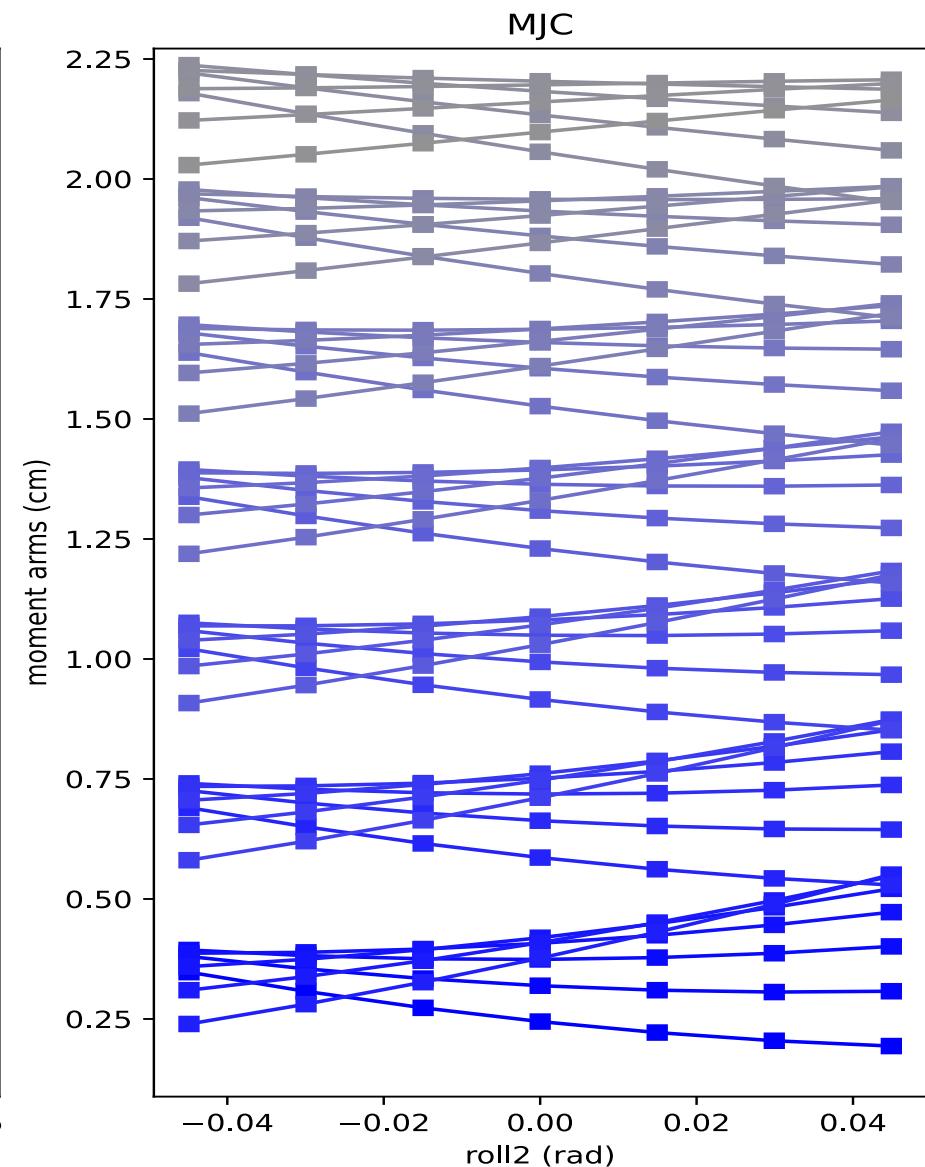
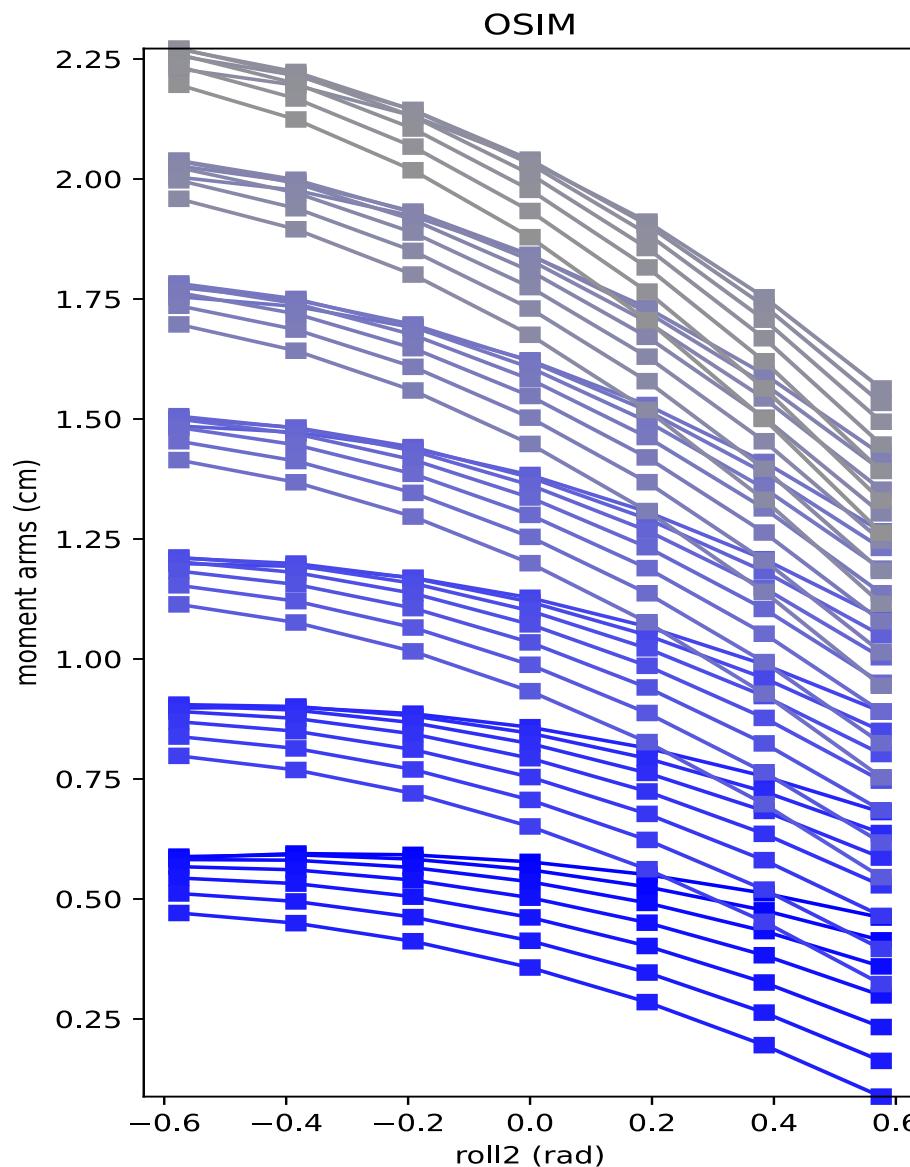
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



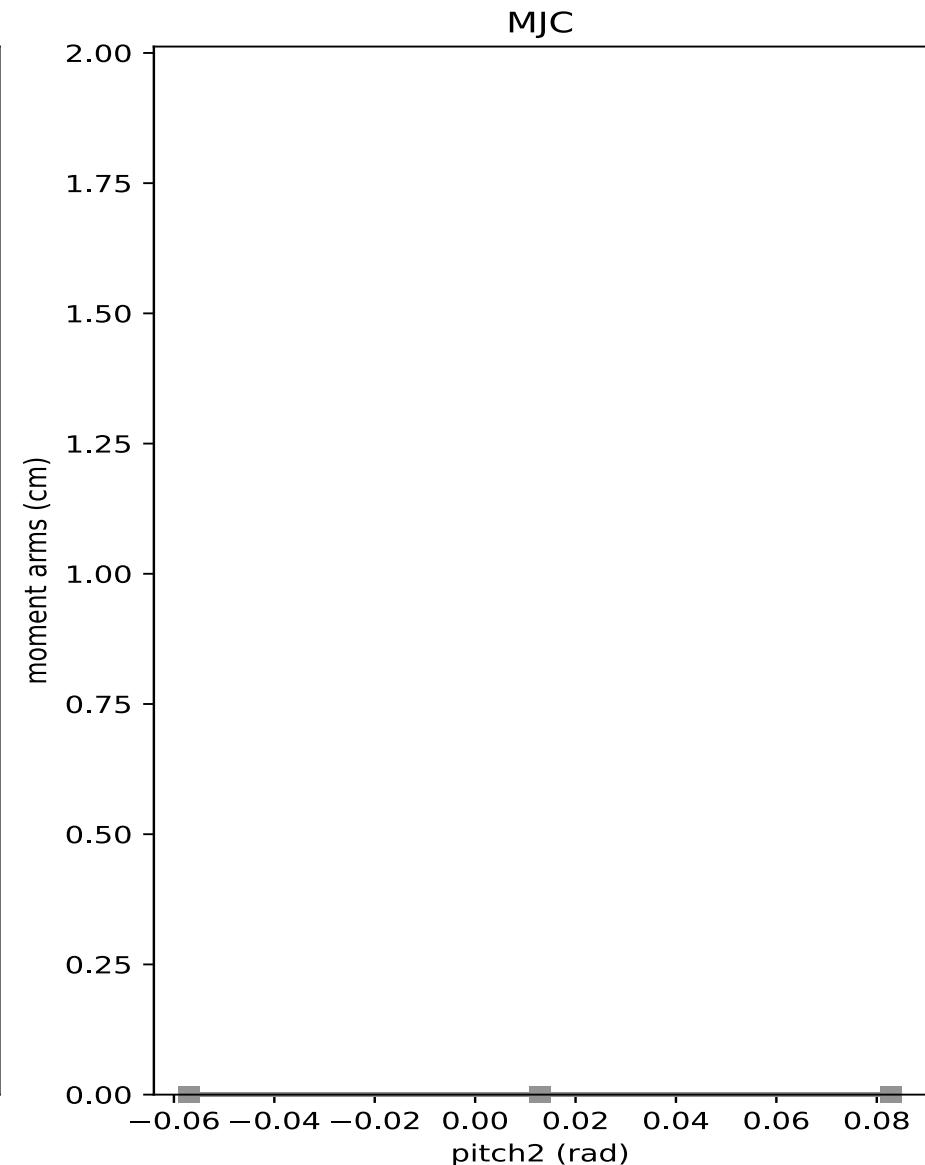
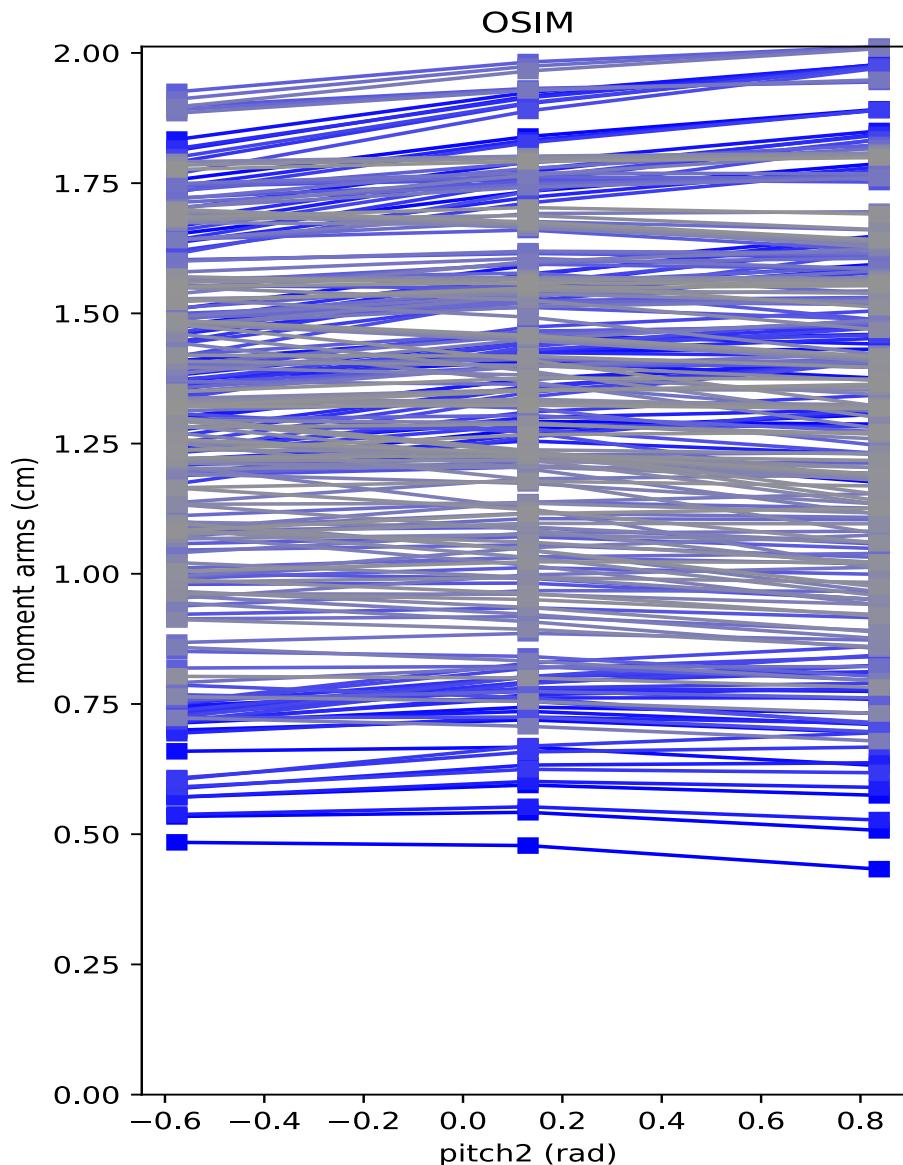
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx - pitch2 - roll2 - yaw2



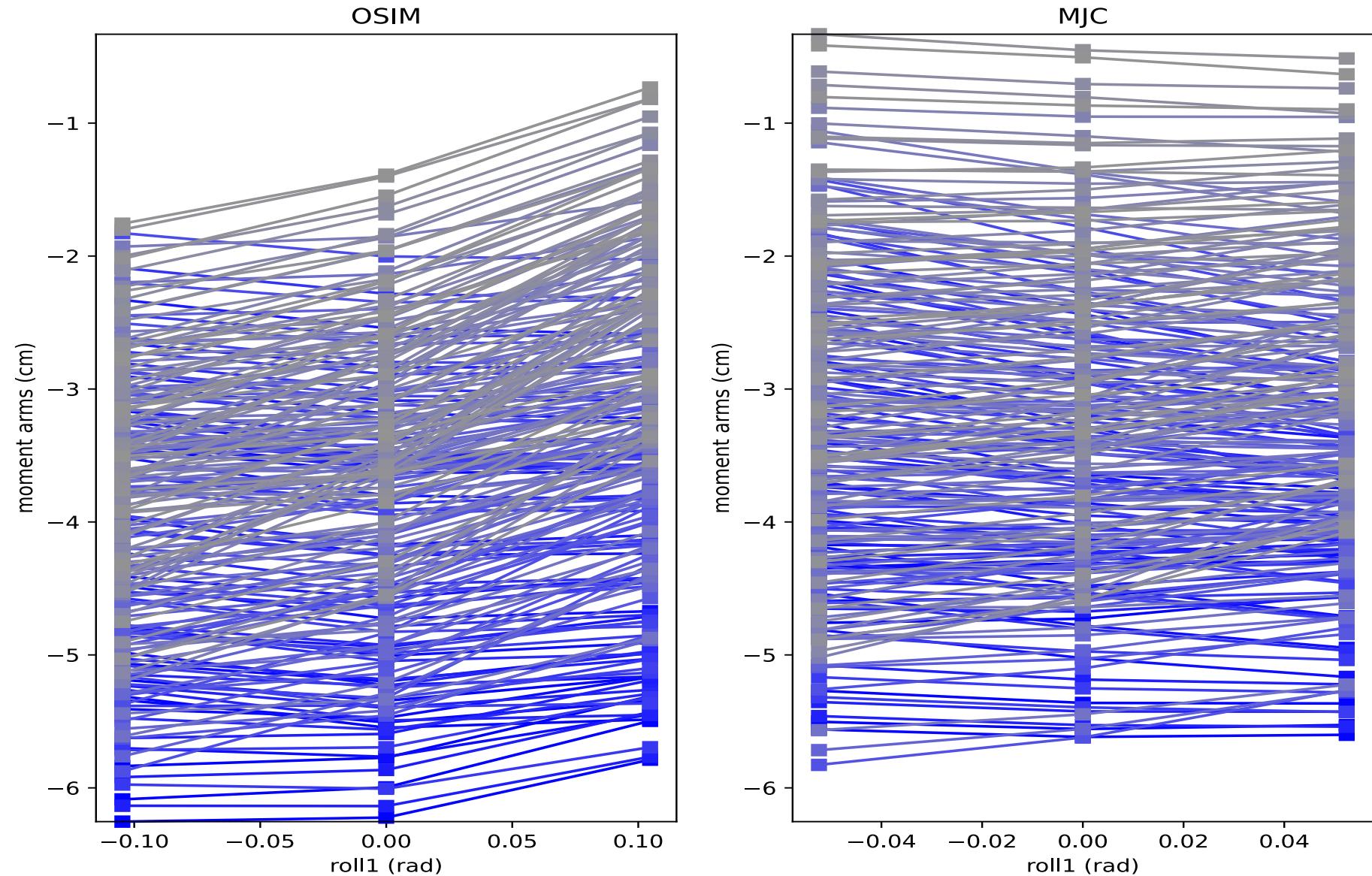
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



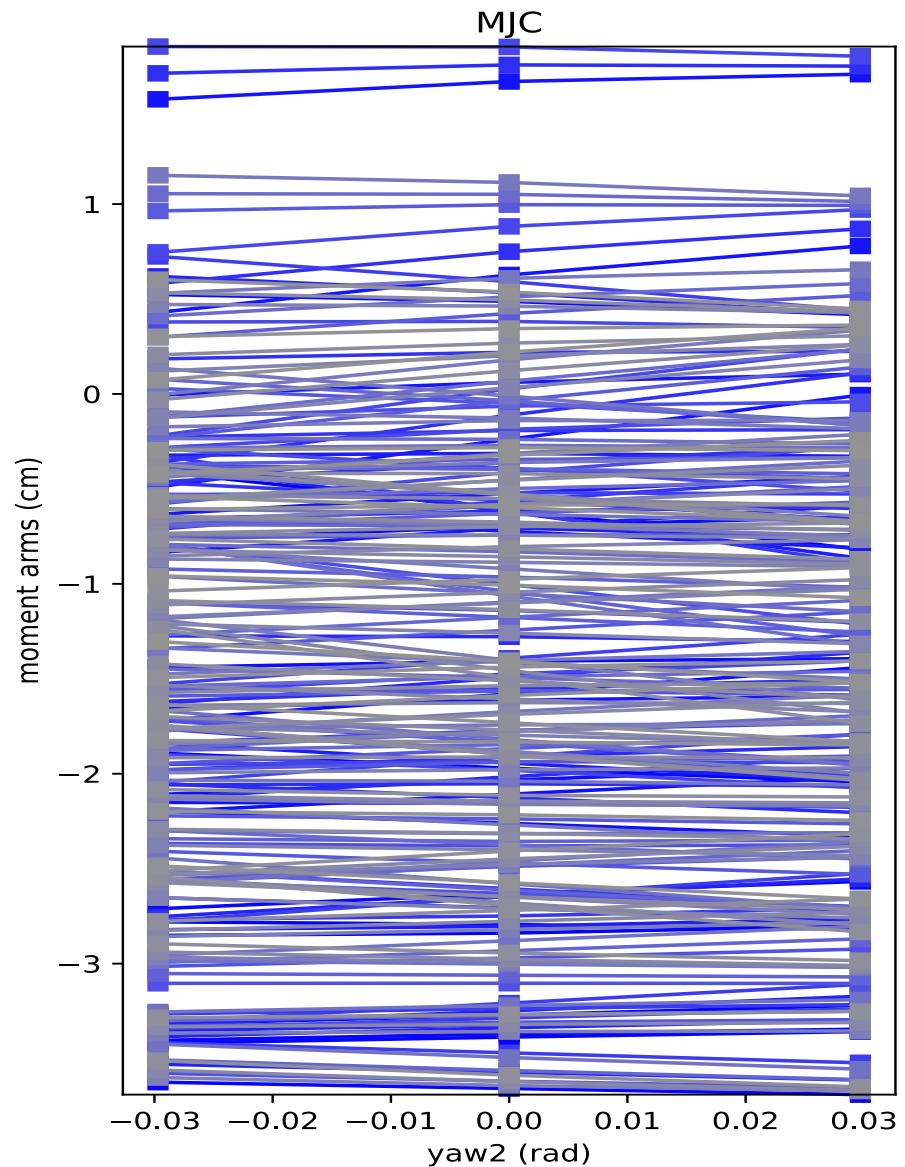
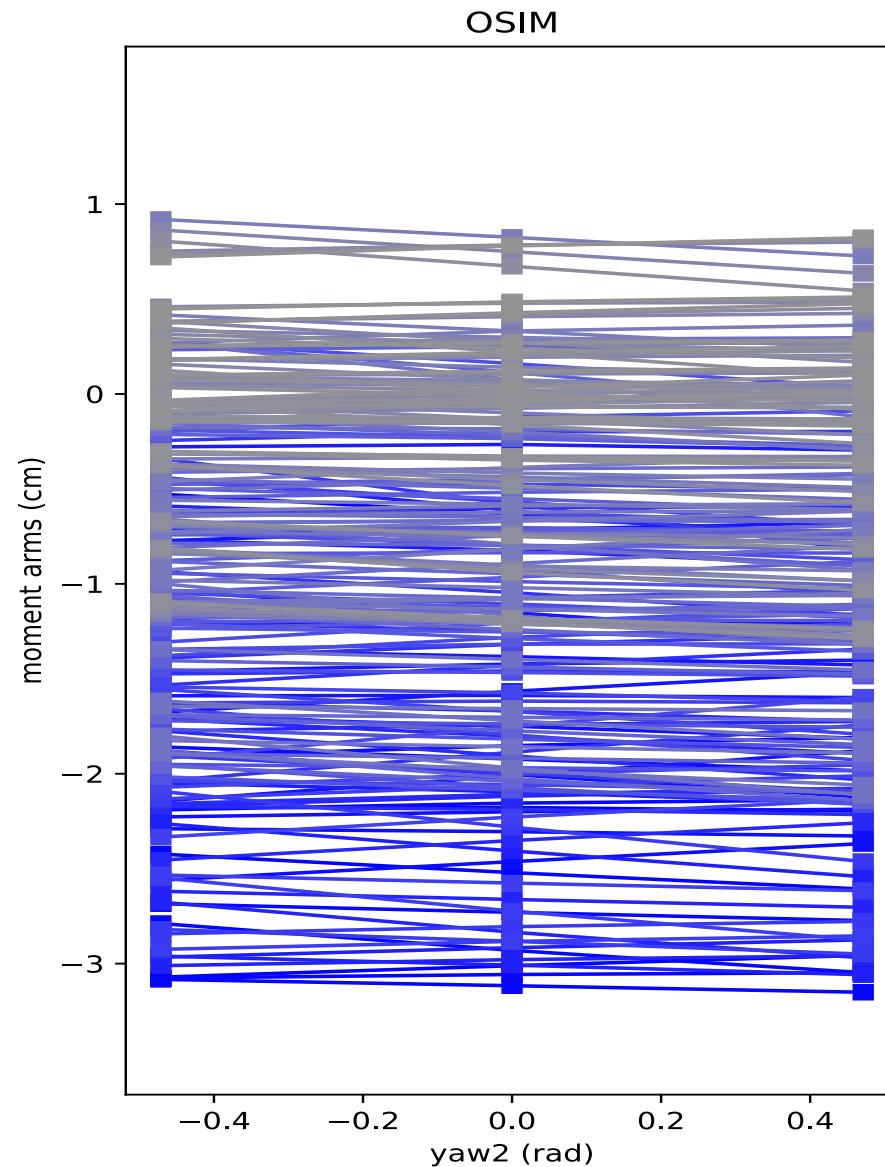
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



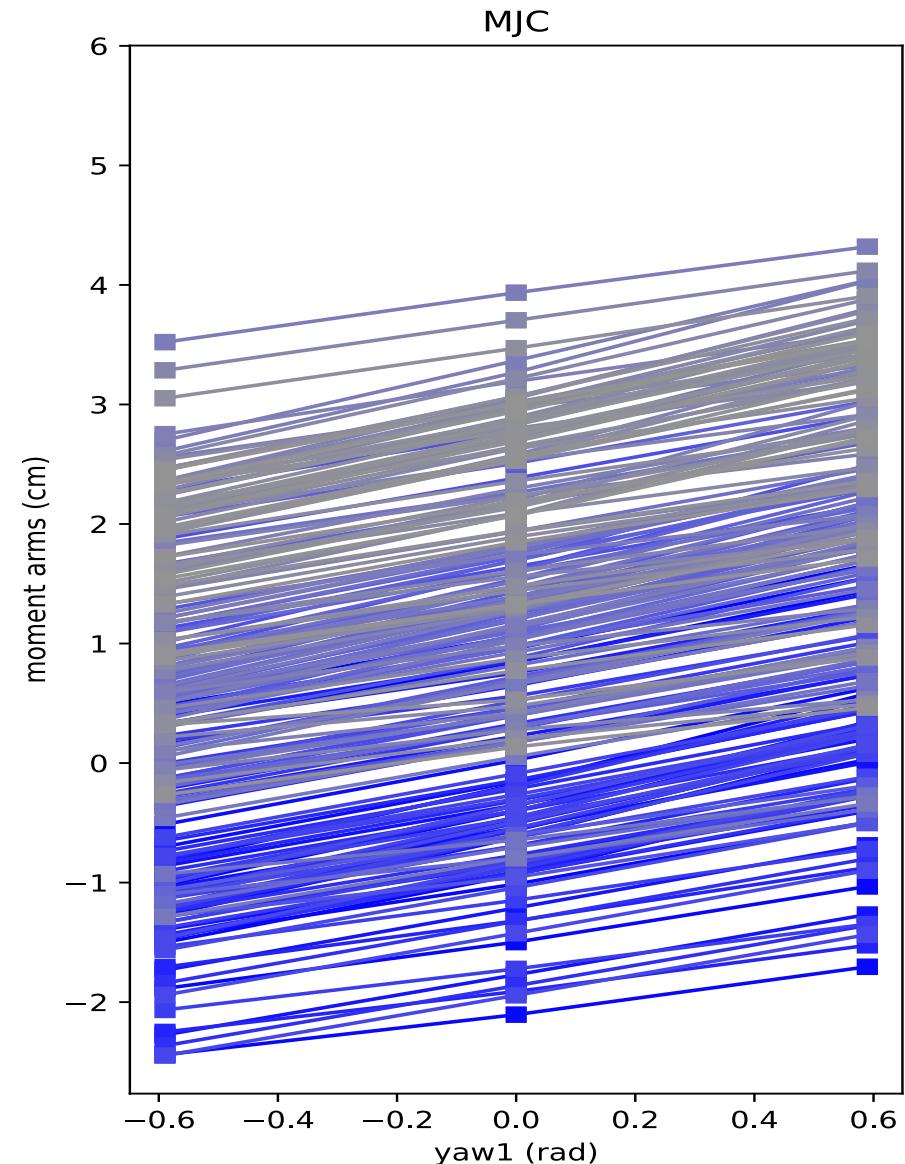
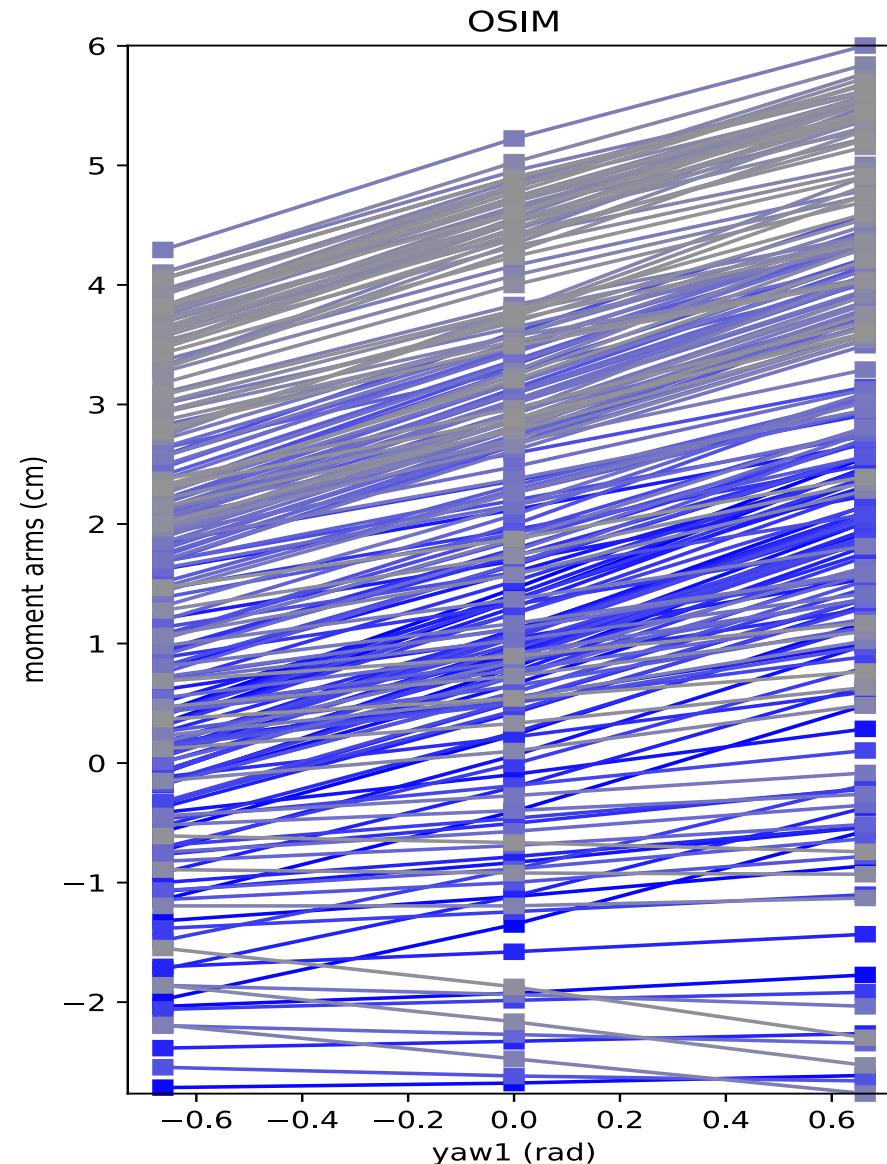
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



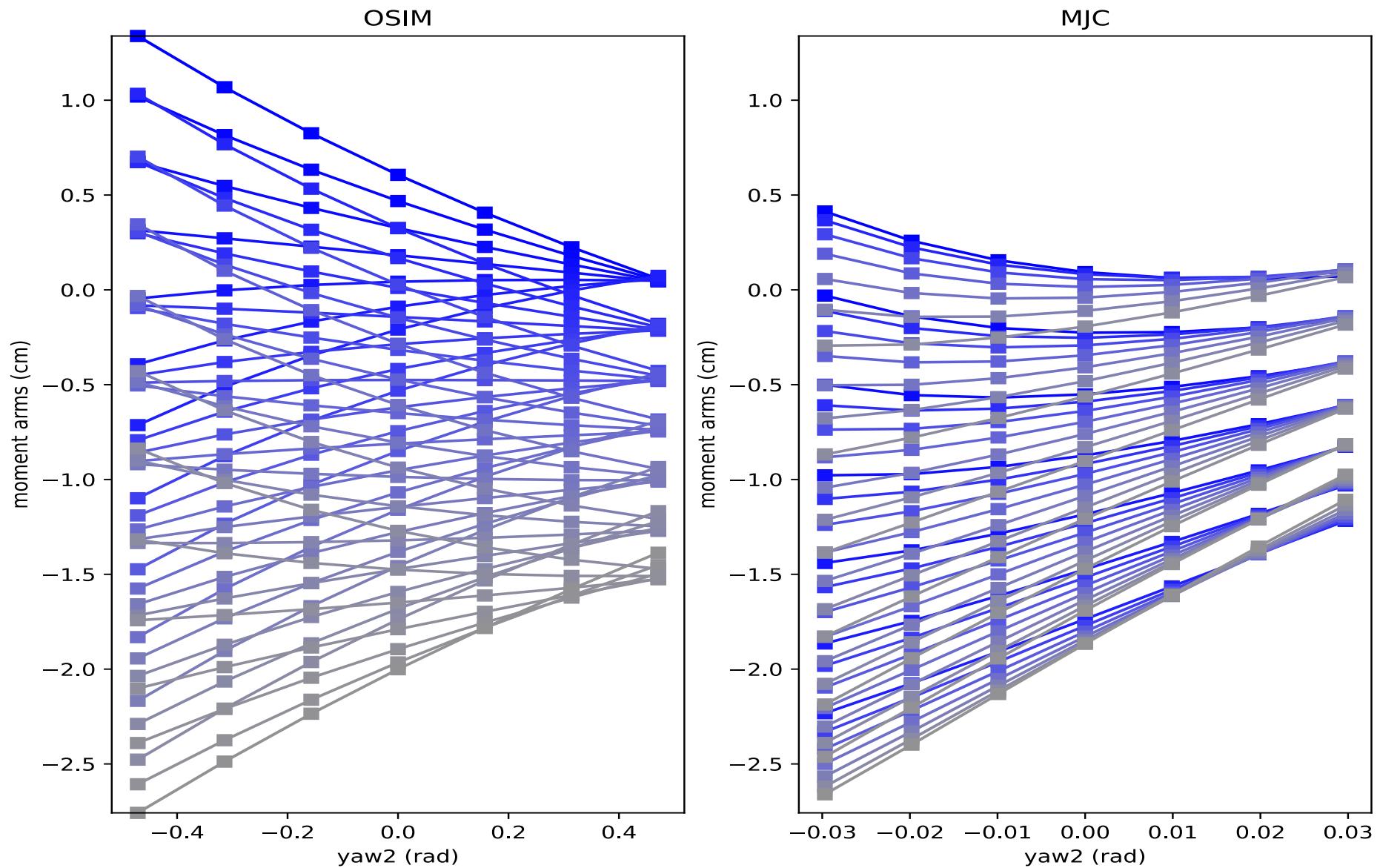
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



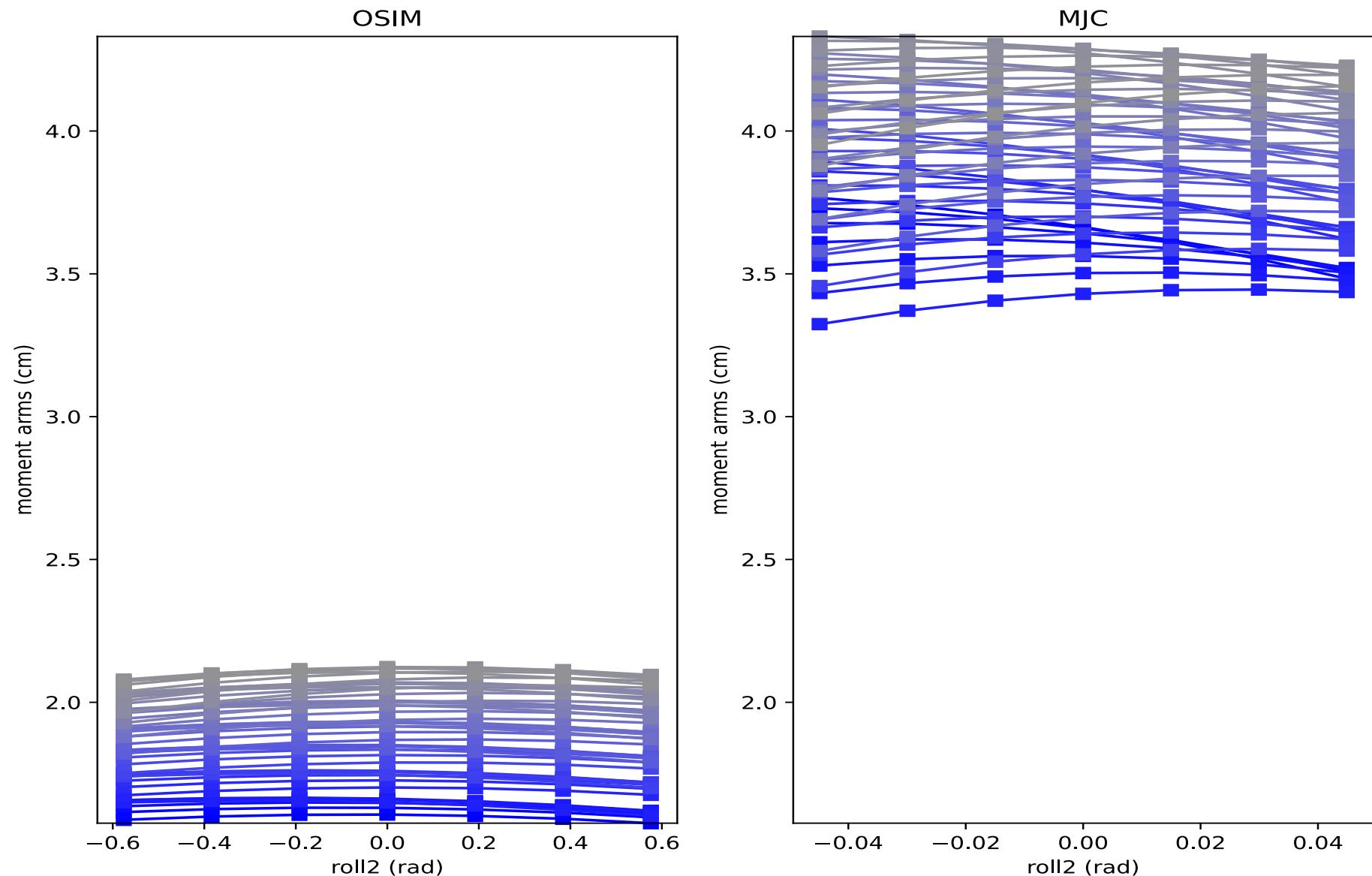
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid - pitch2 - roll2 - yaw2



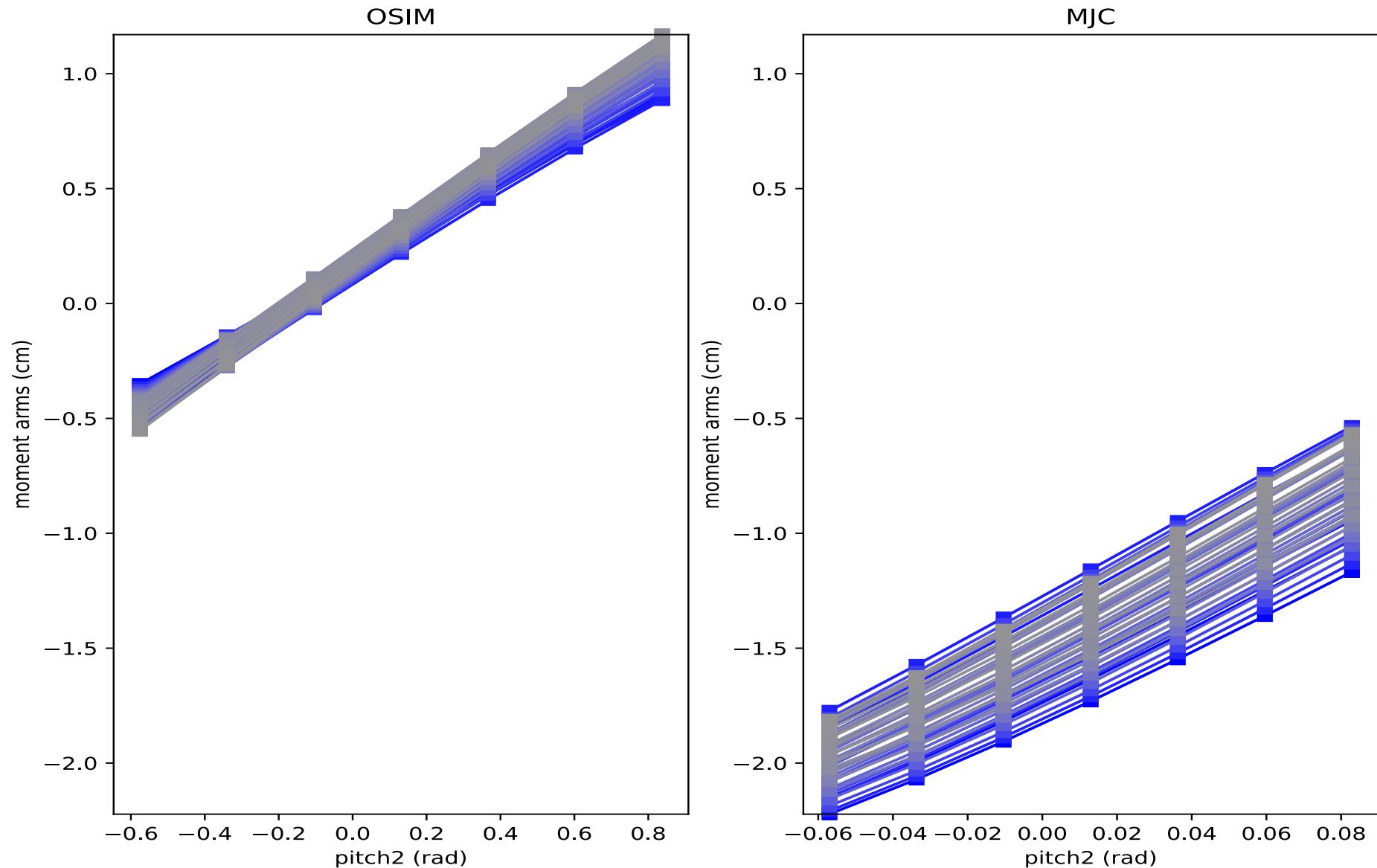
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant - pitch2 - roll2 - yaw2



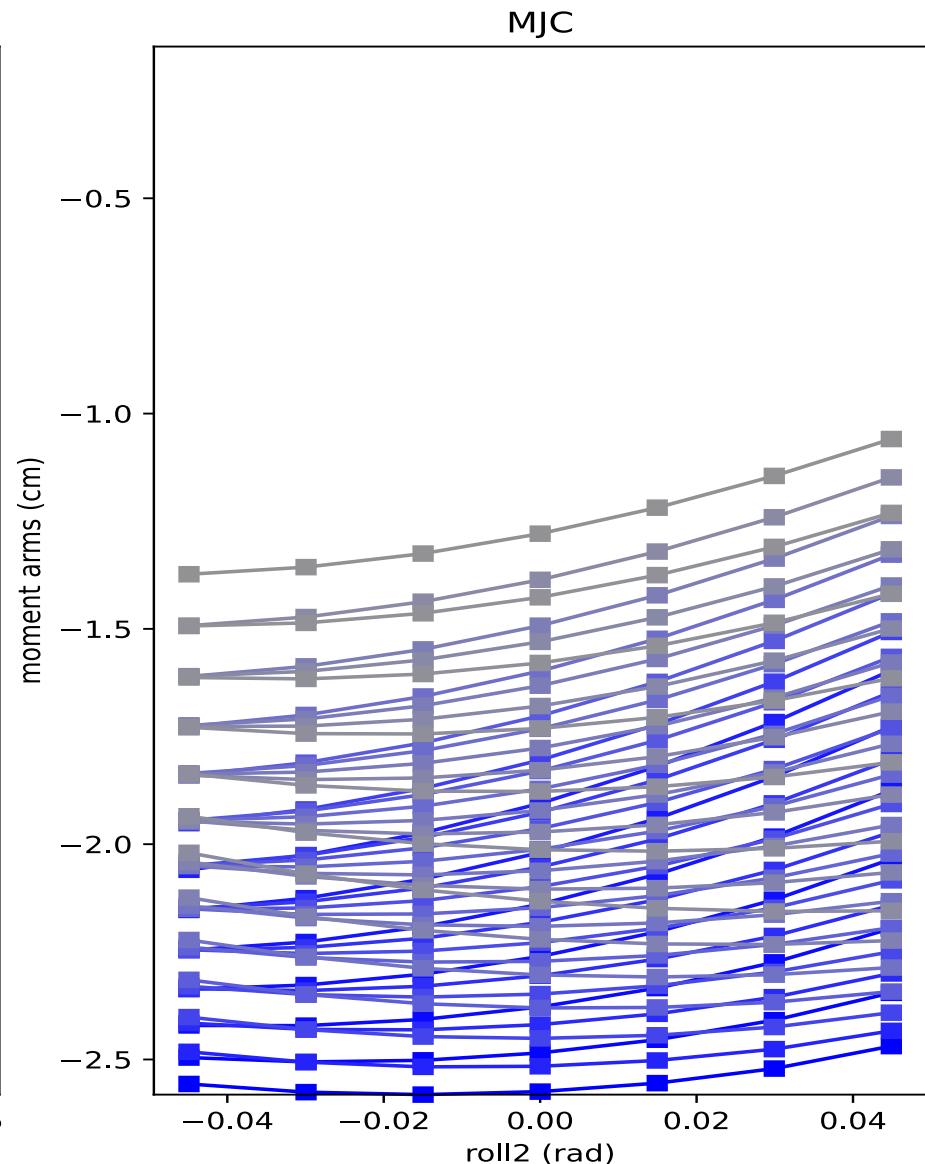
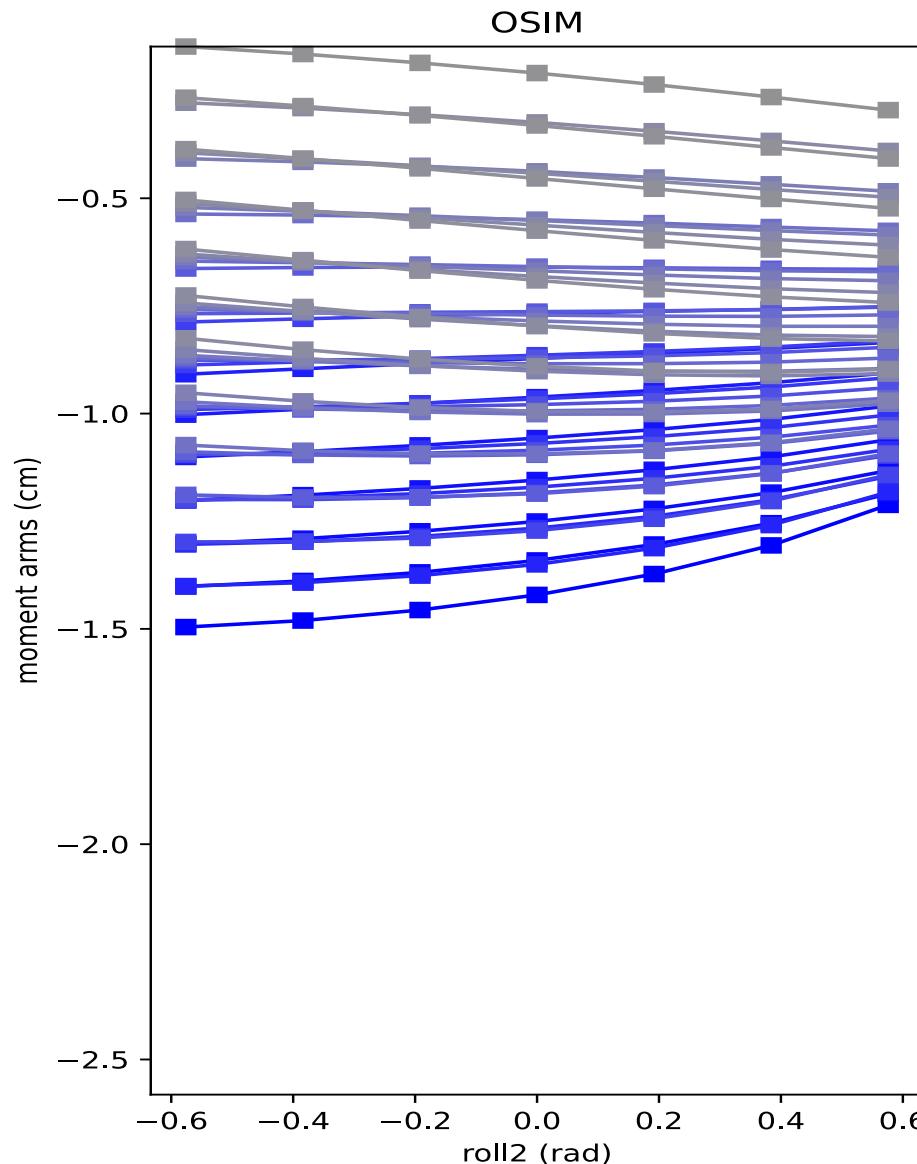
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med_L - pitch2 - roll2 - yaw2



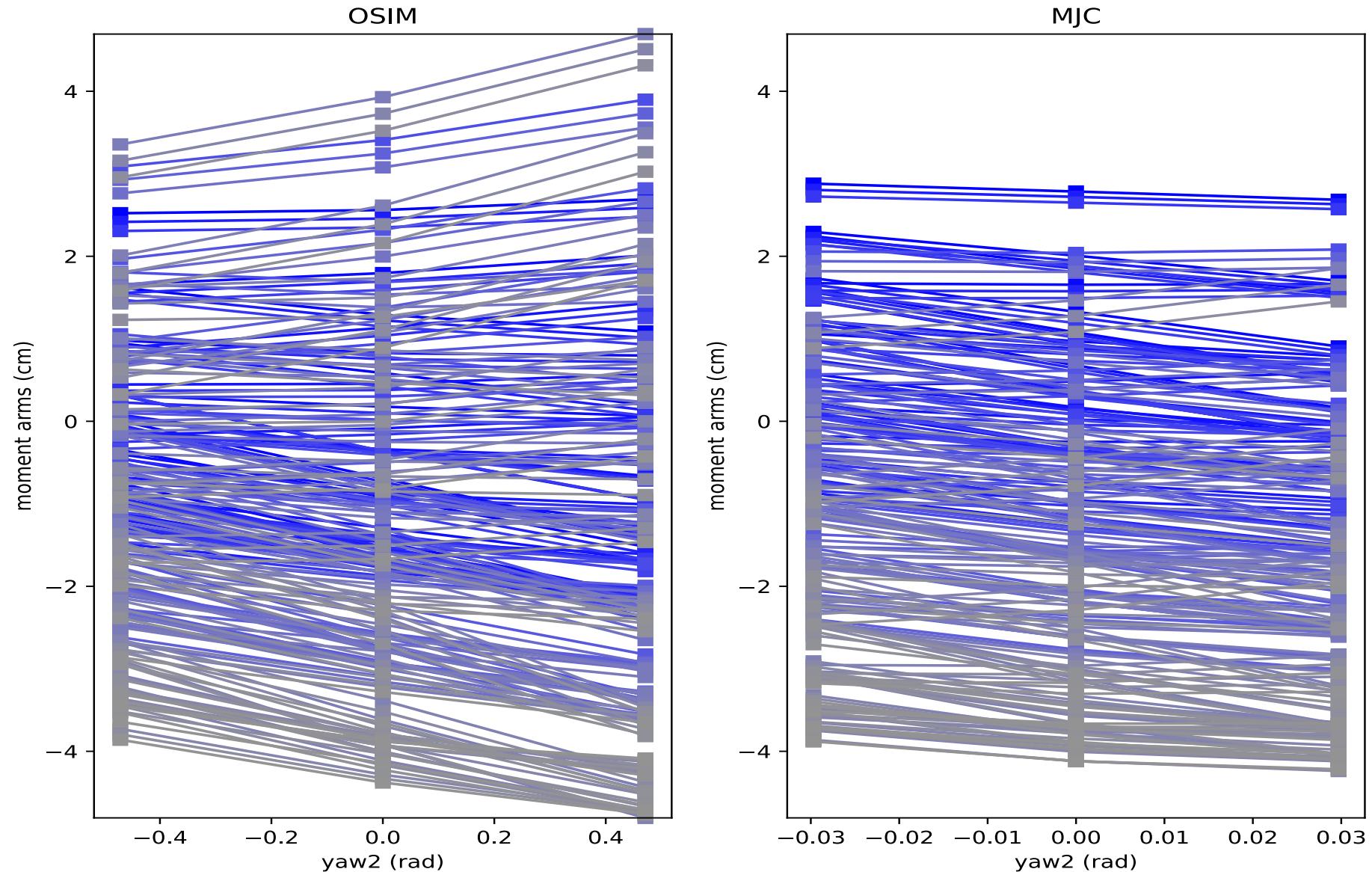
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx_L - pitch2 - roll2 - yaw2



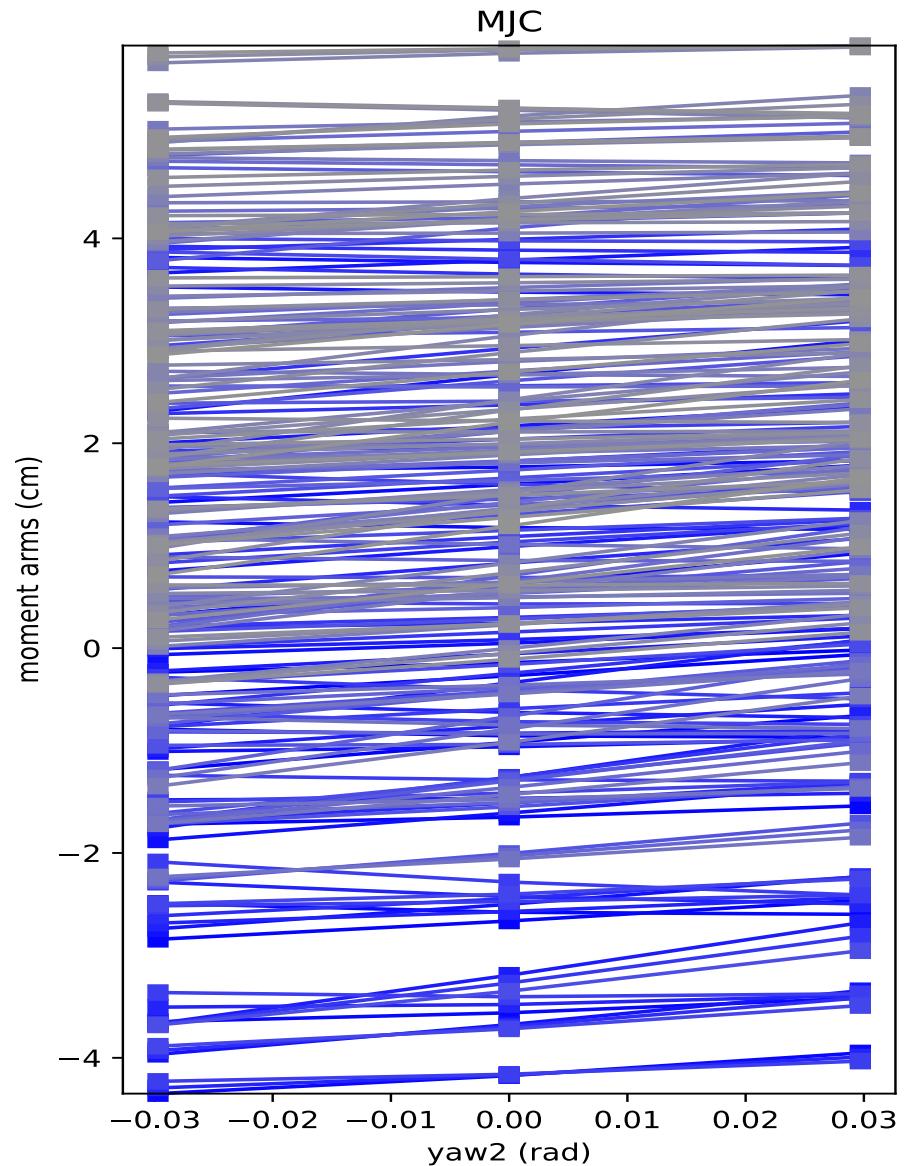
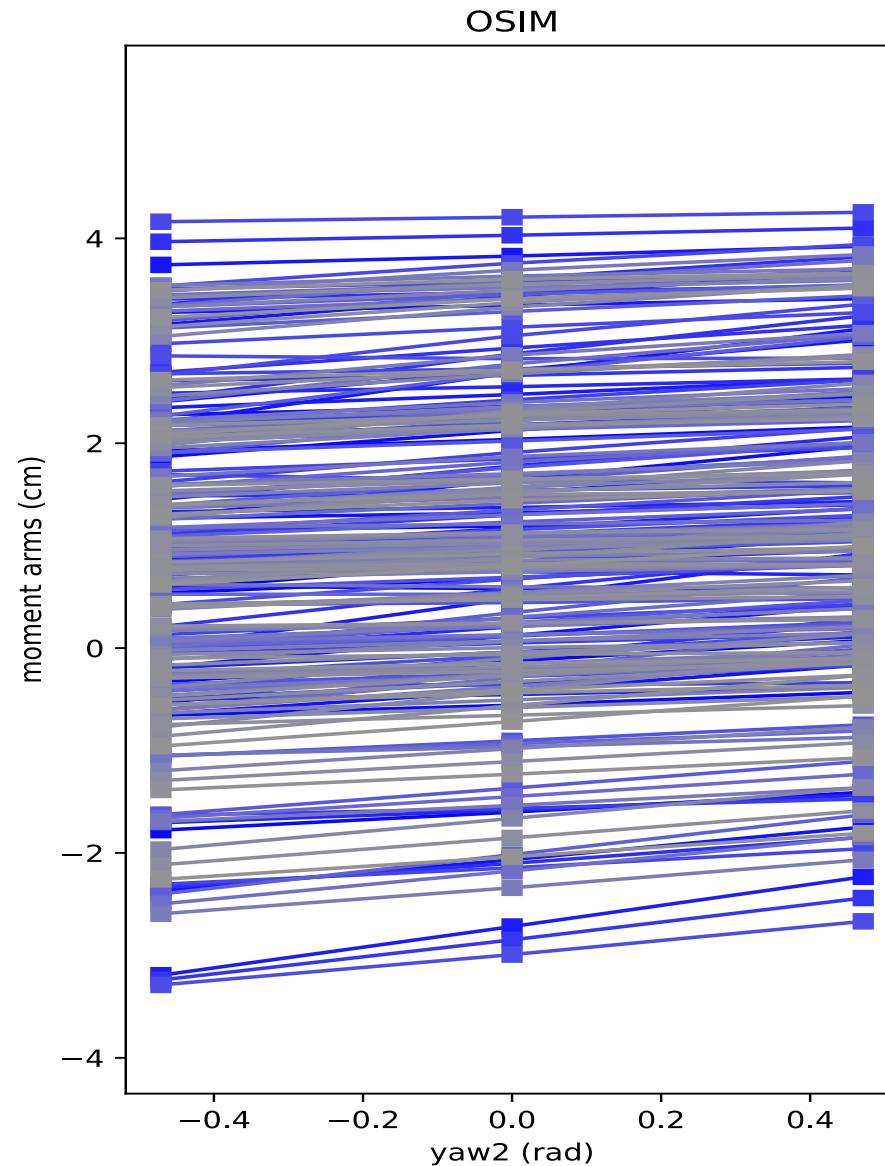
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_skLthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



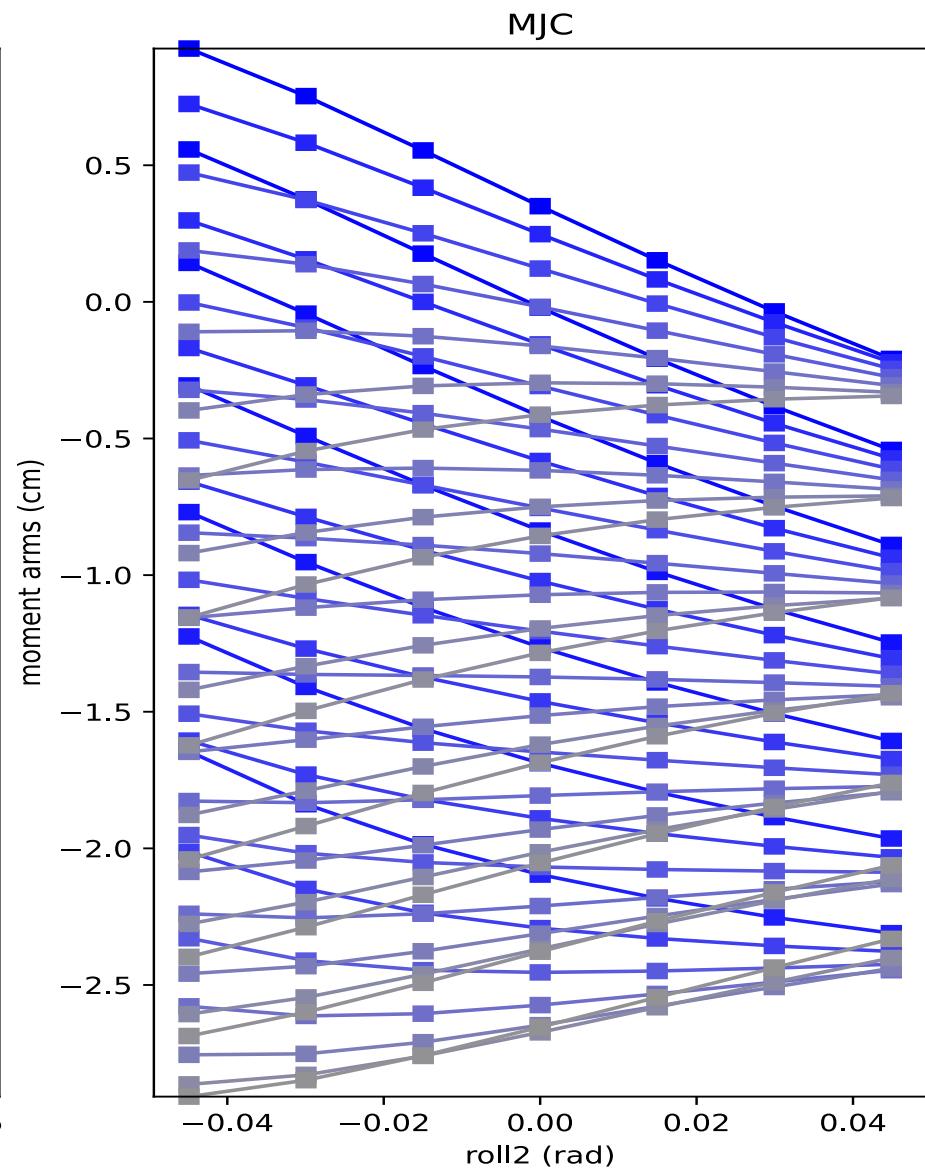
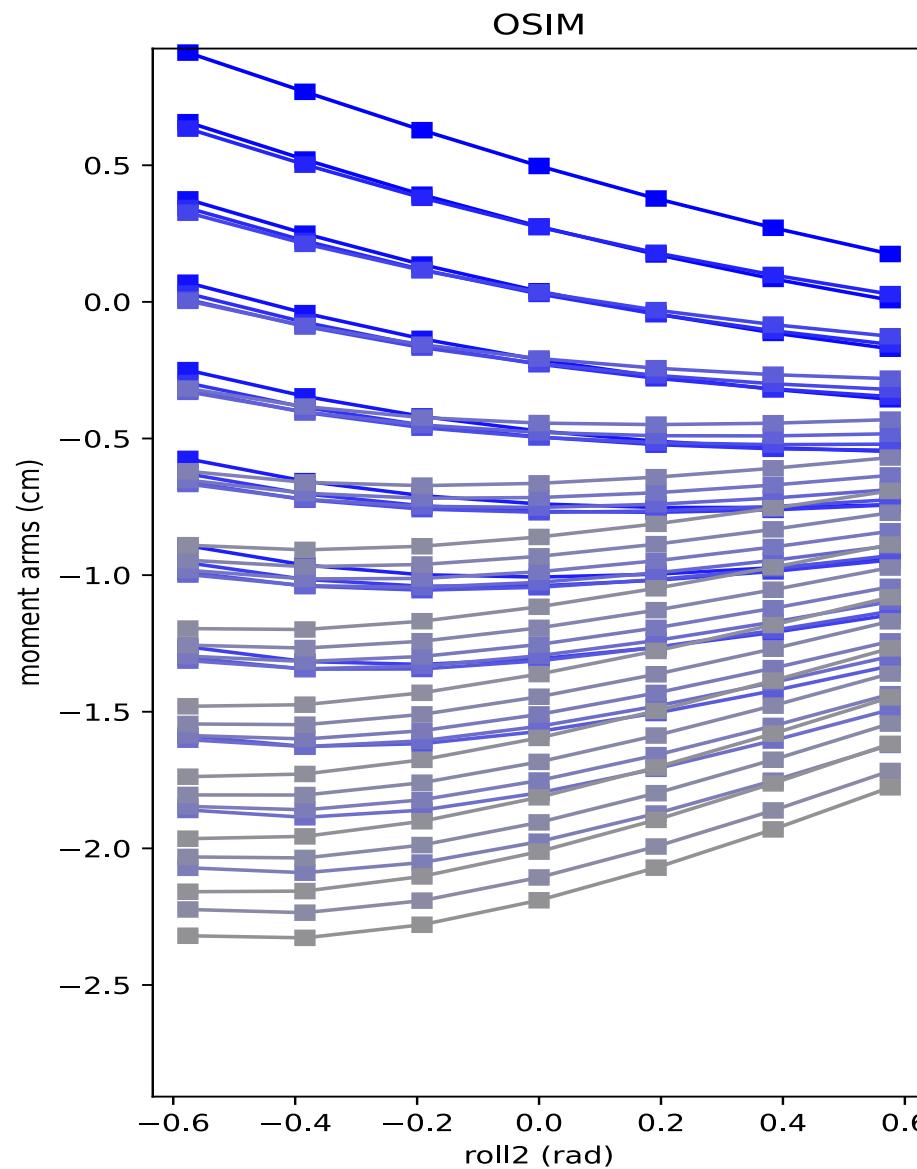
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



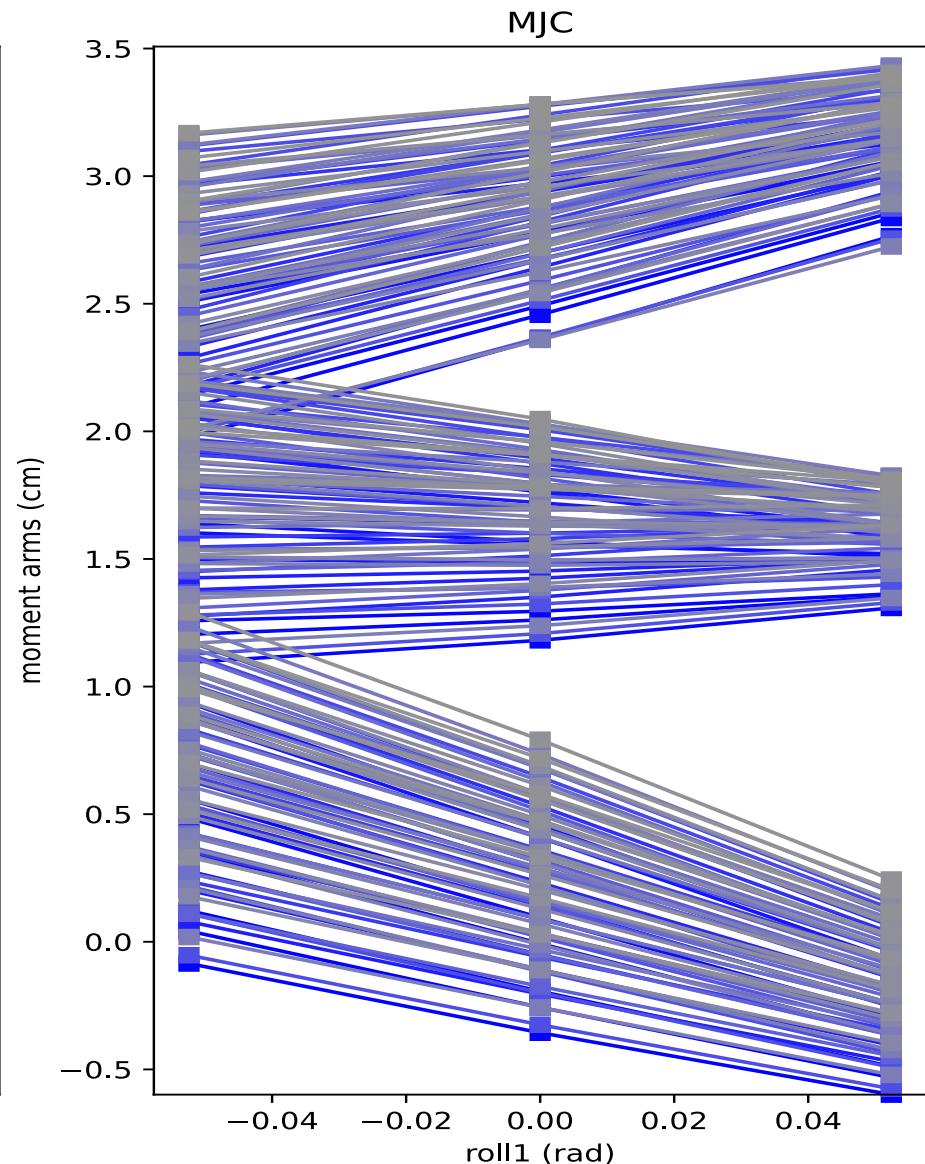
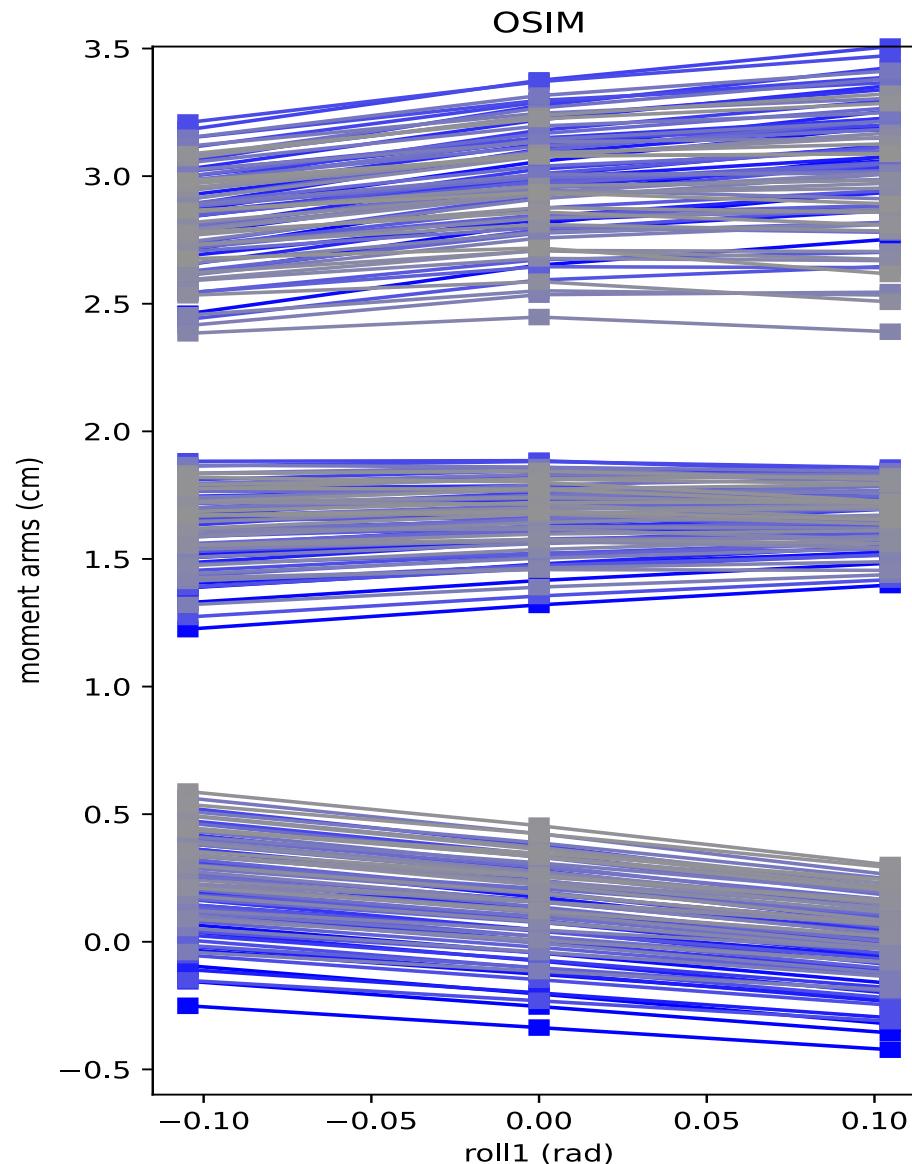
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid_L - pitch2 - roll2 - yaw2



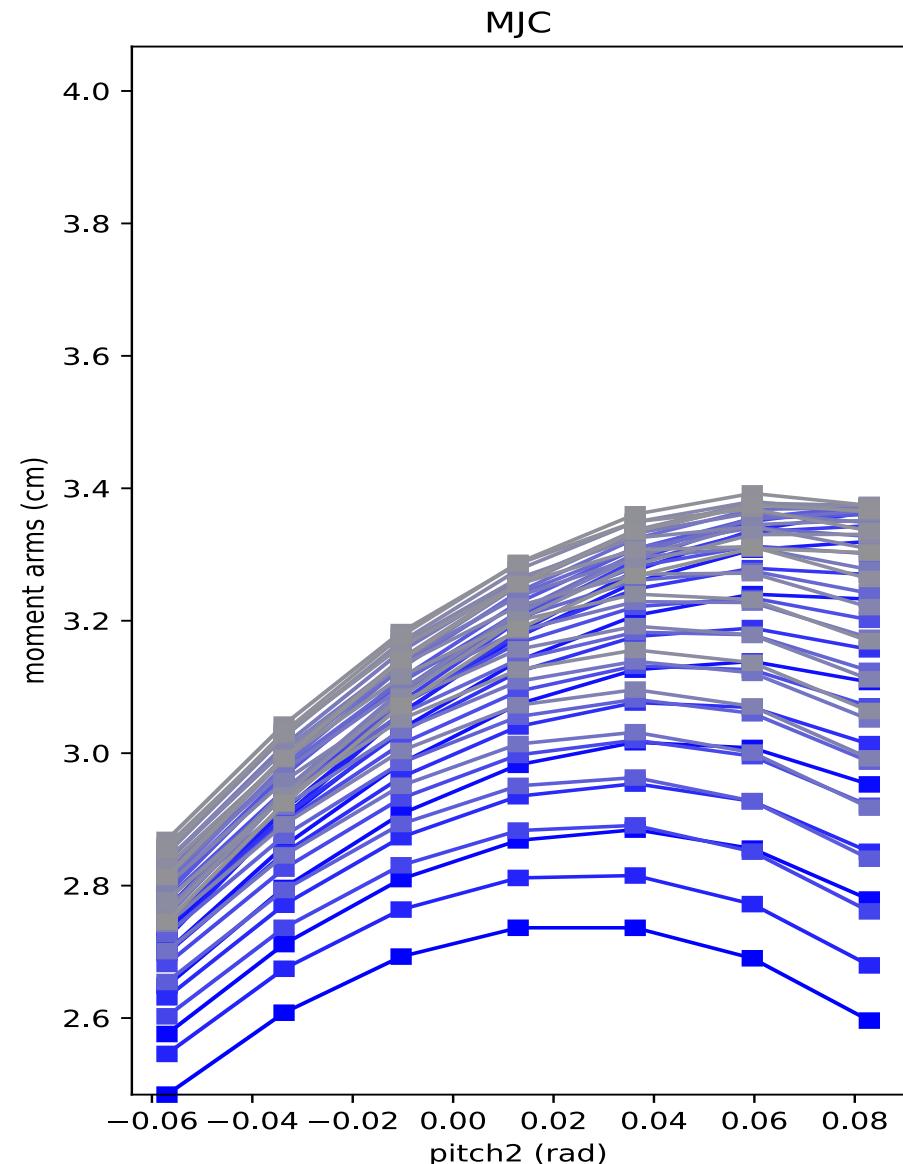
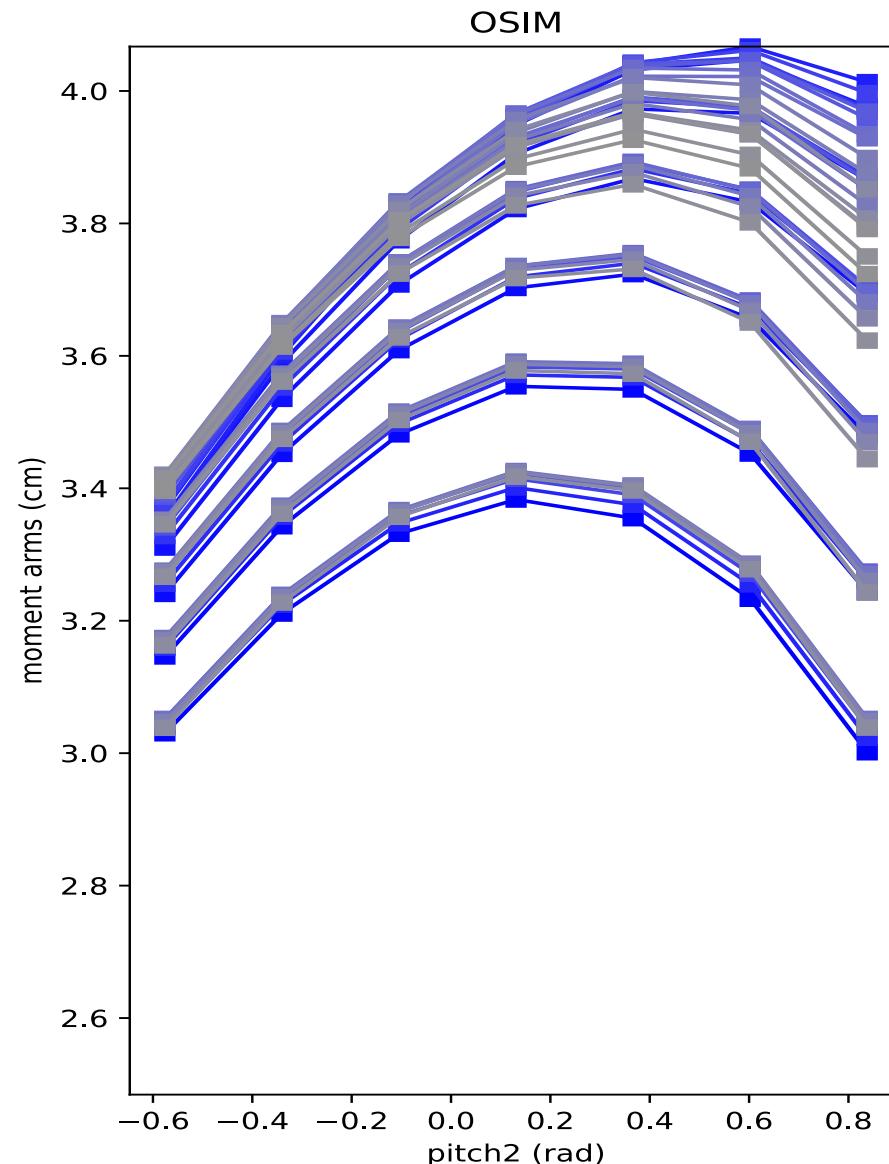
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



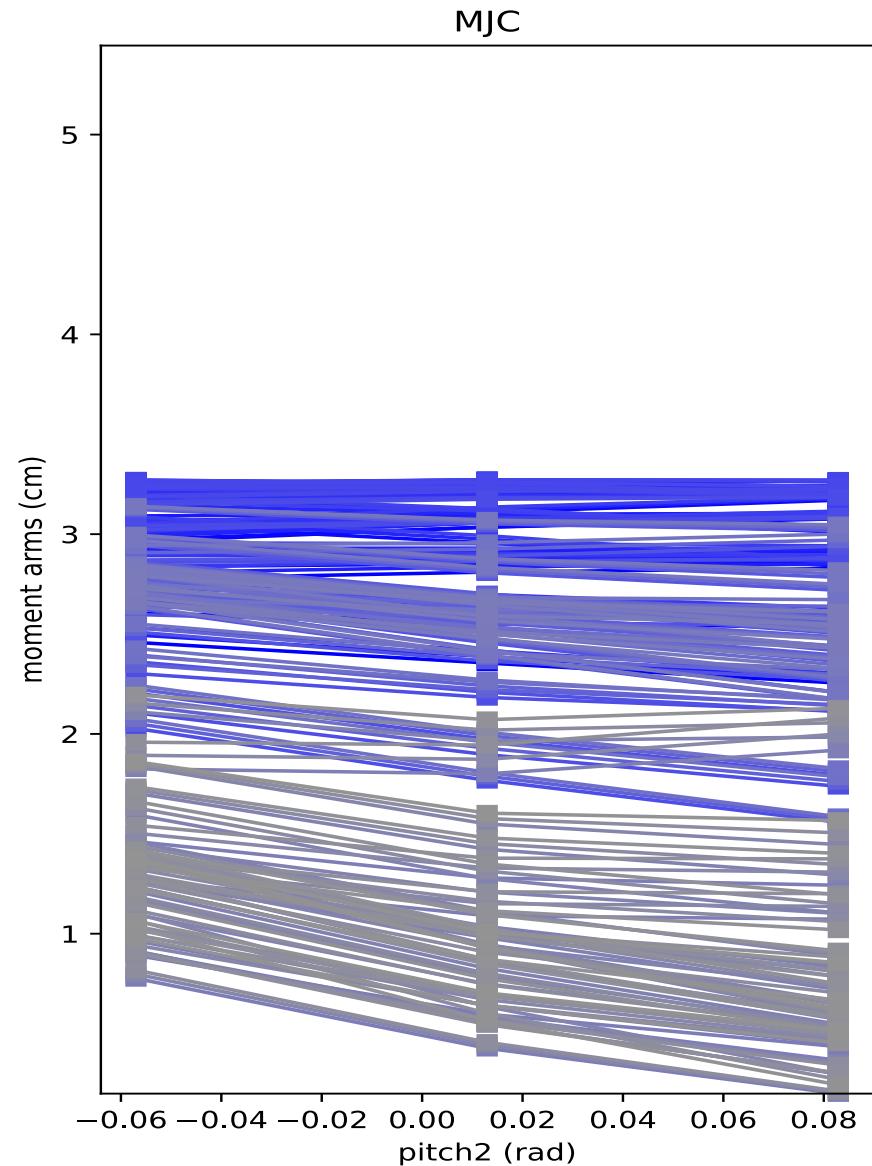
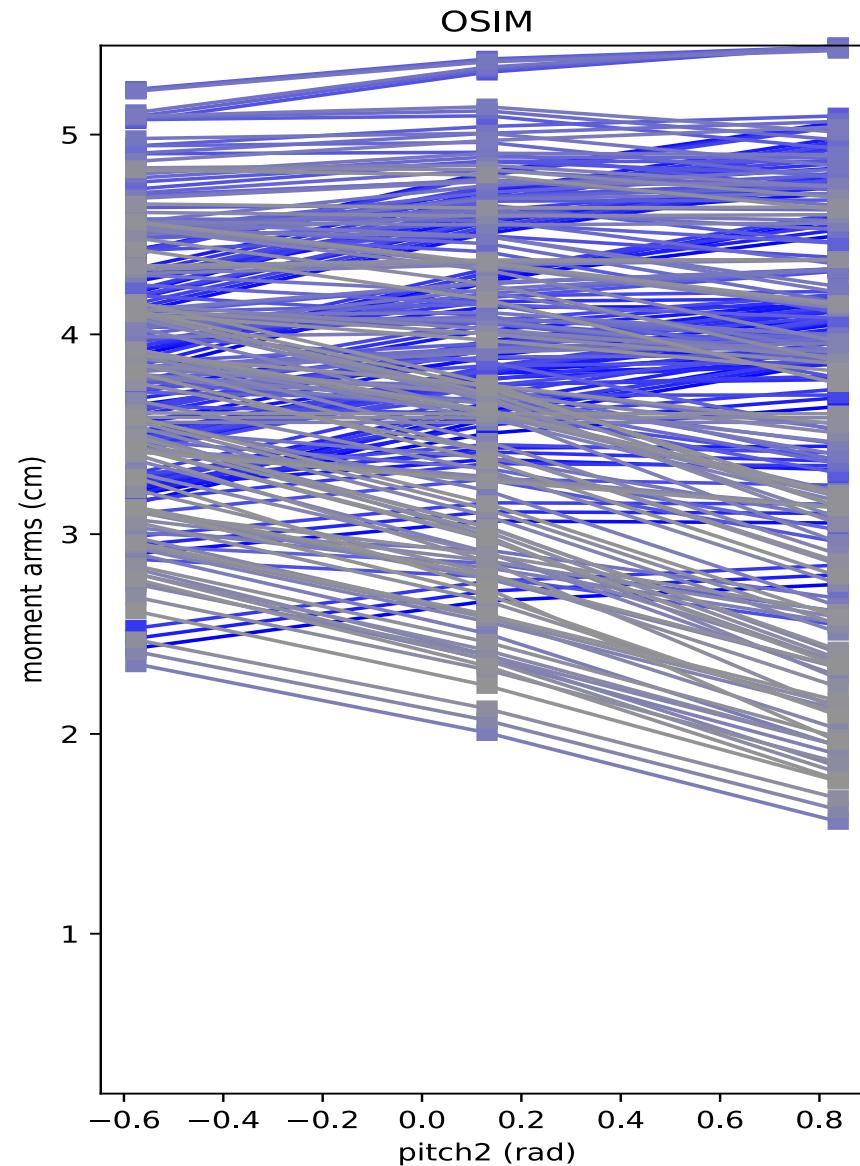
Muscle specific moment arm comparison with Osim model after optimization

semi_cerv_c3thx - pitch2 - roll2 - yaw2



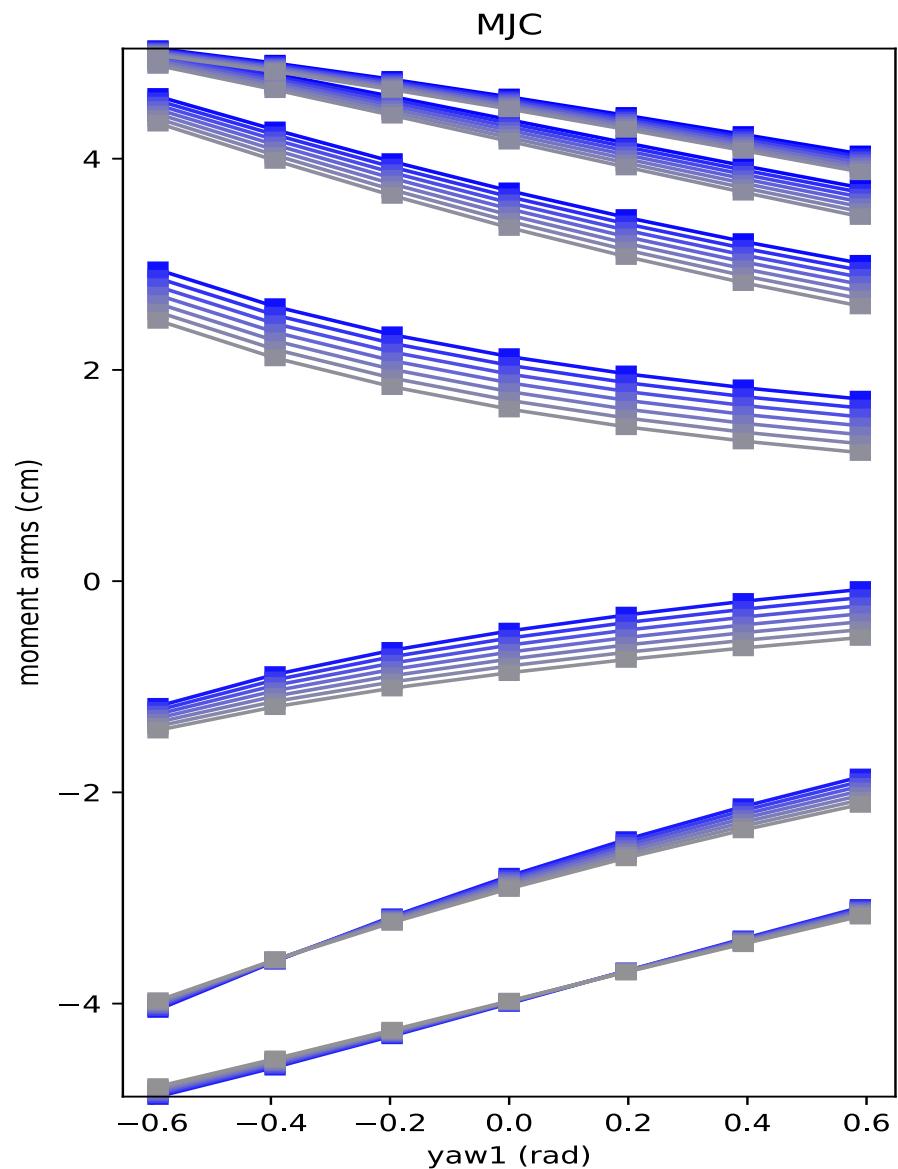
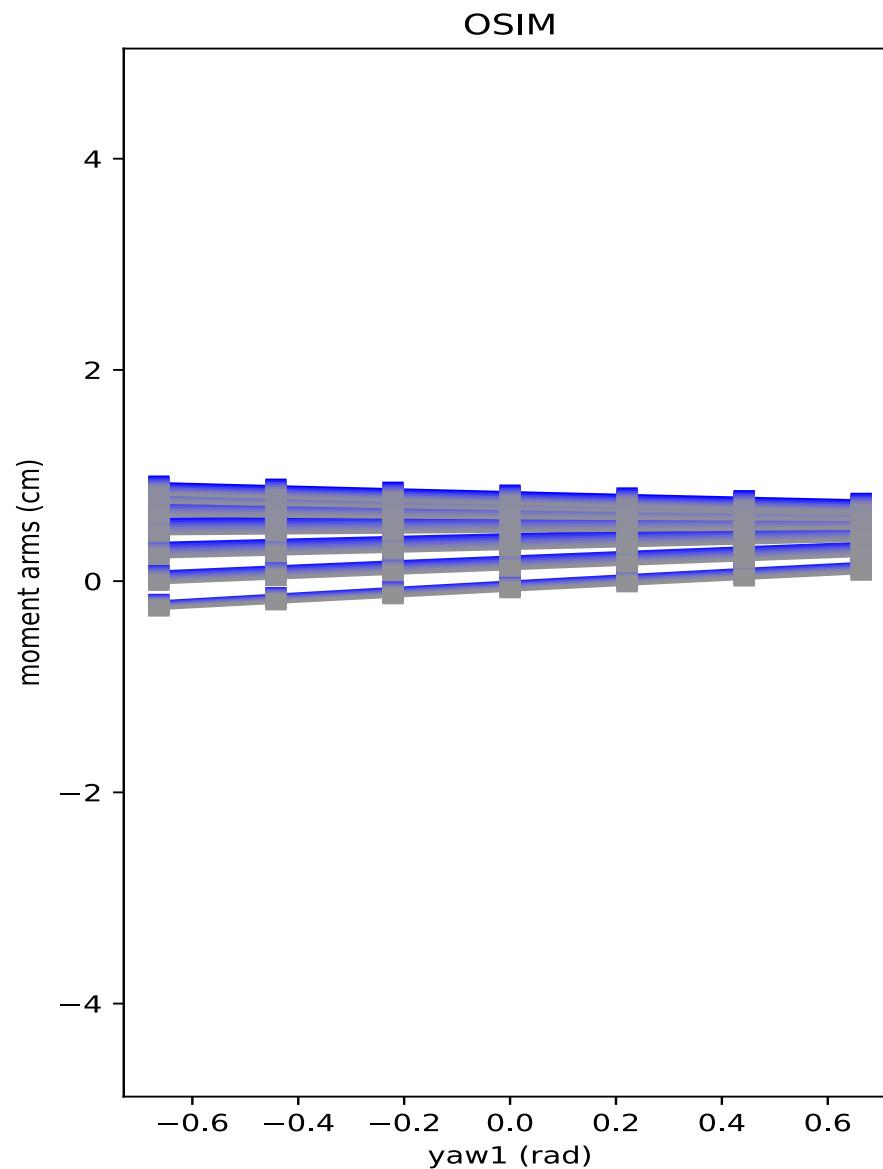
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



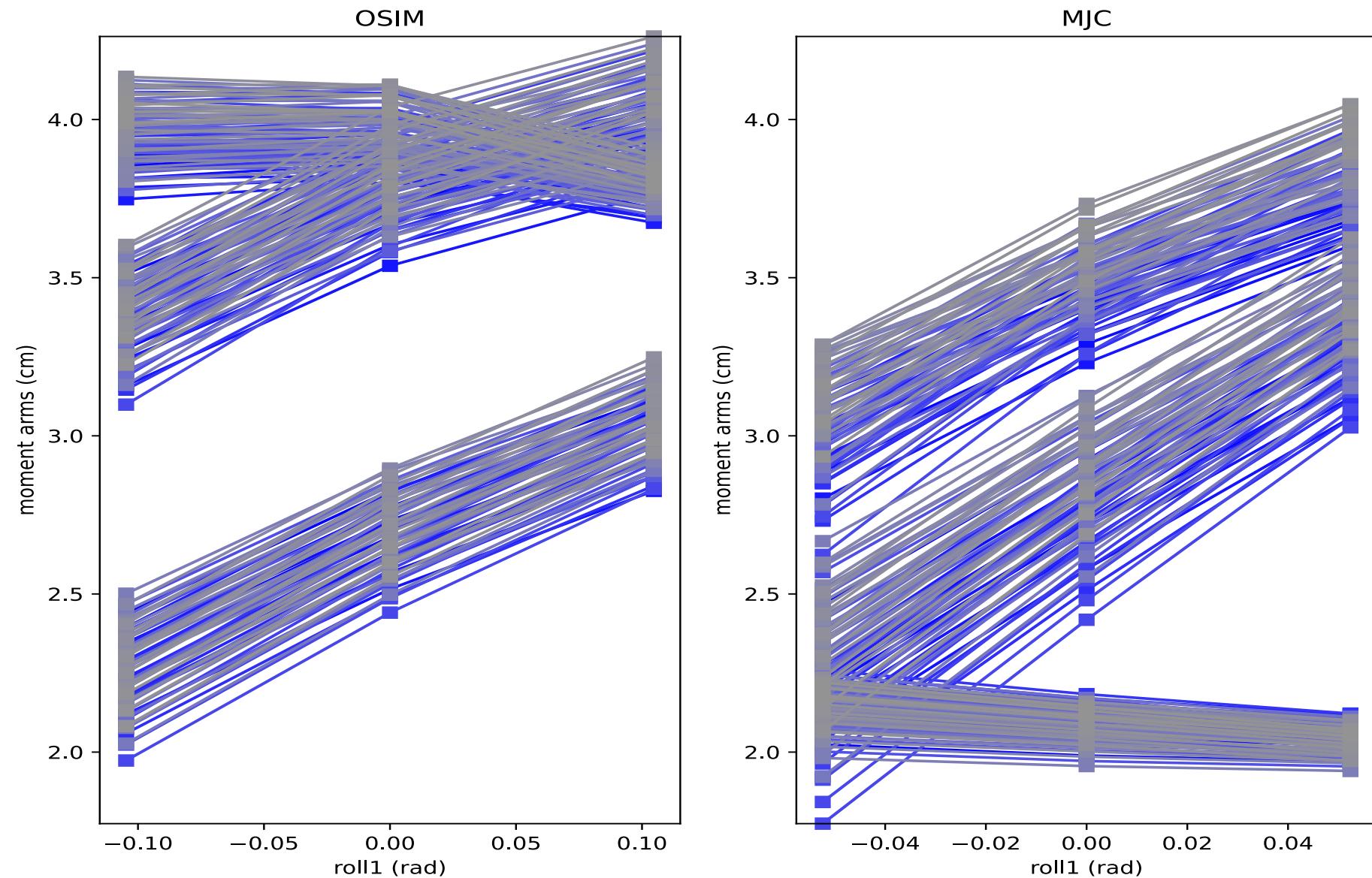
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch1 - roll1 - yaw1



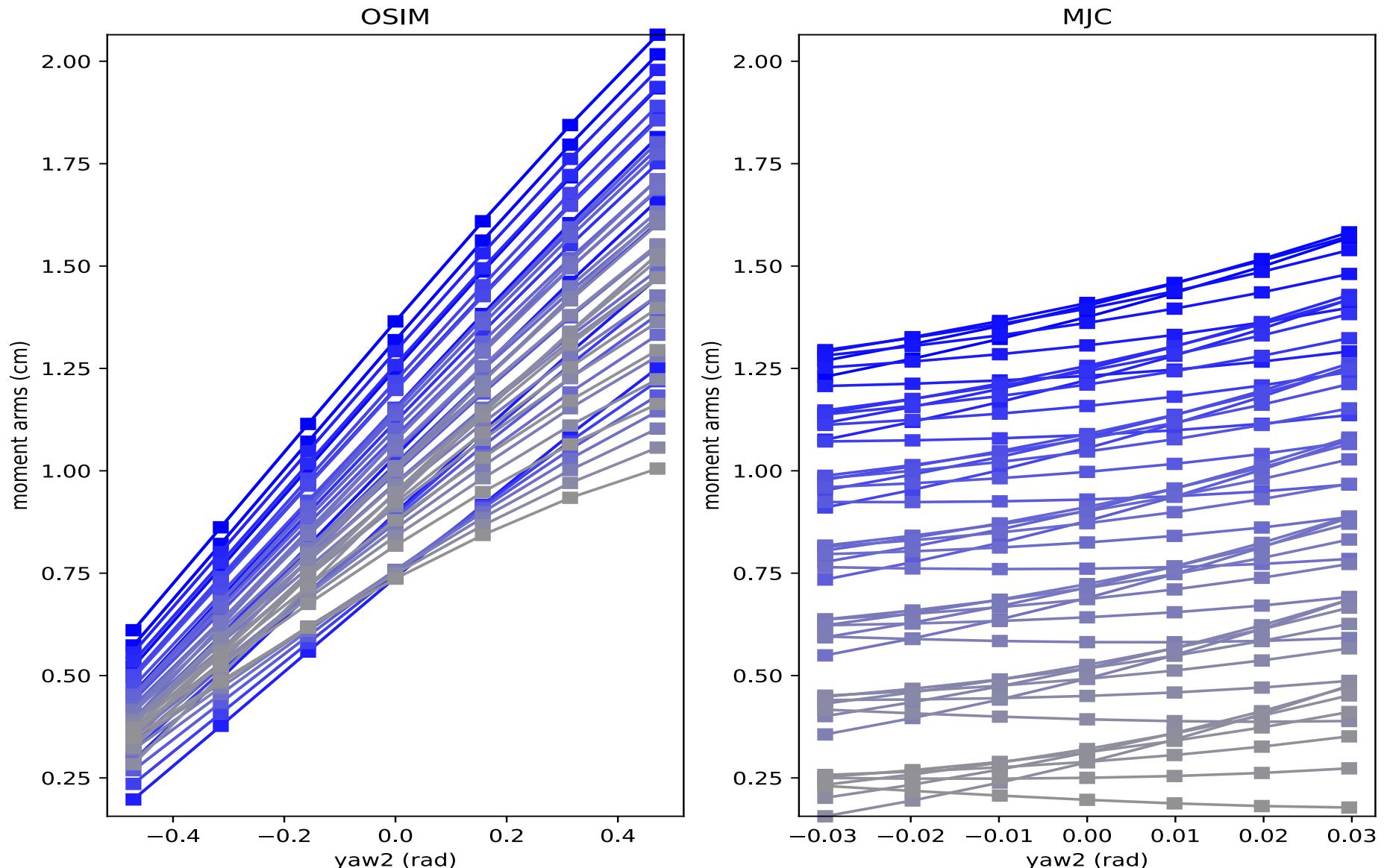
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



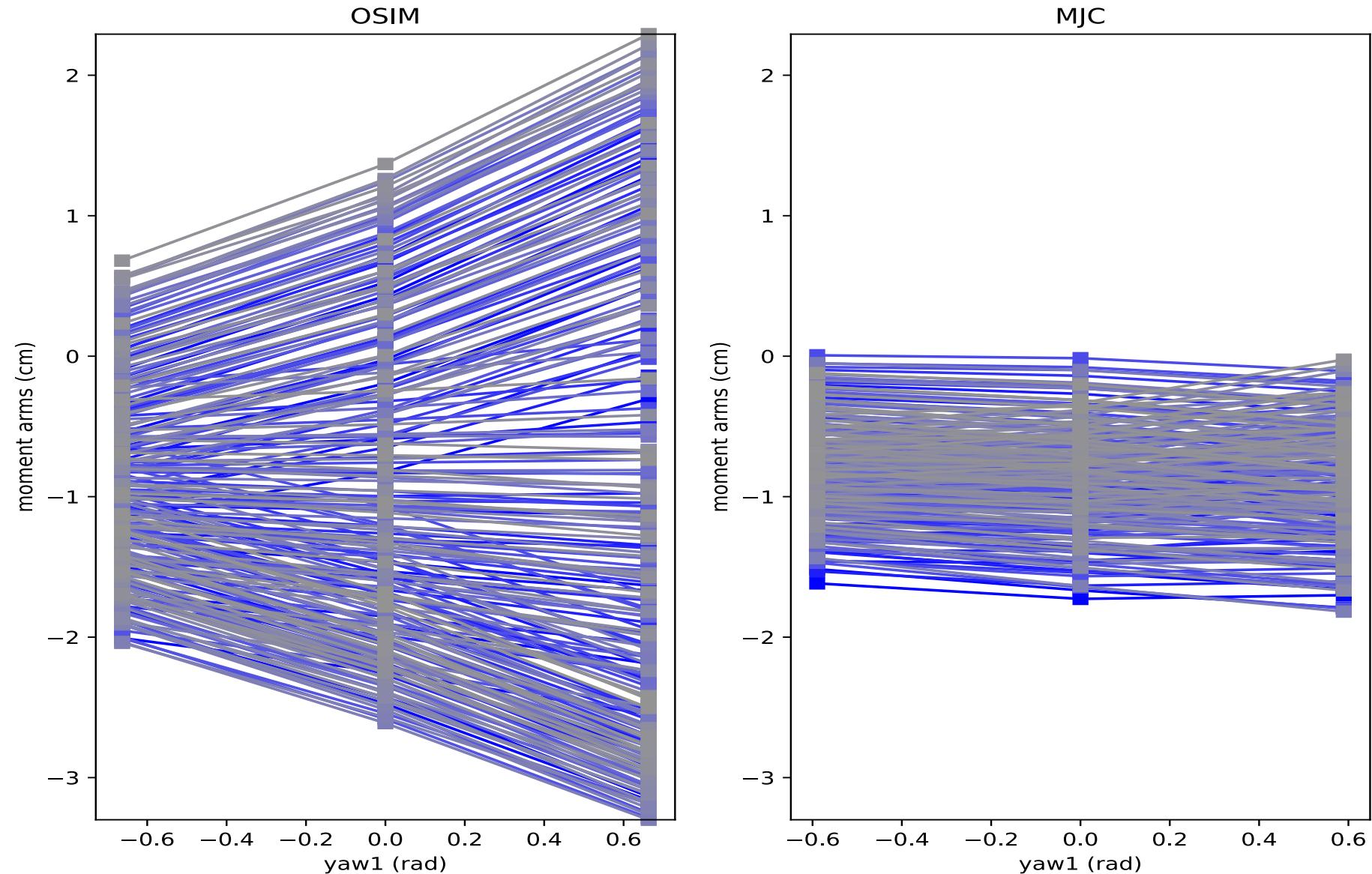
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx_L - pitch2 - roll2 - yaw2



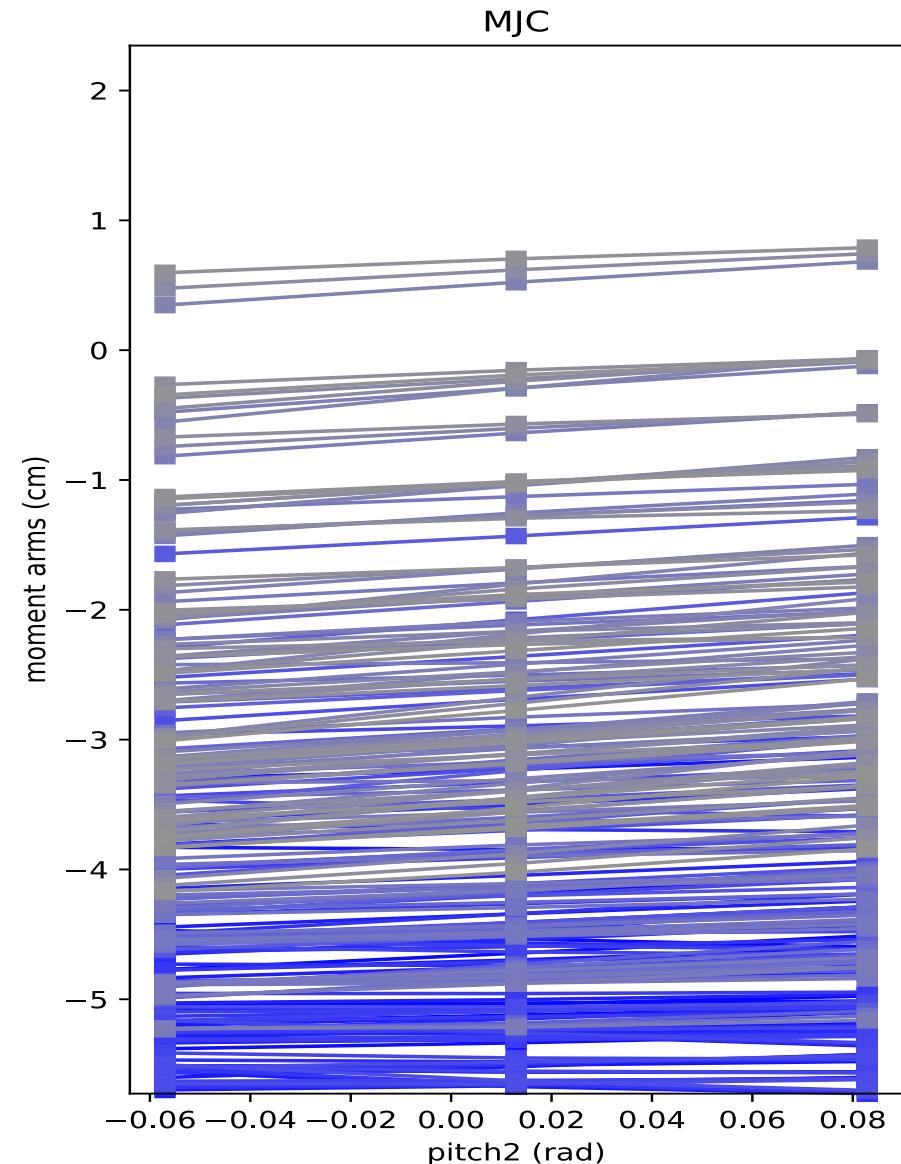
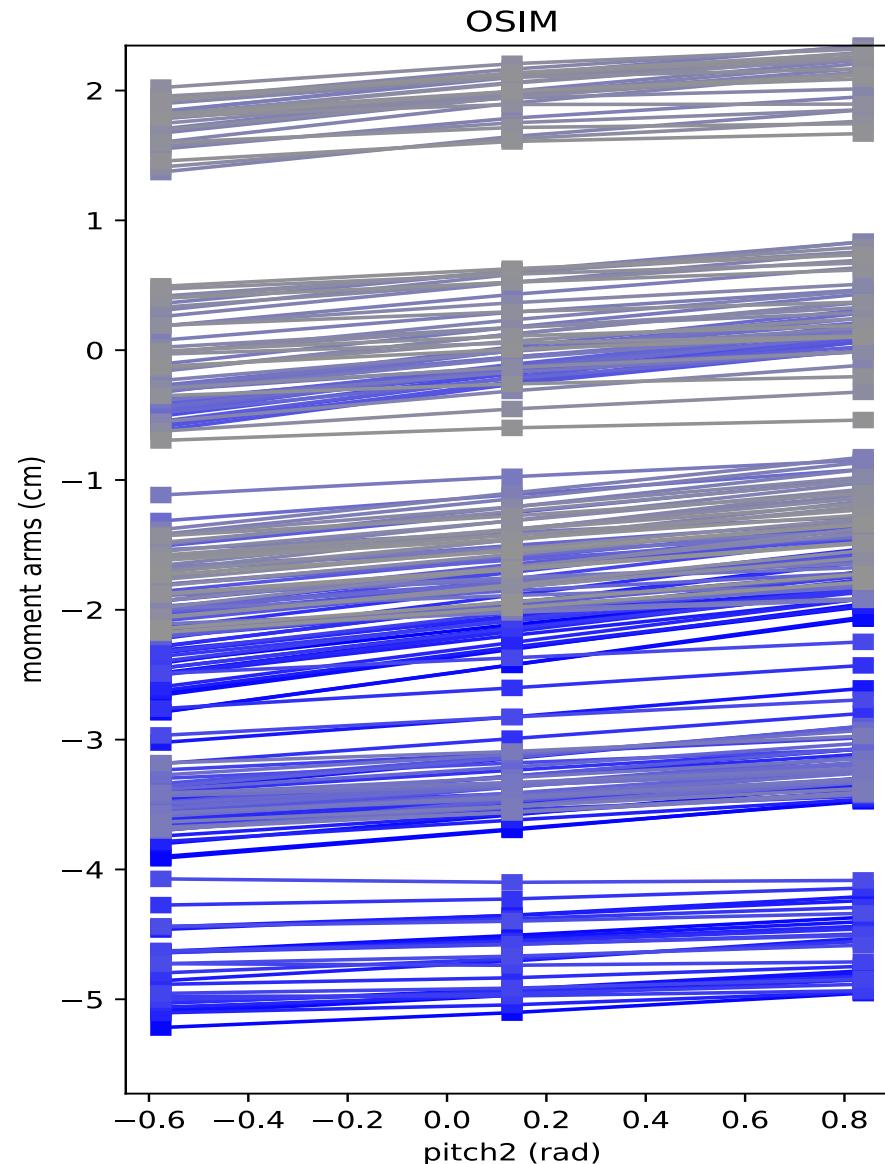
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



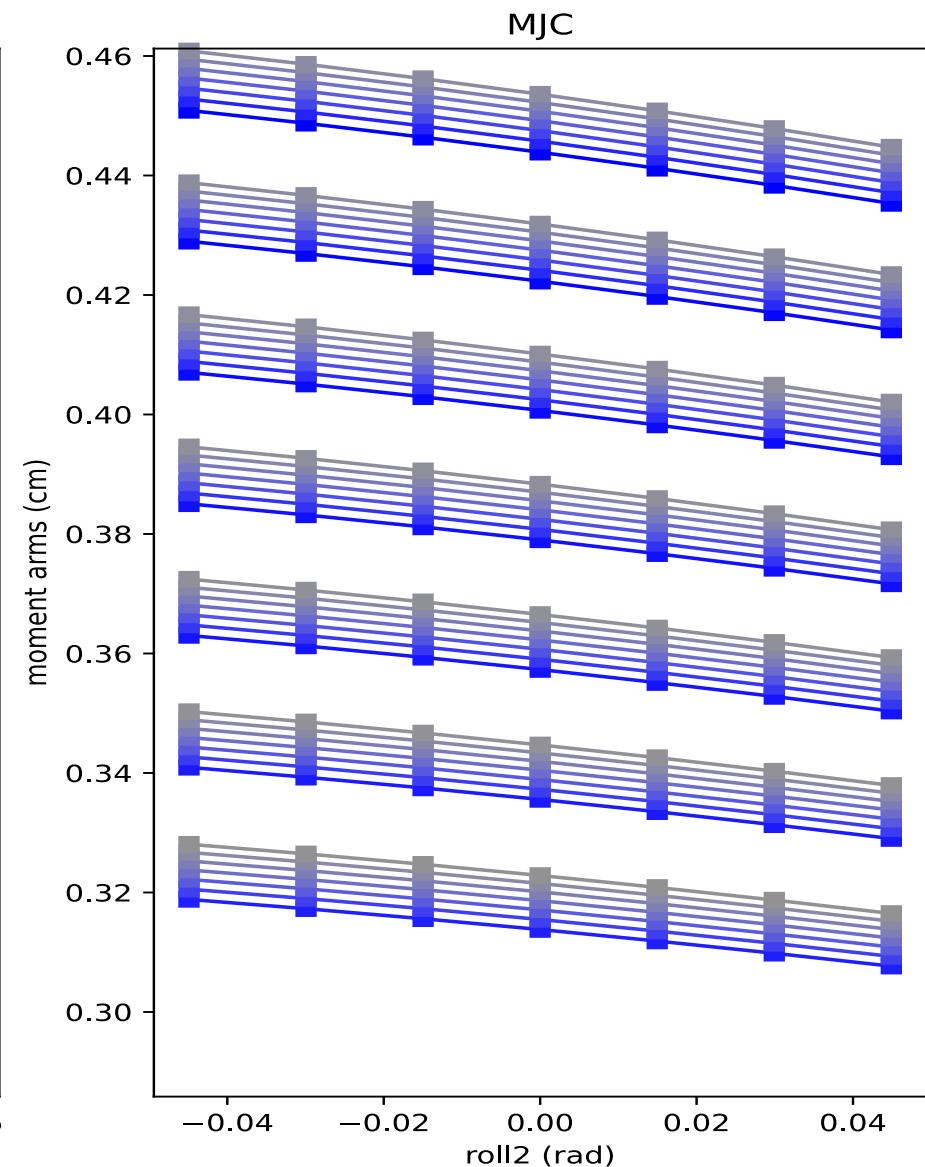
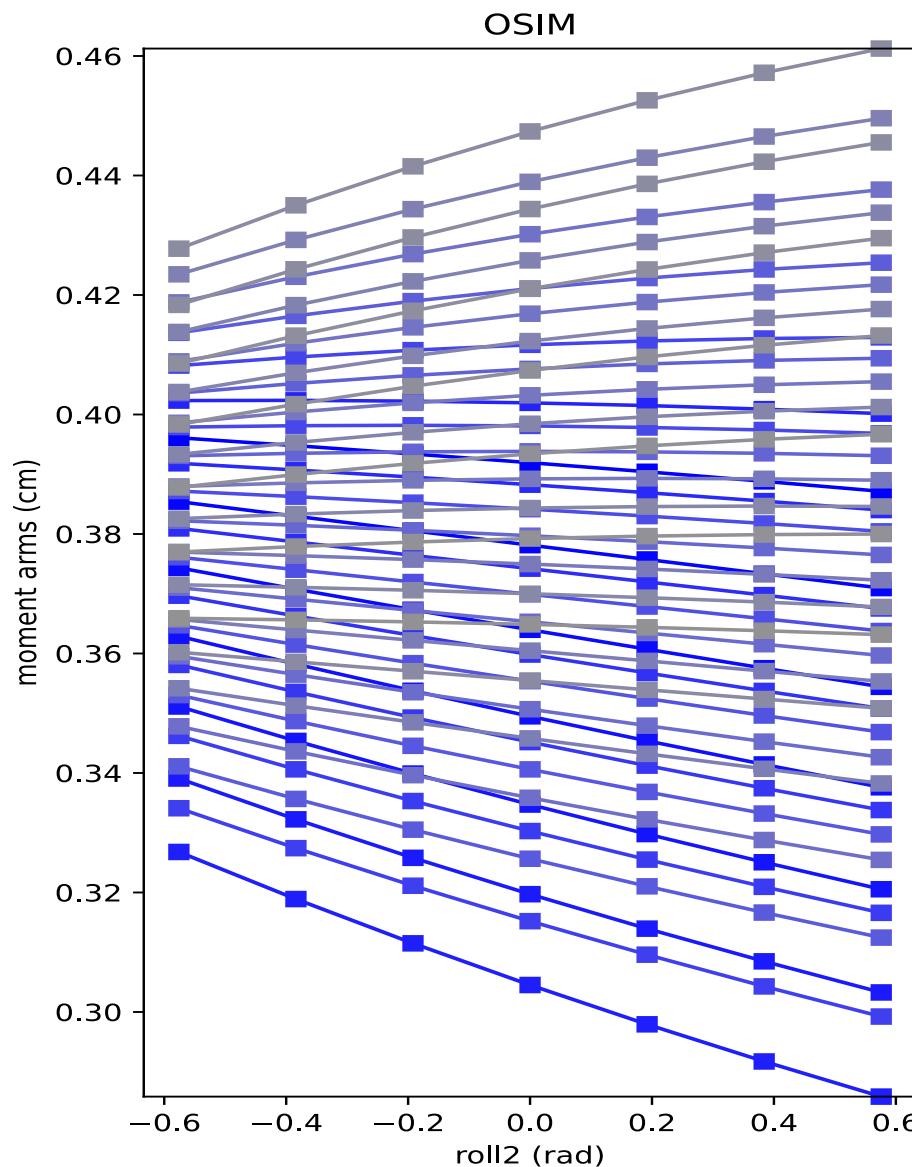
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



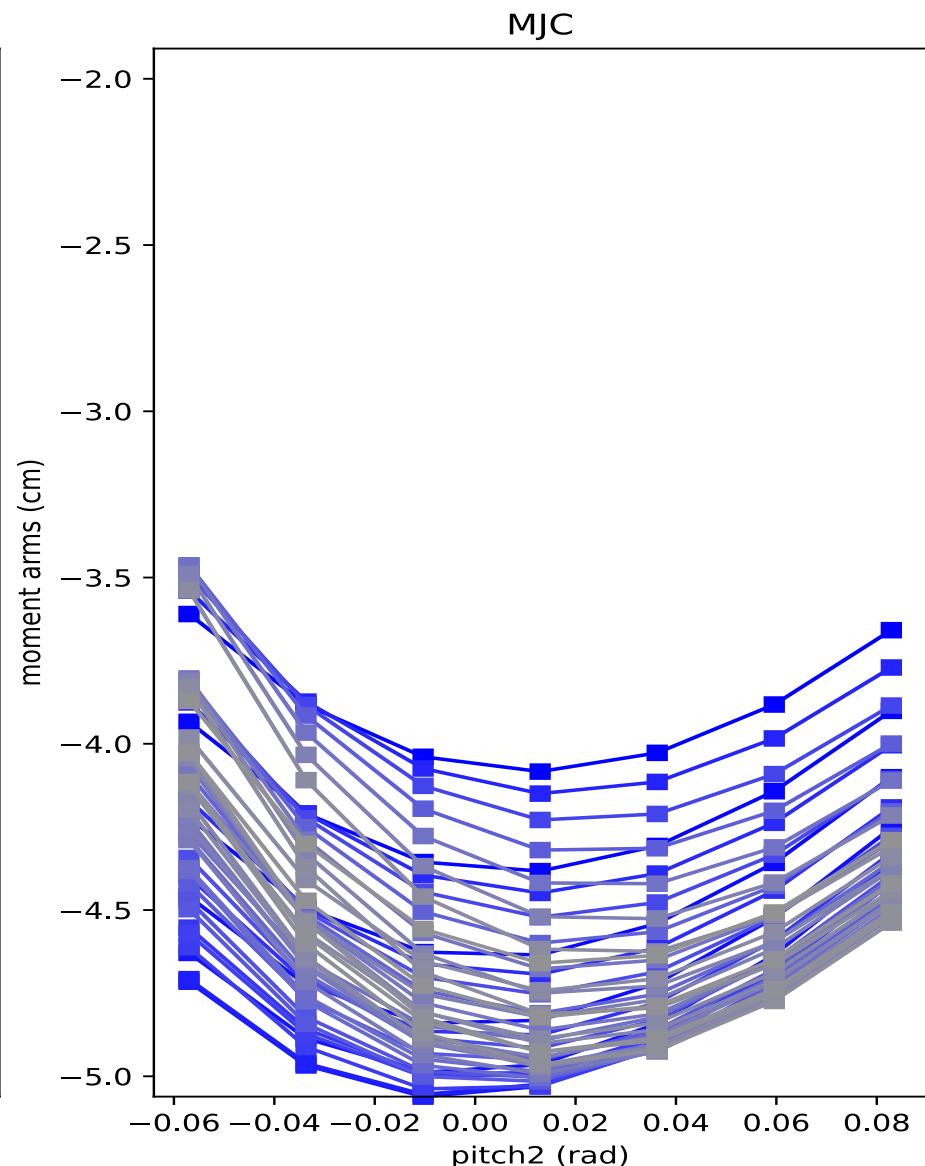
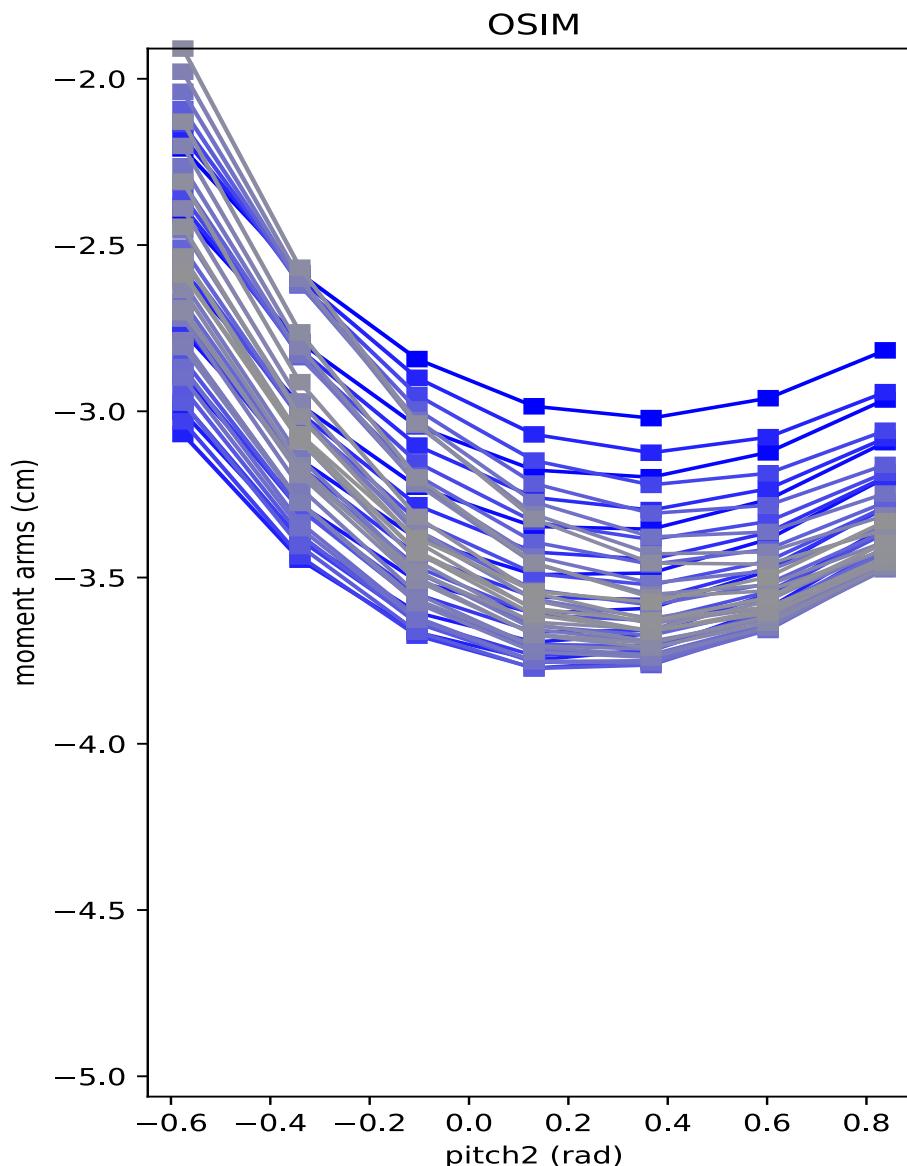
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch2 - roll2 - yaw2



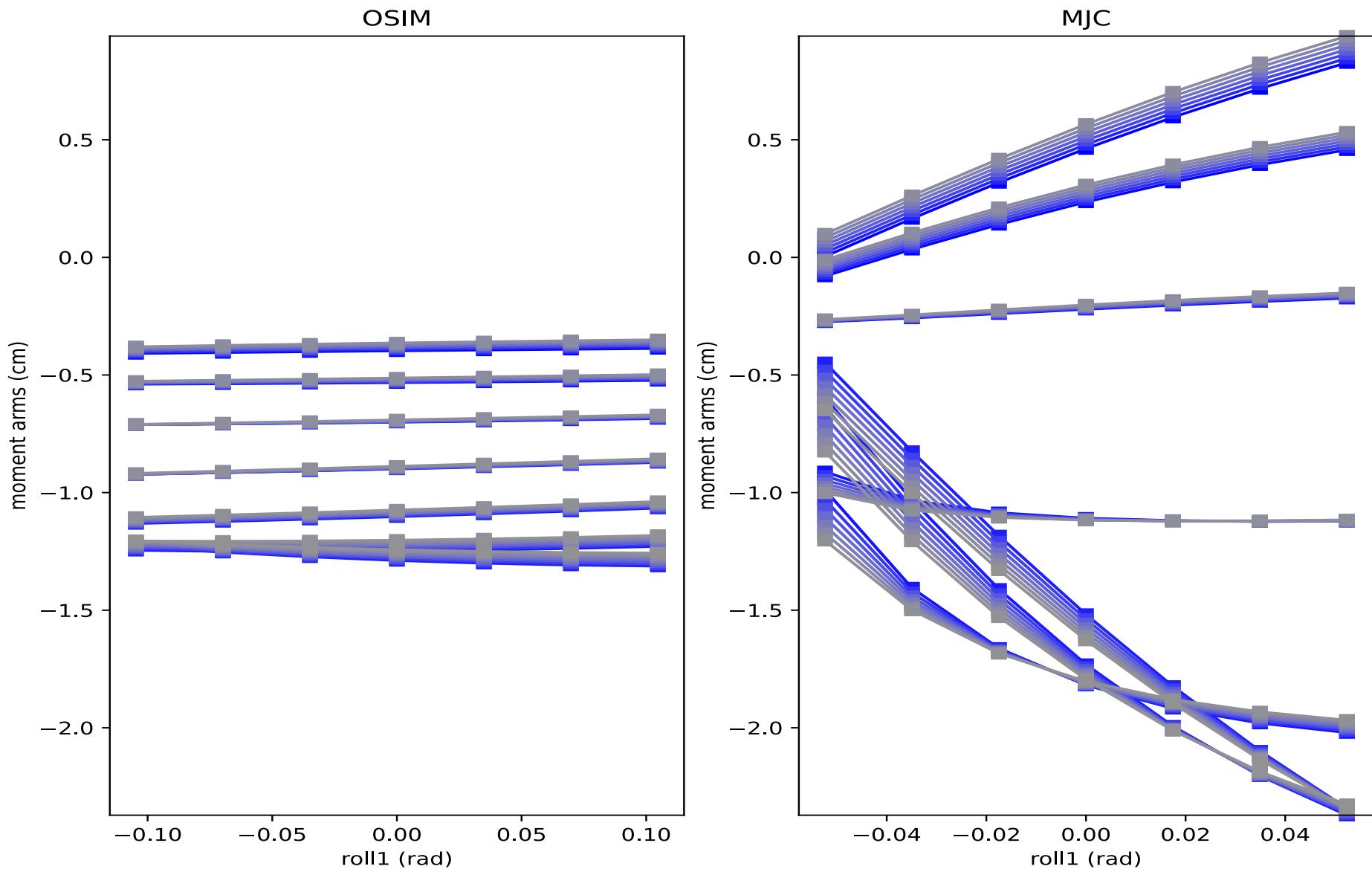
Muscle specific moment arm comparison with Osim model after optimization

SternoThyroid - pitch2 - roll2 - yaw2



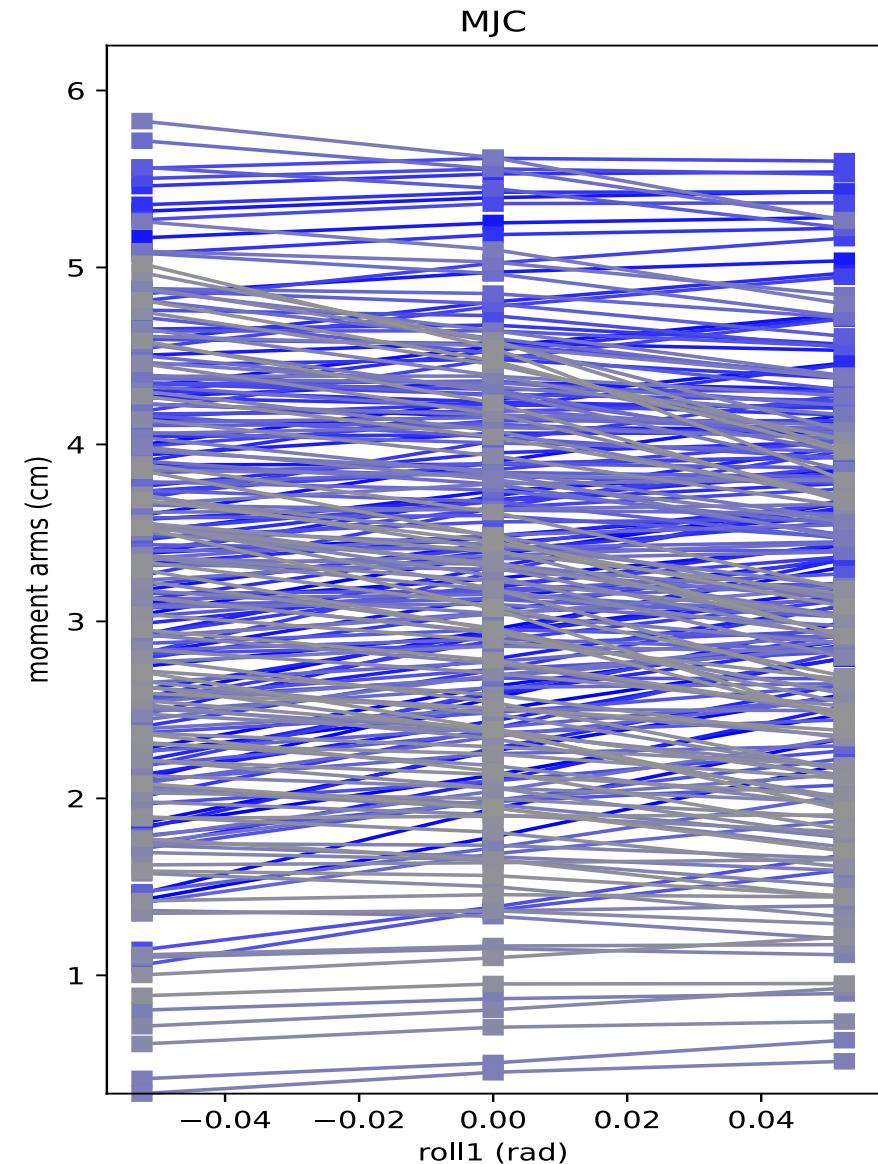
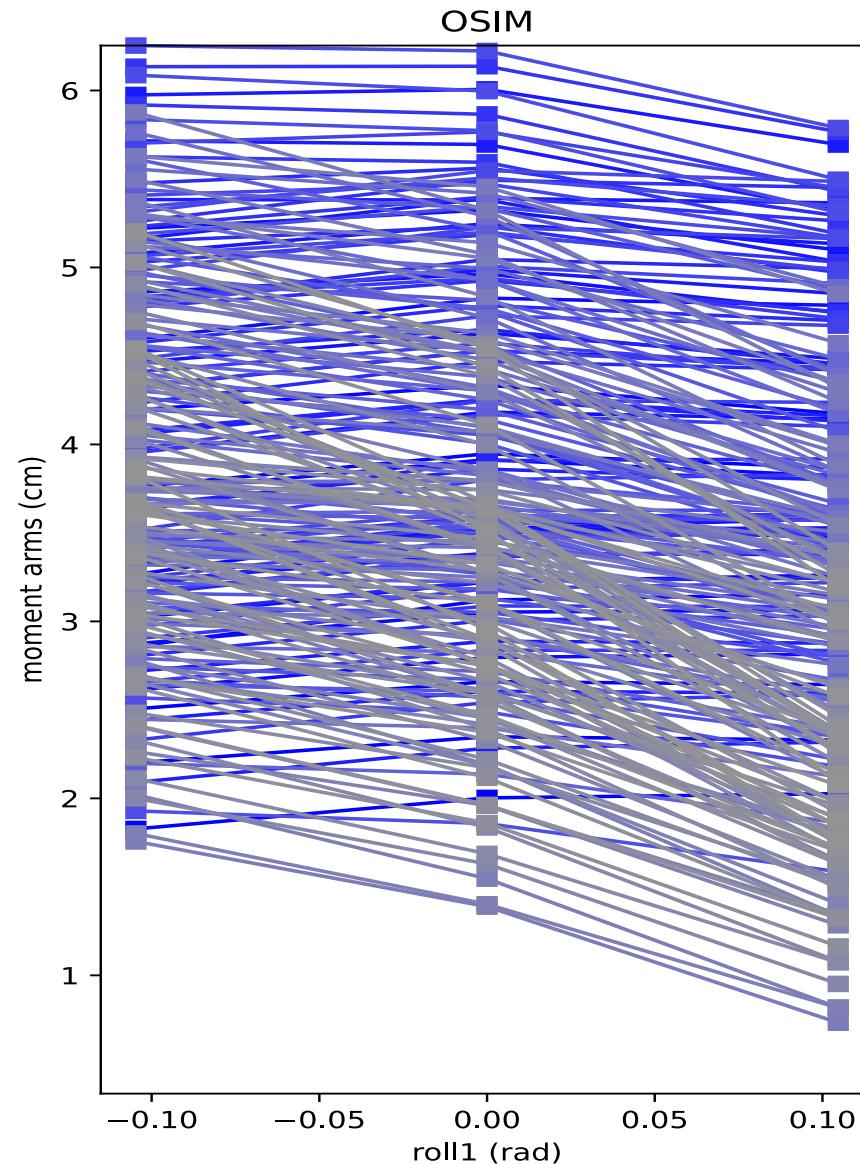
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4_L - pitch1 - roll1 - yaw1



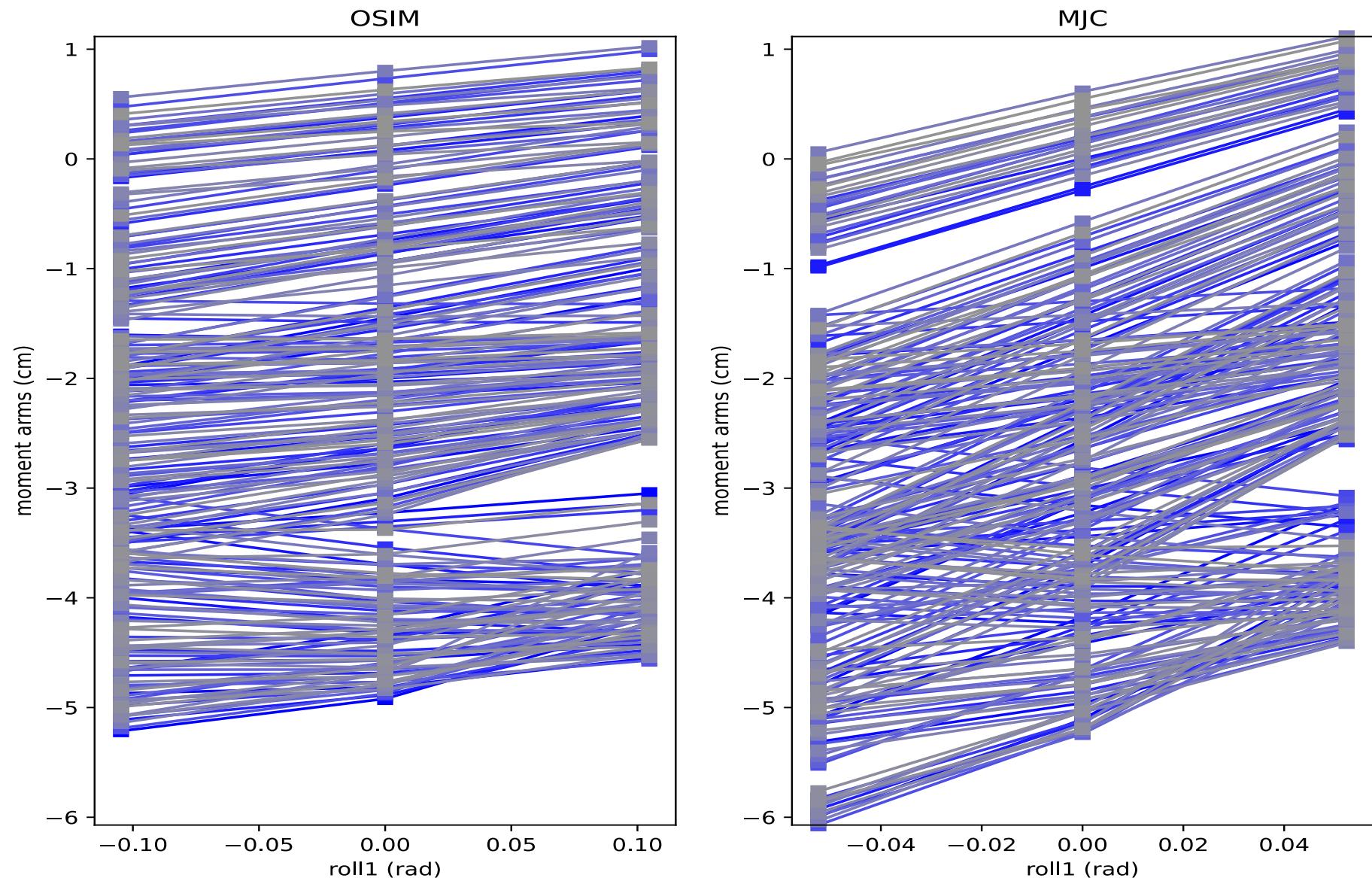
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



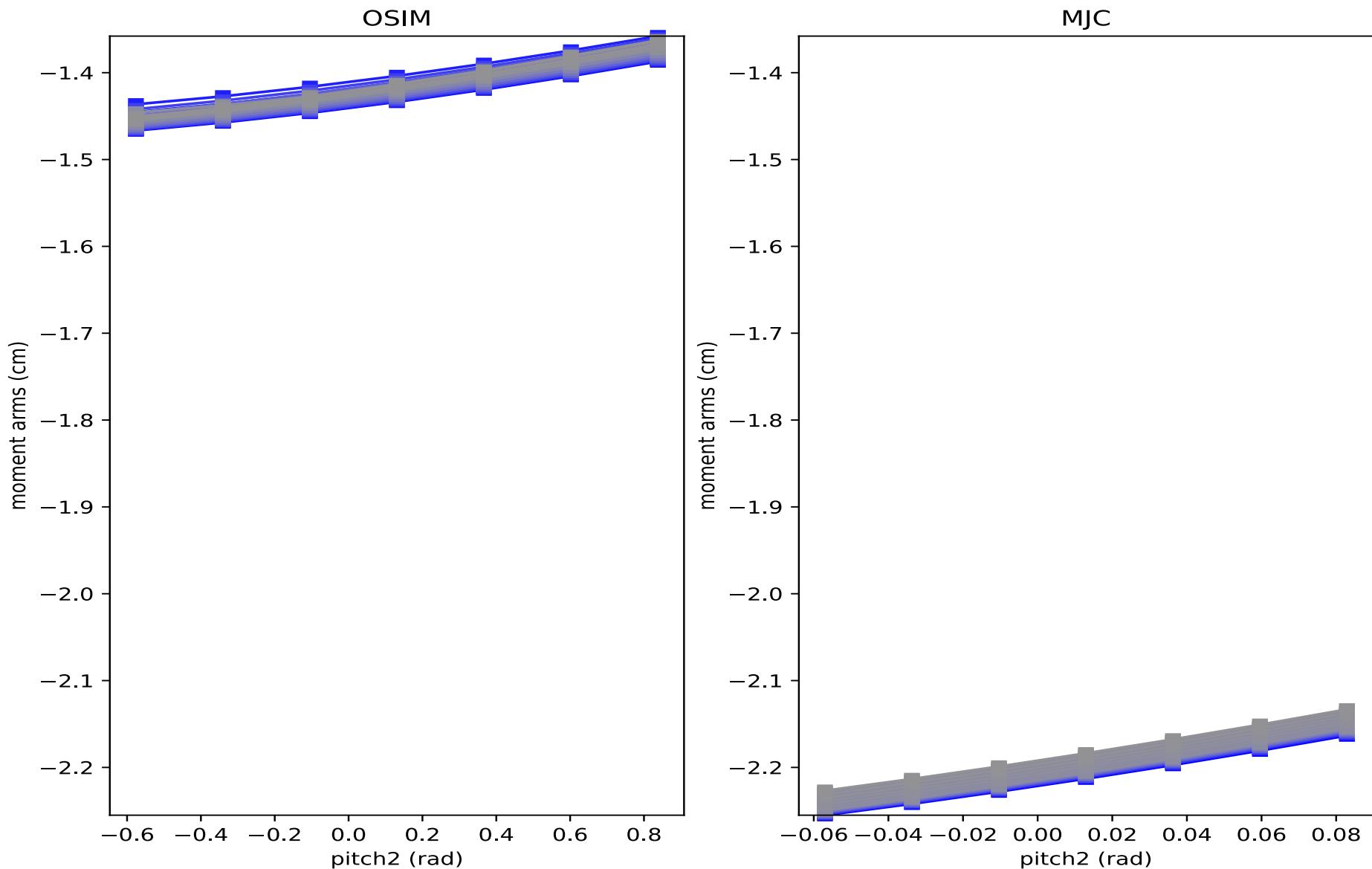
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



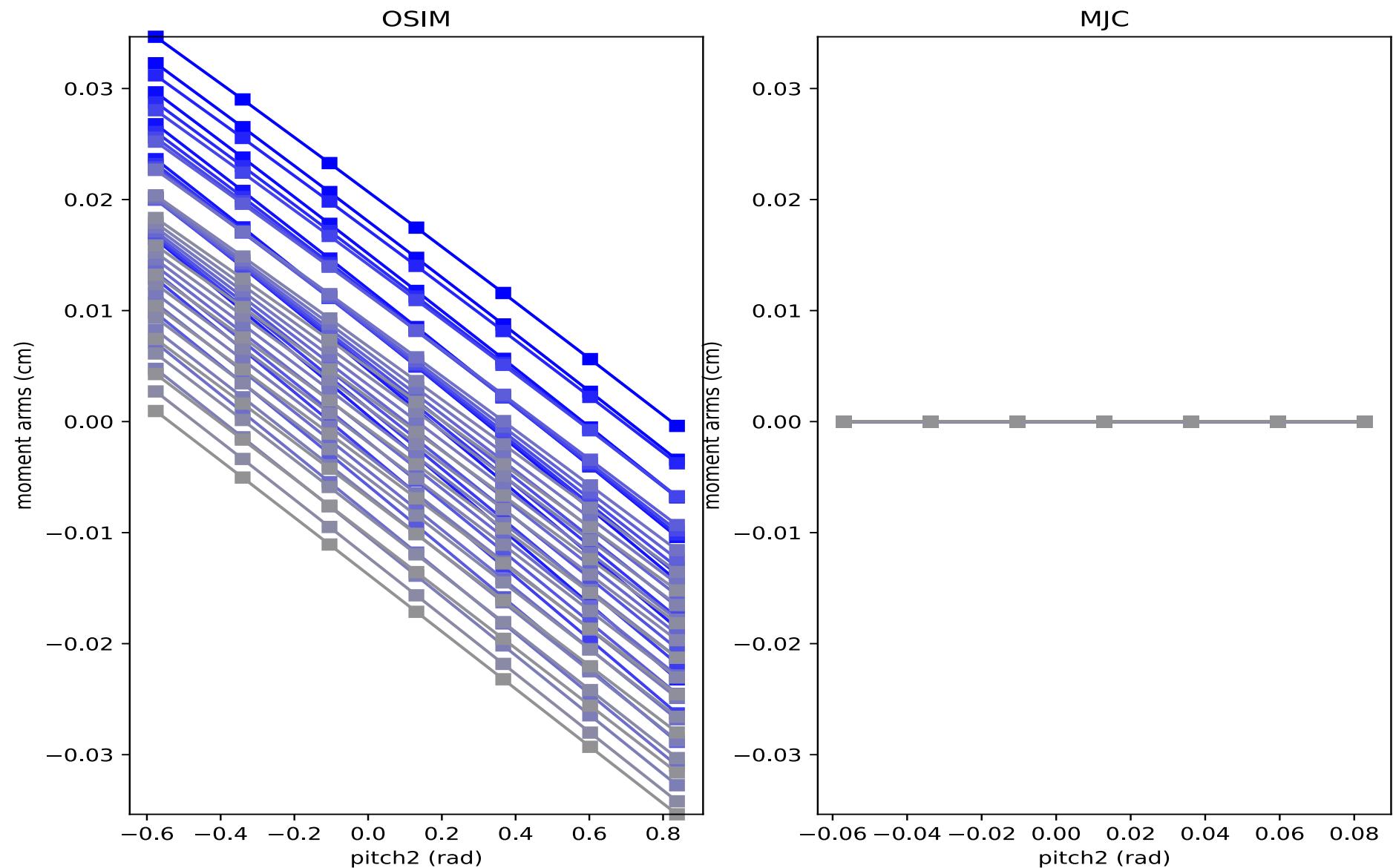
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch2 - roll2 - yaw2



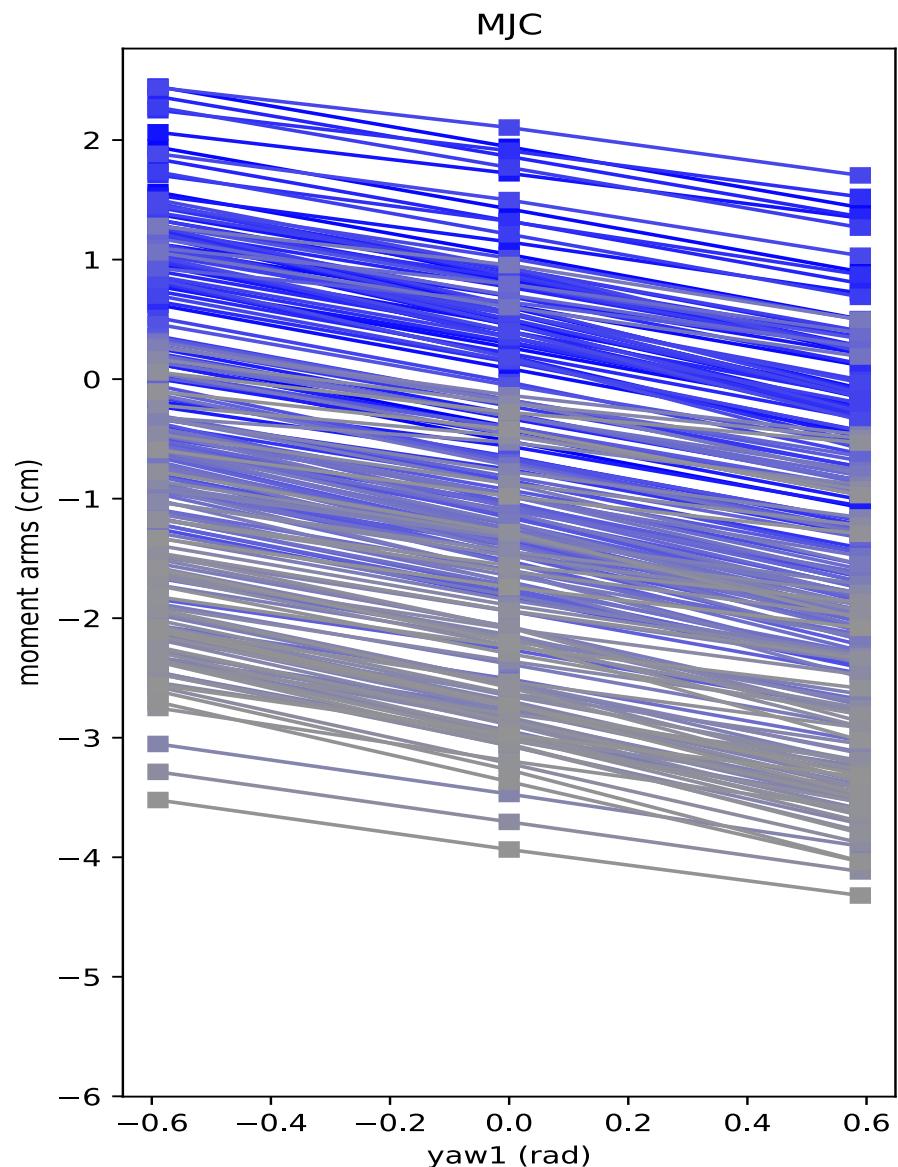
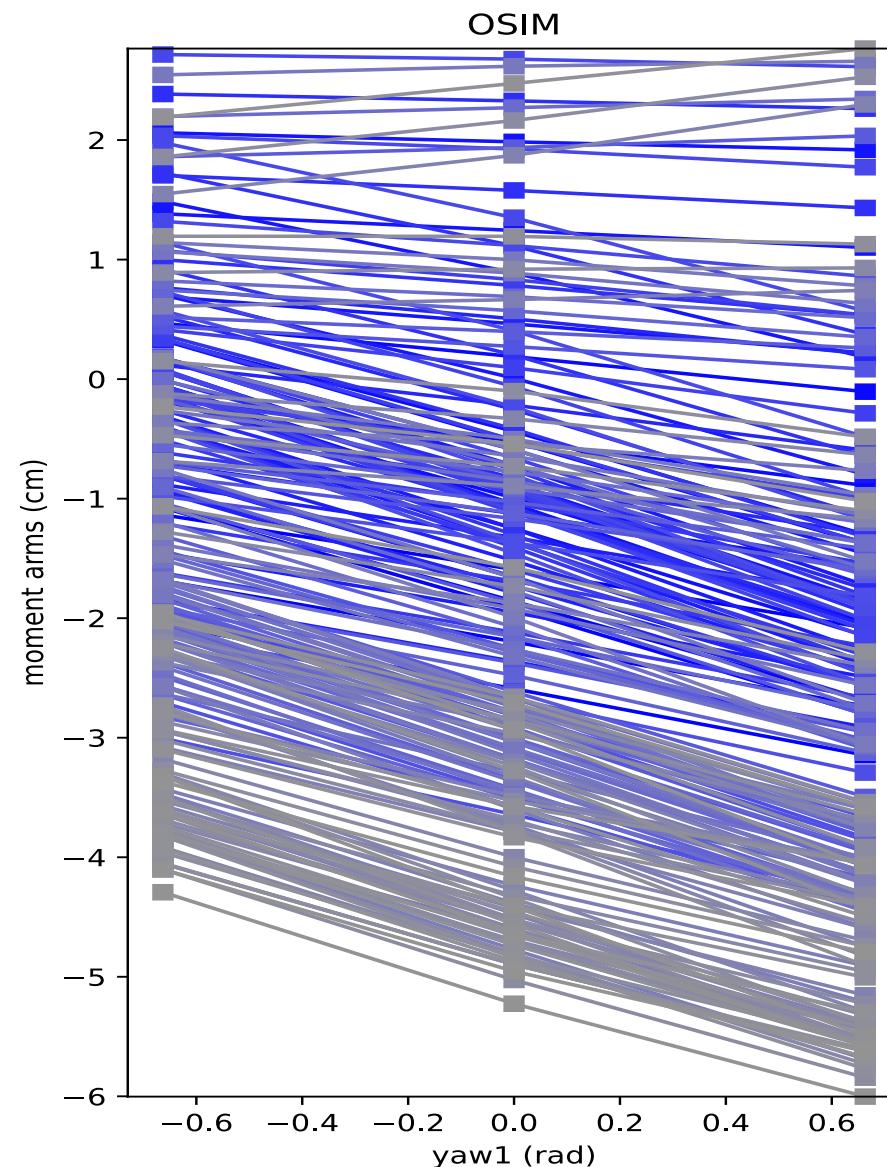
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4_L - pitch2 - roll2 - yaw2



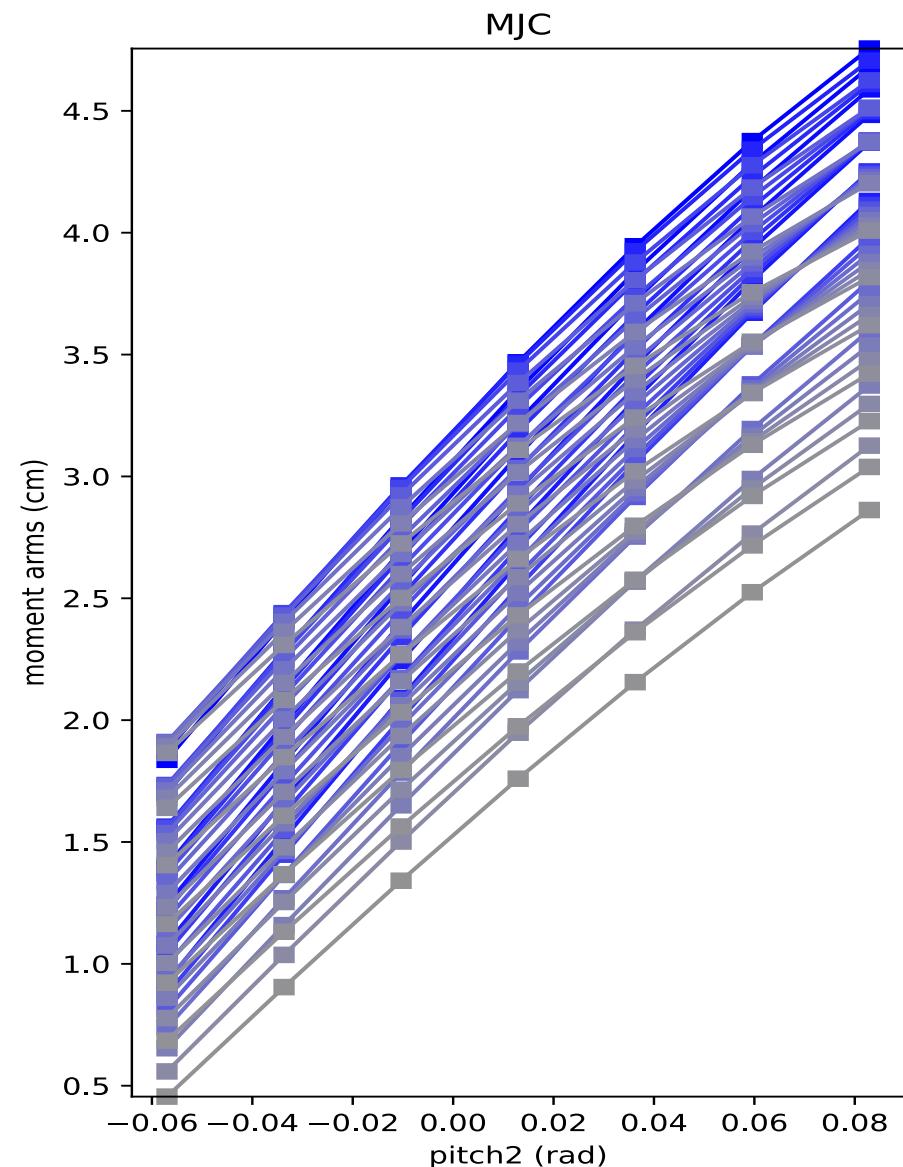
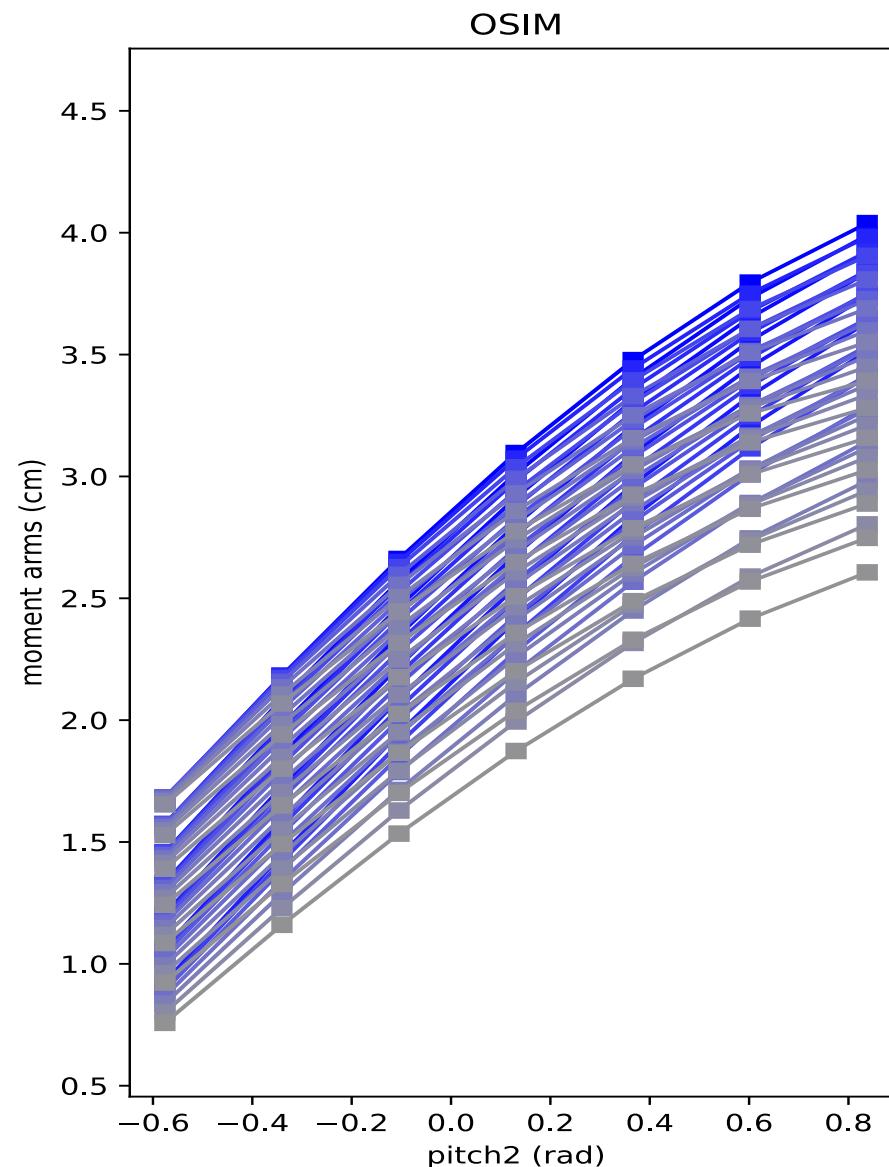
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



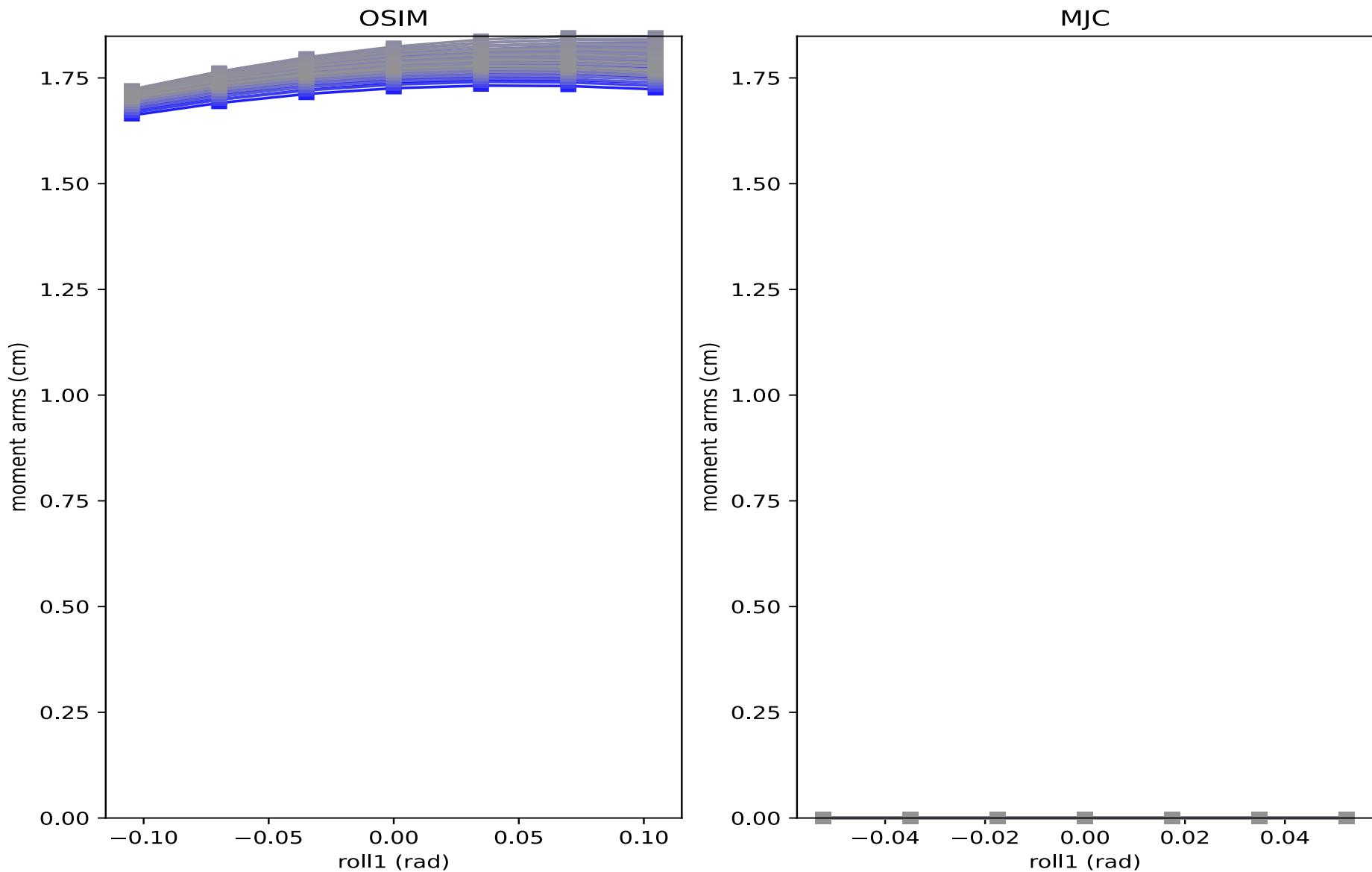
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx - pitch2 - roll2 - yaw2



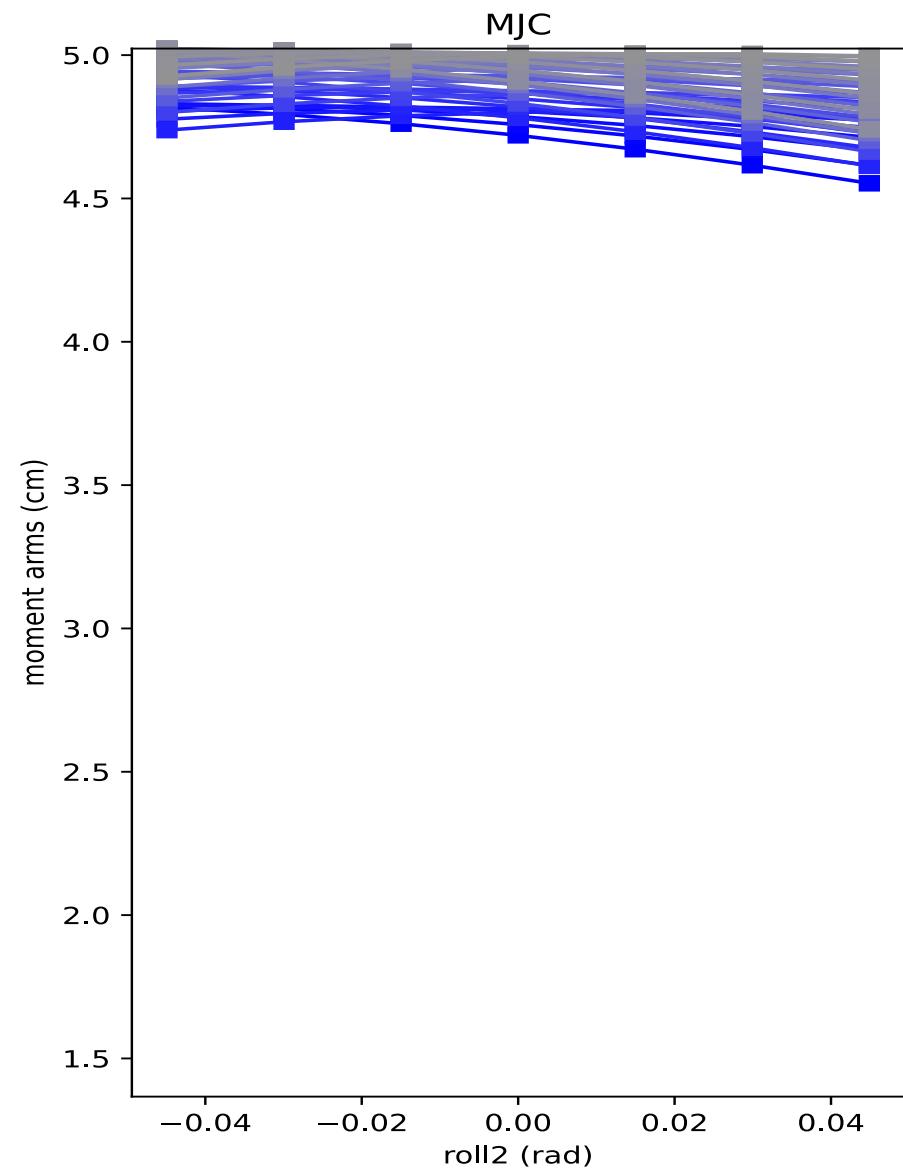
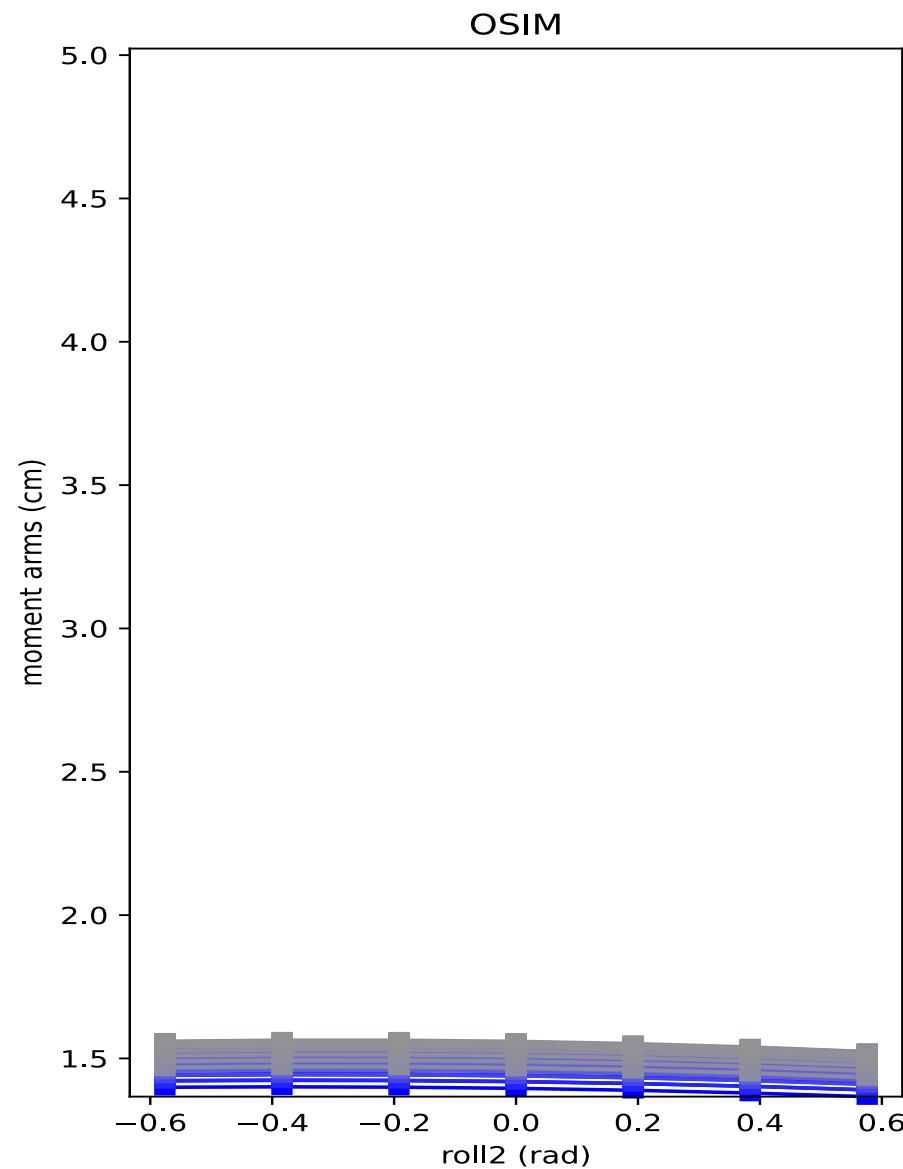
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat - pitch1 - roll1 - yaw1



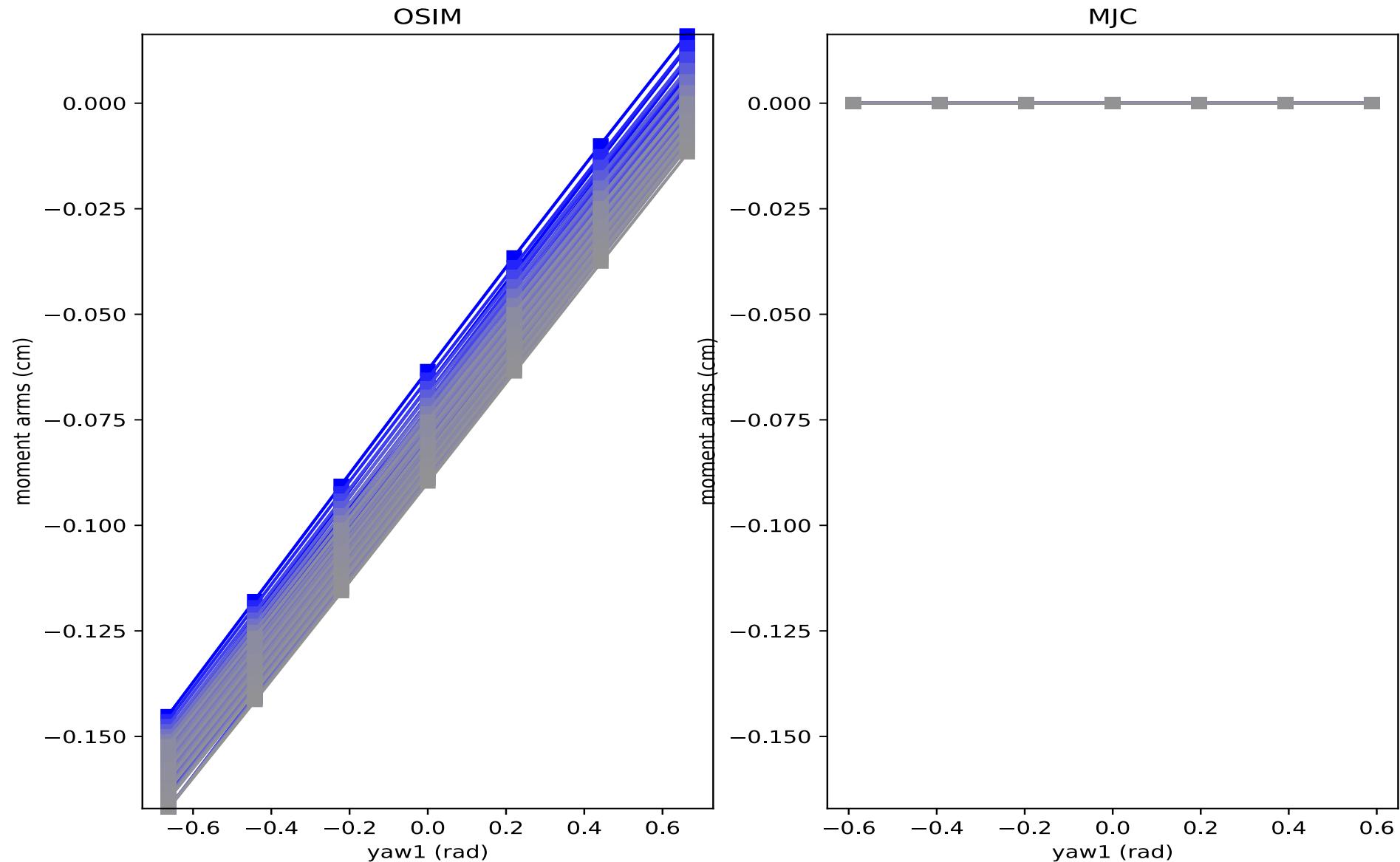
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post - pitch2 - roll2 - yaw2



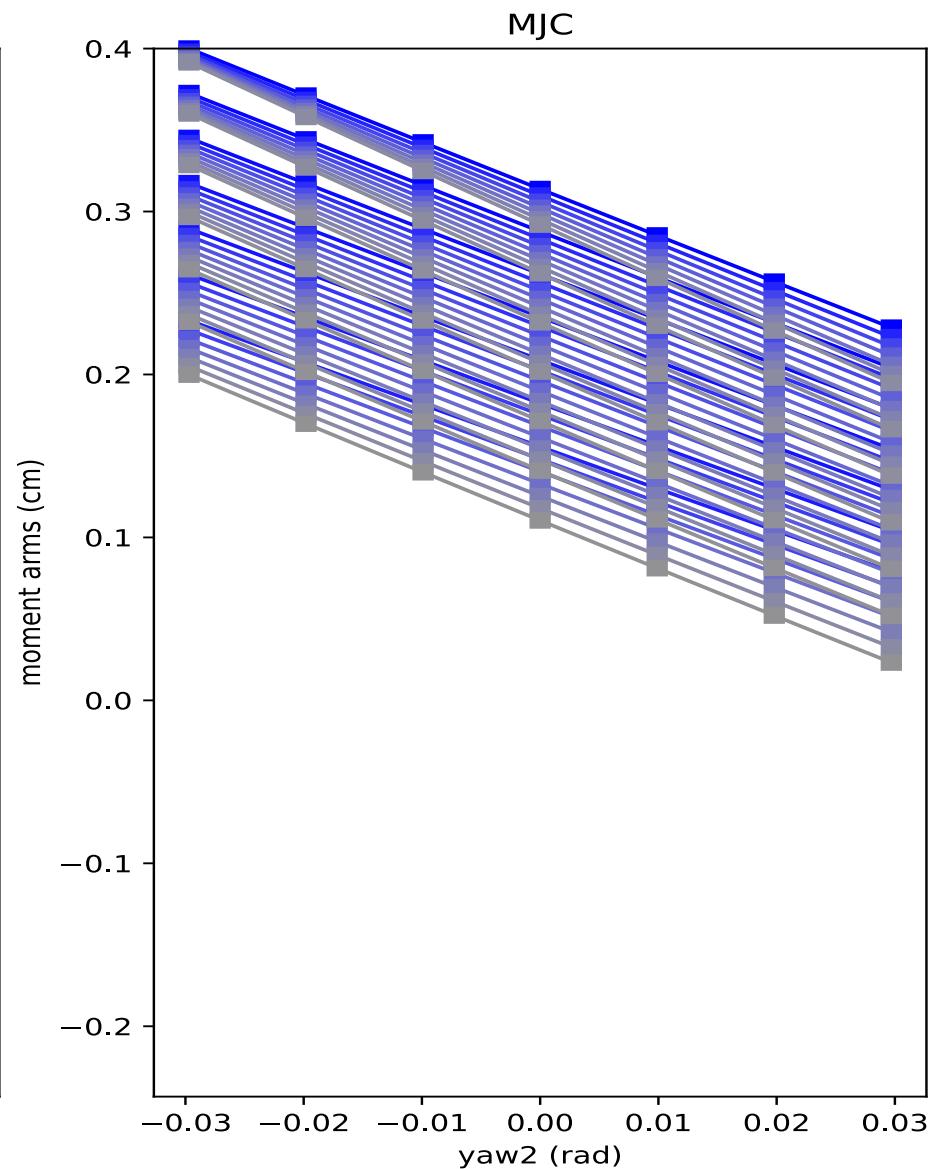
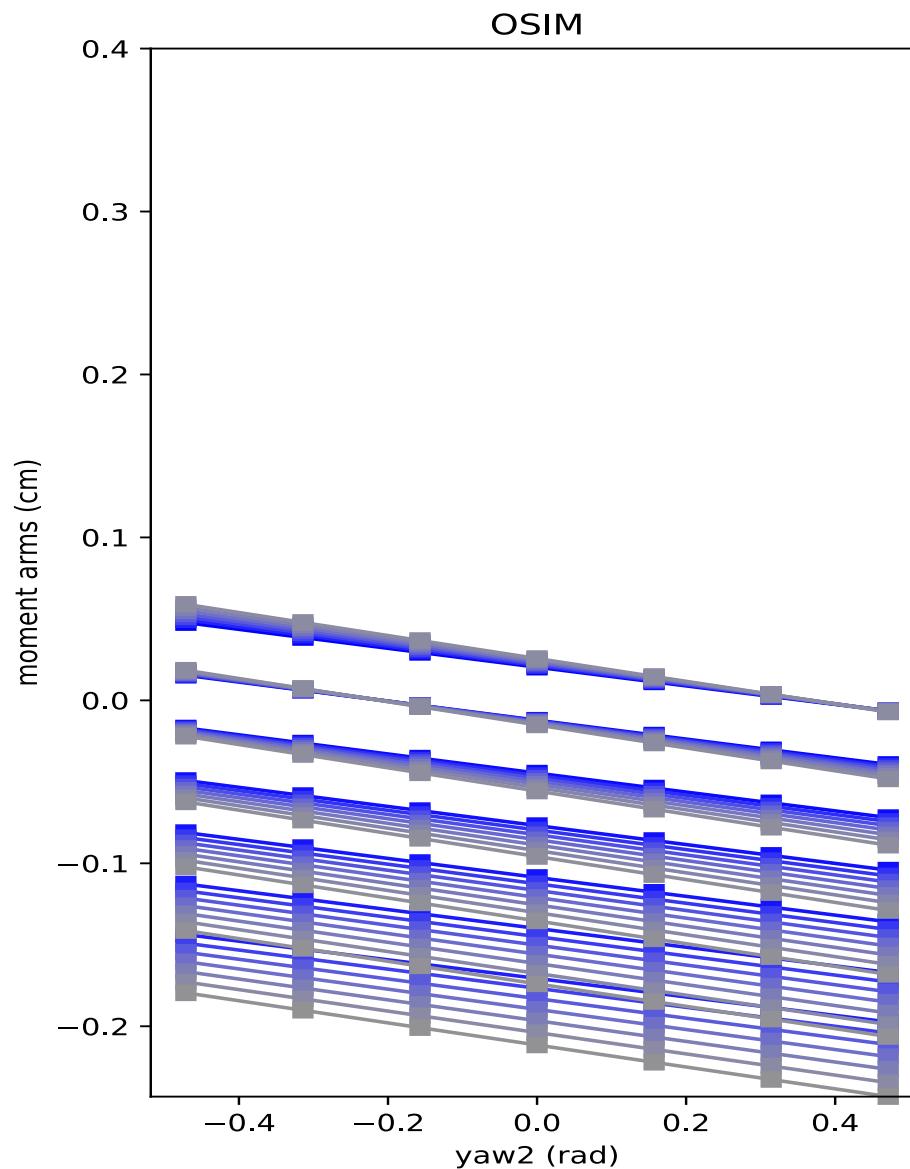
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Lat_L - pitch1 - roll1 - yaw1



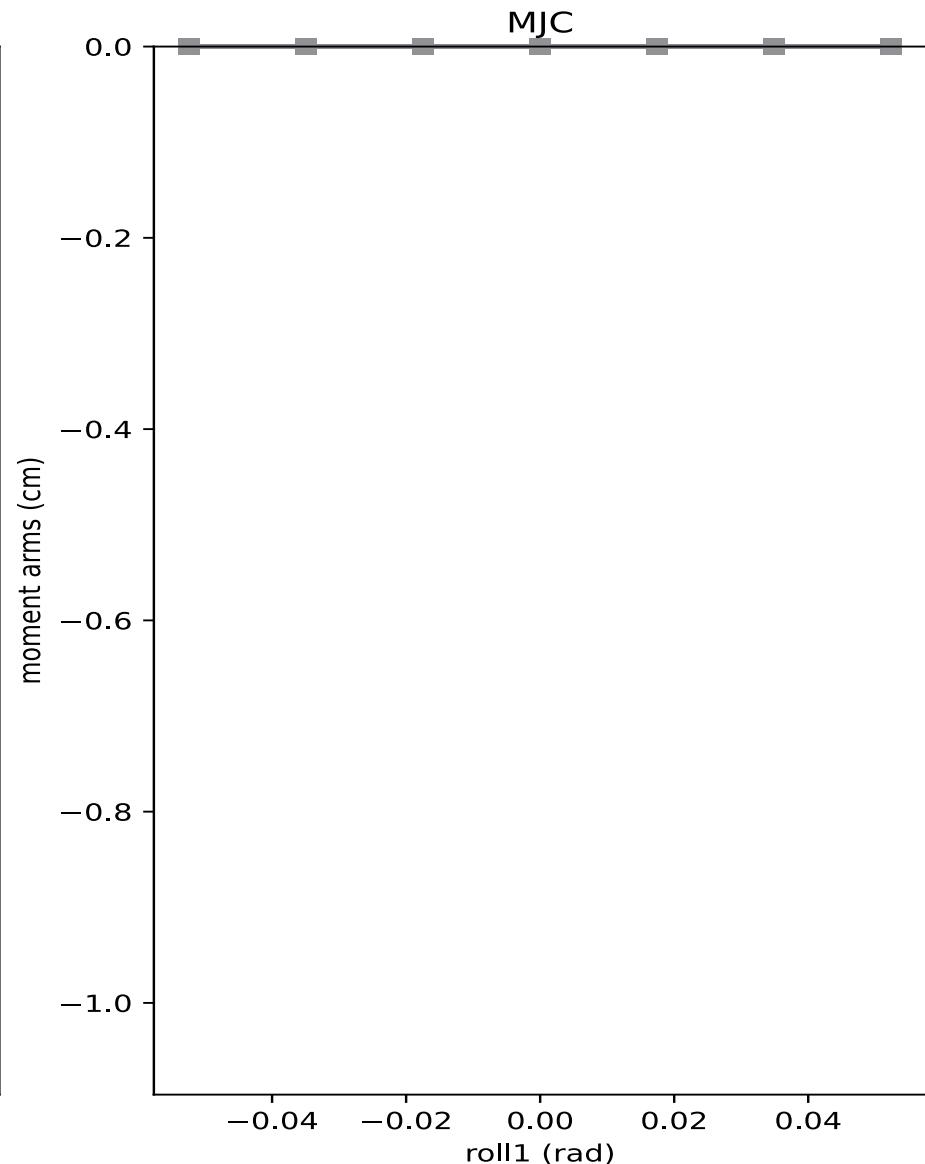
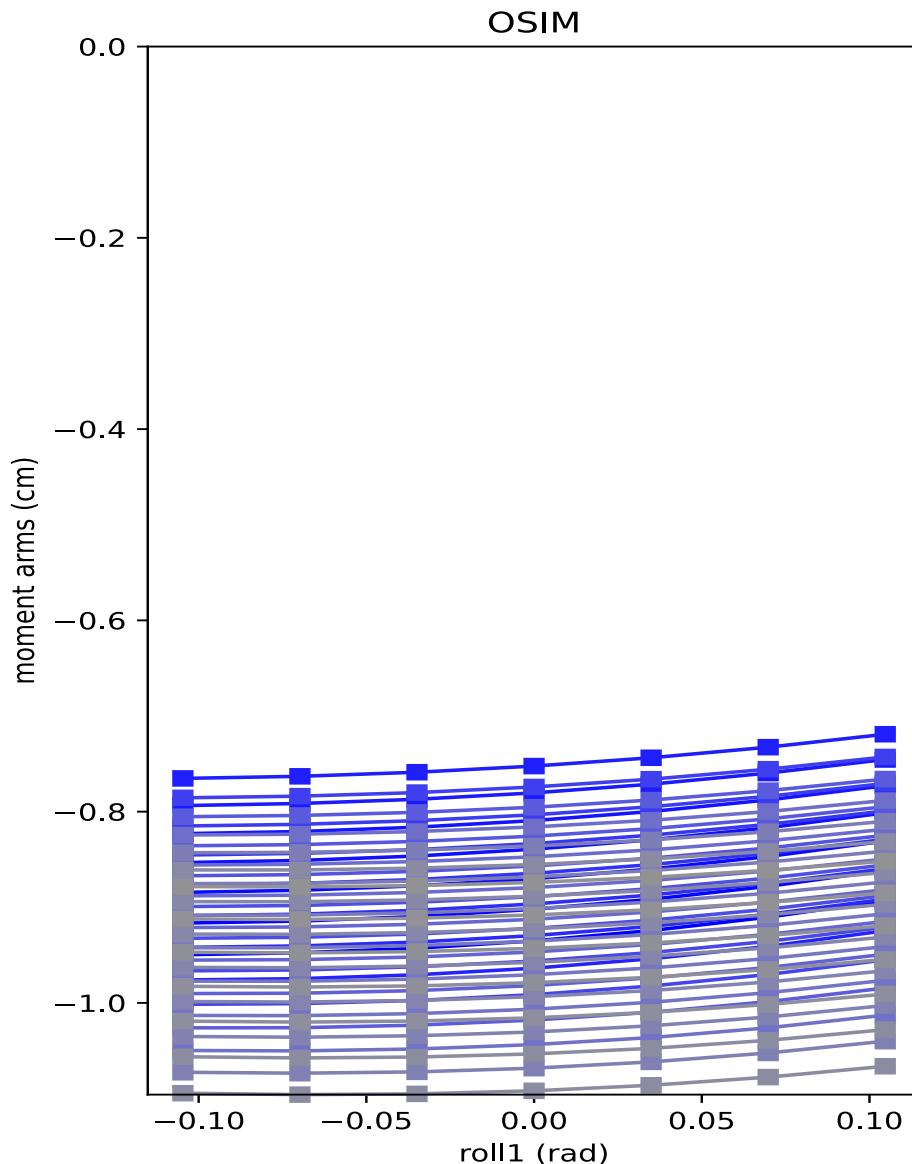
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx - pitch2 - roll2 - yaw2



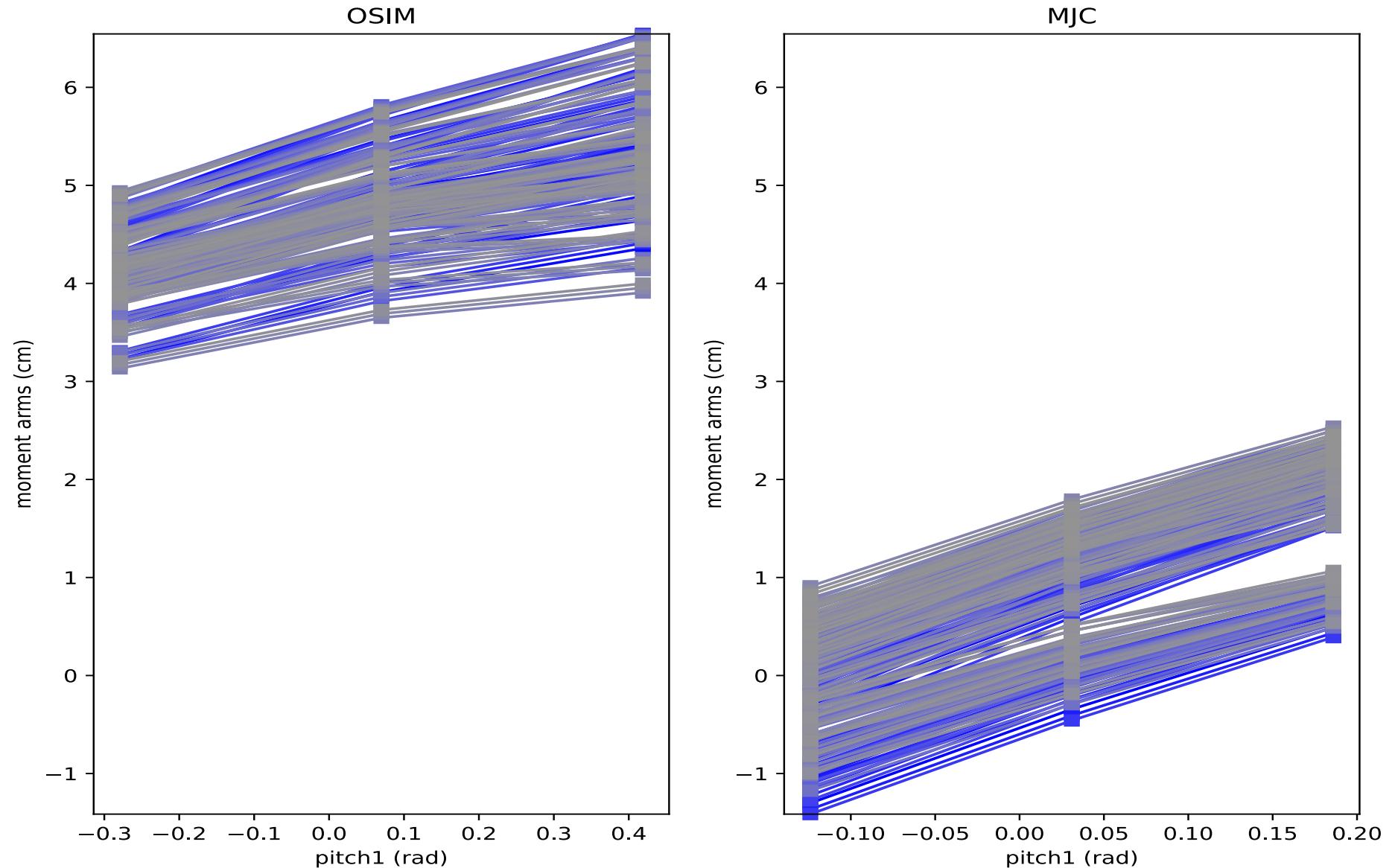
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup_L - pitch1 - roll1 - yaw1



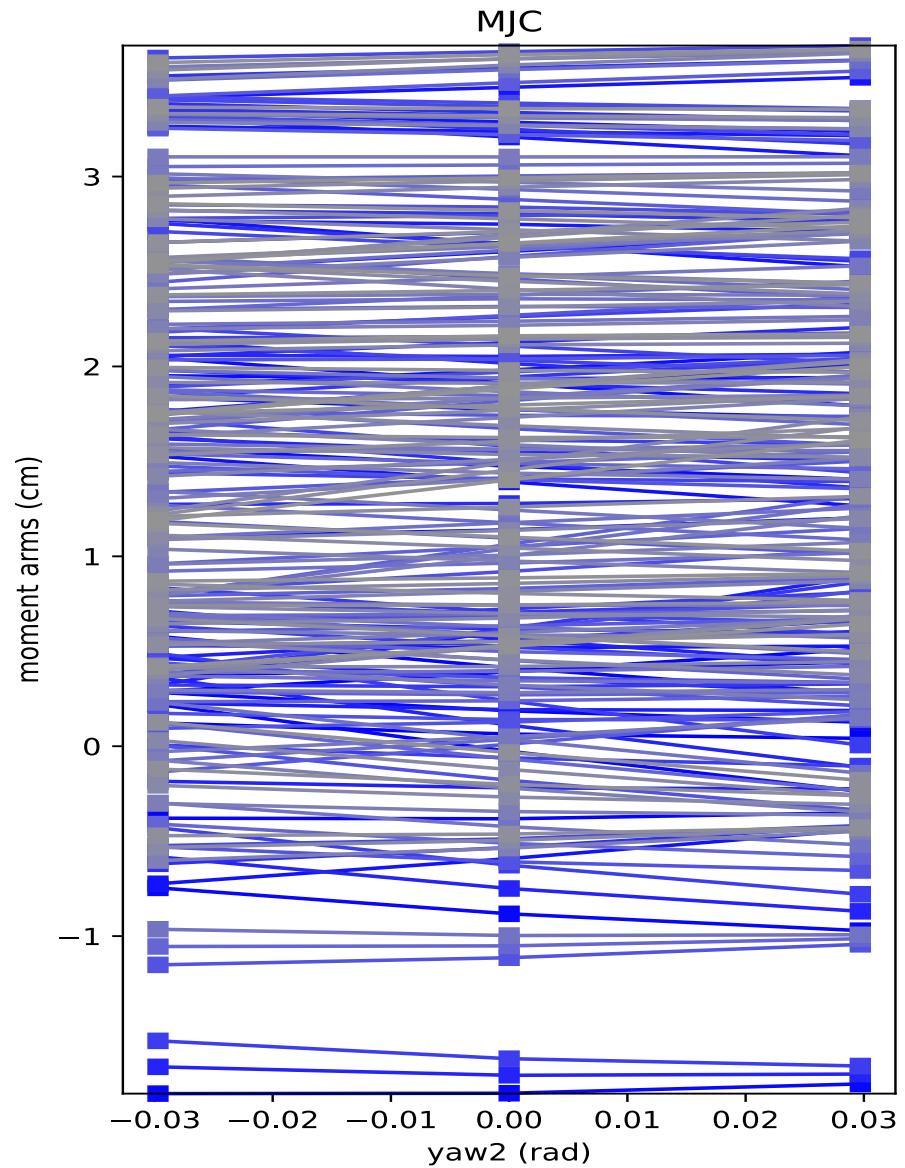
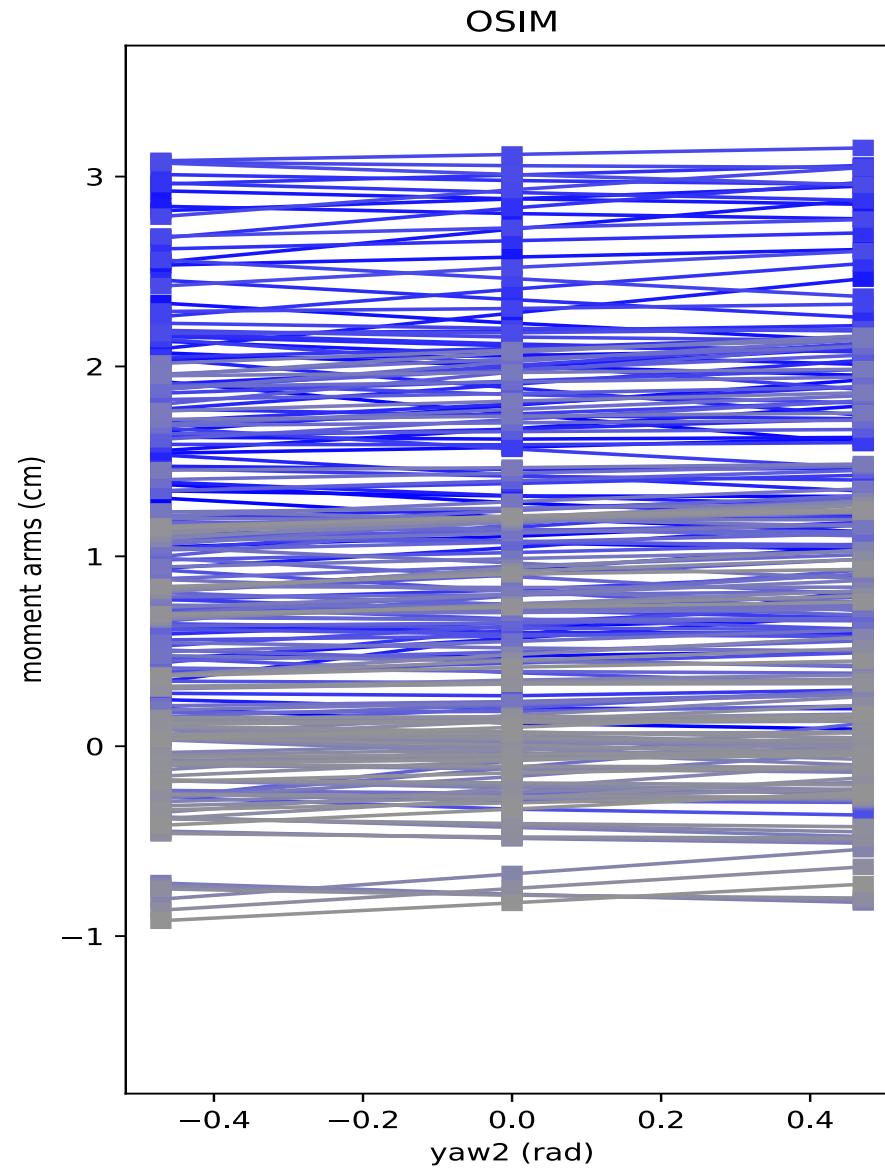
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



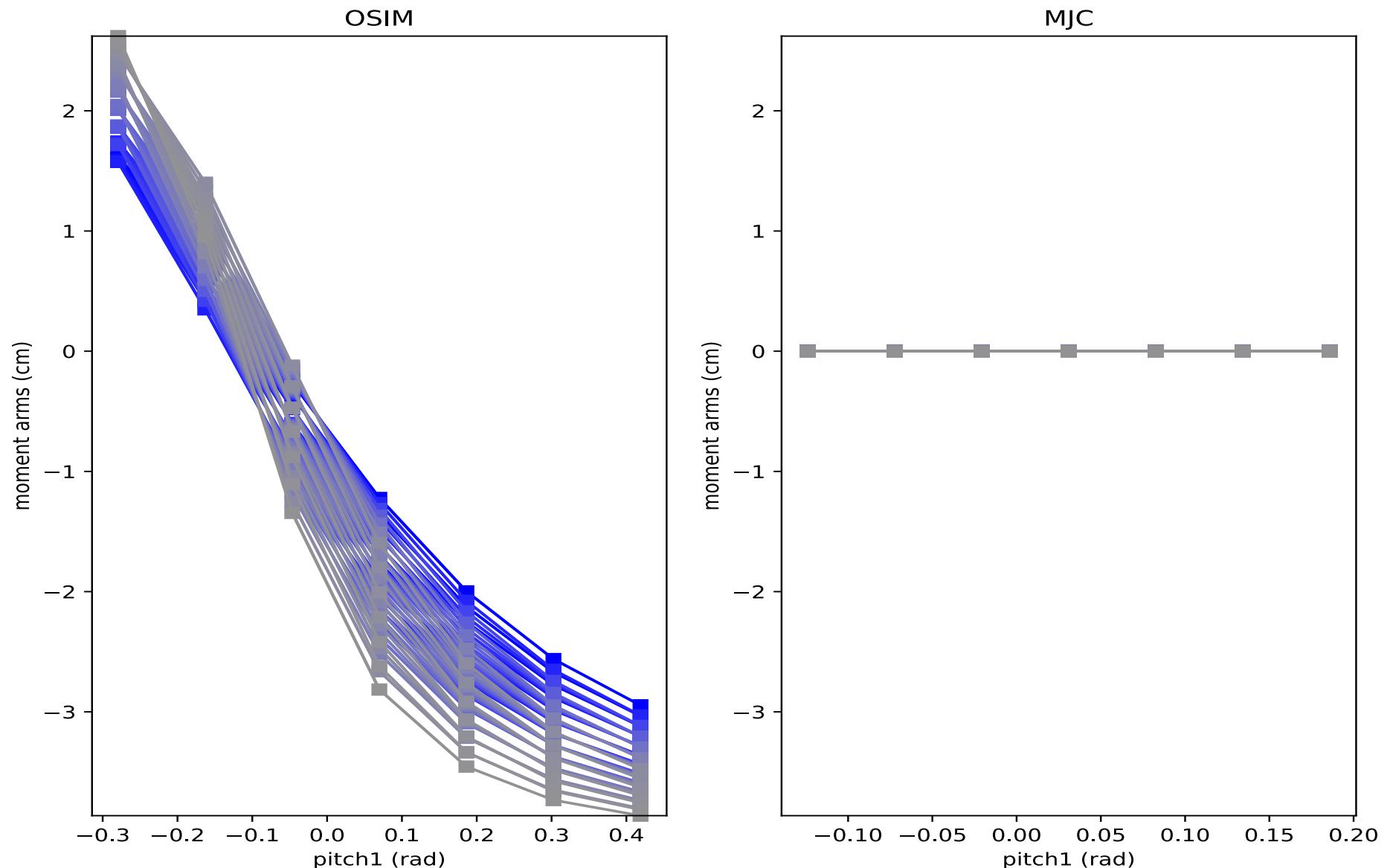
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



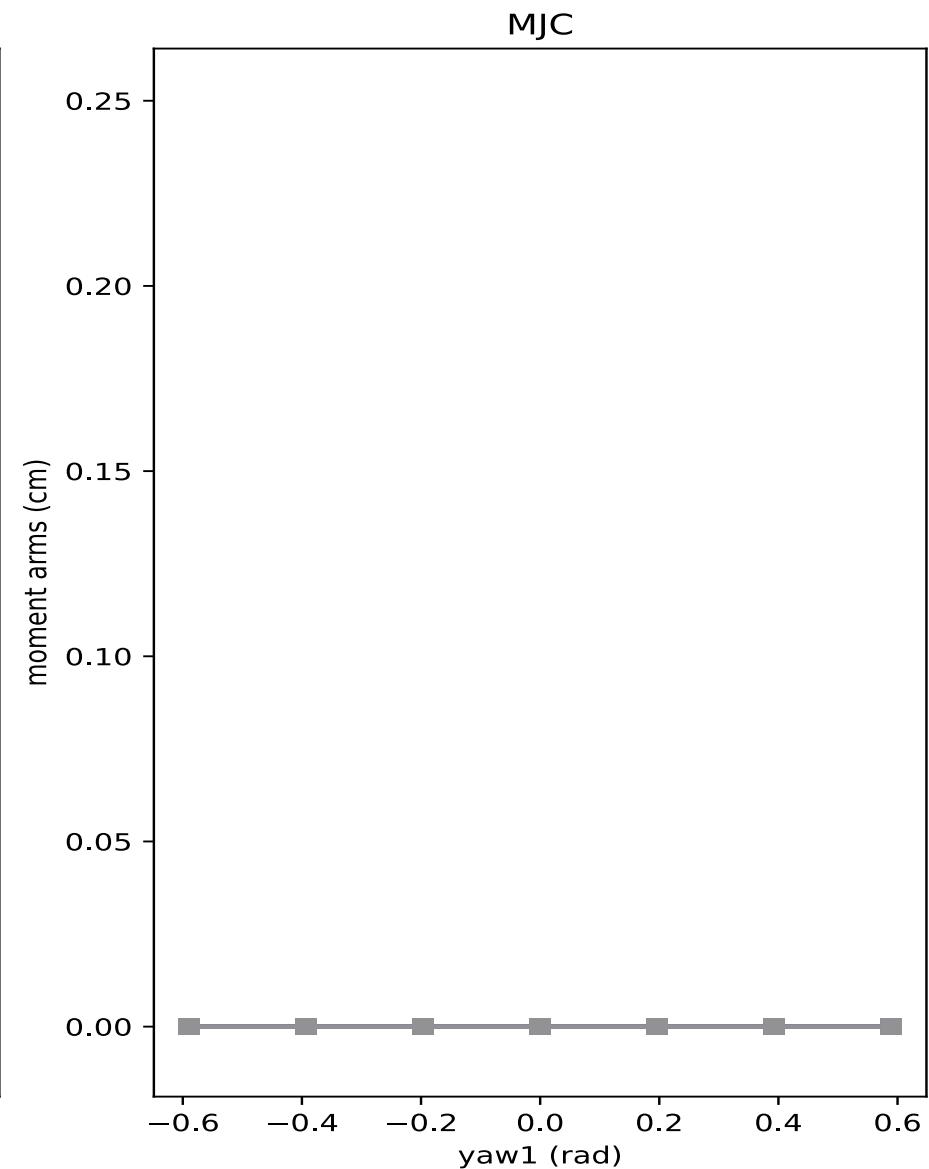
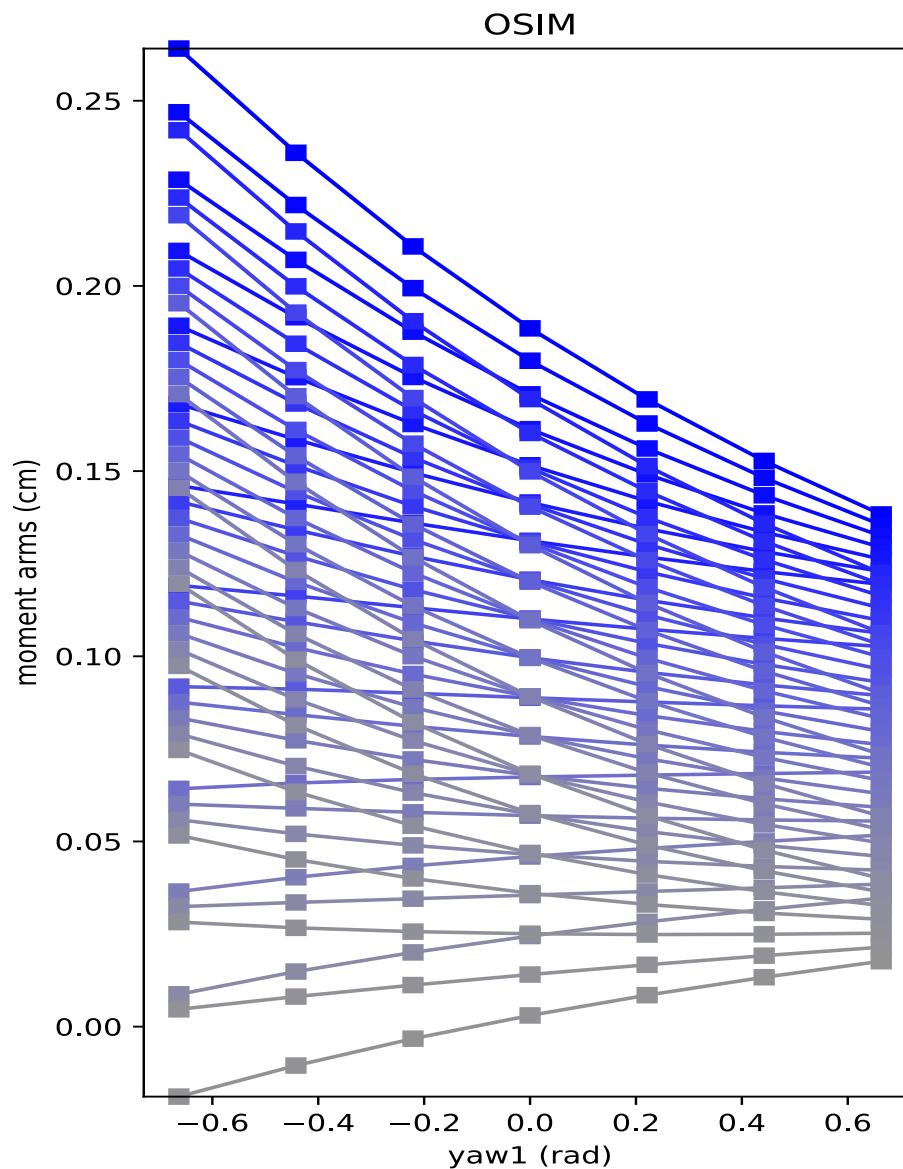
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant - pitch1 - roll1 - yaw1



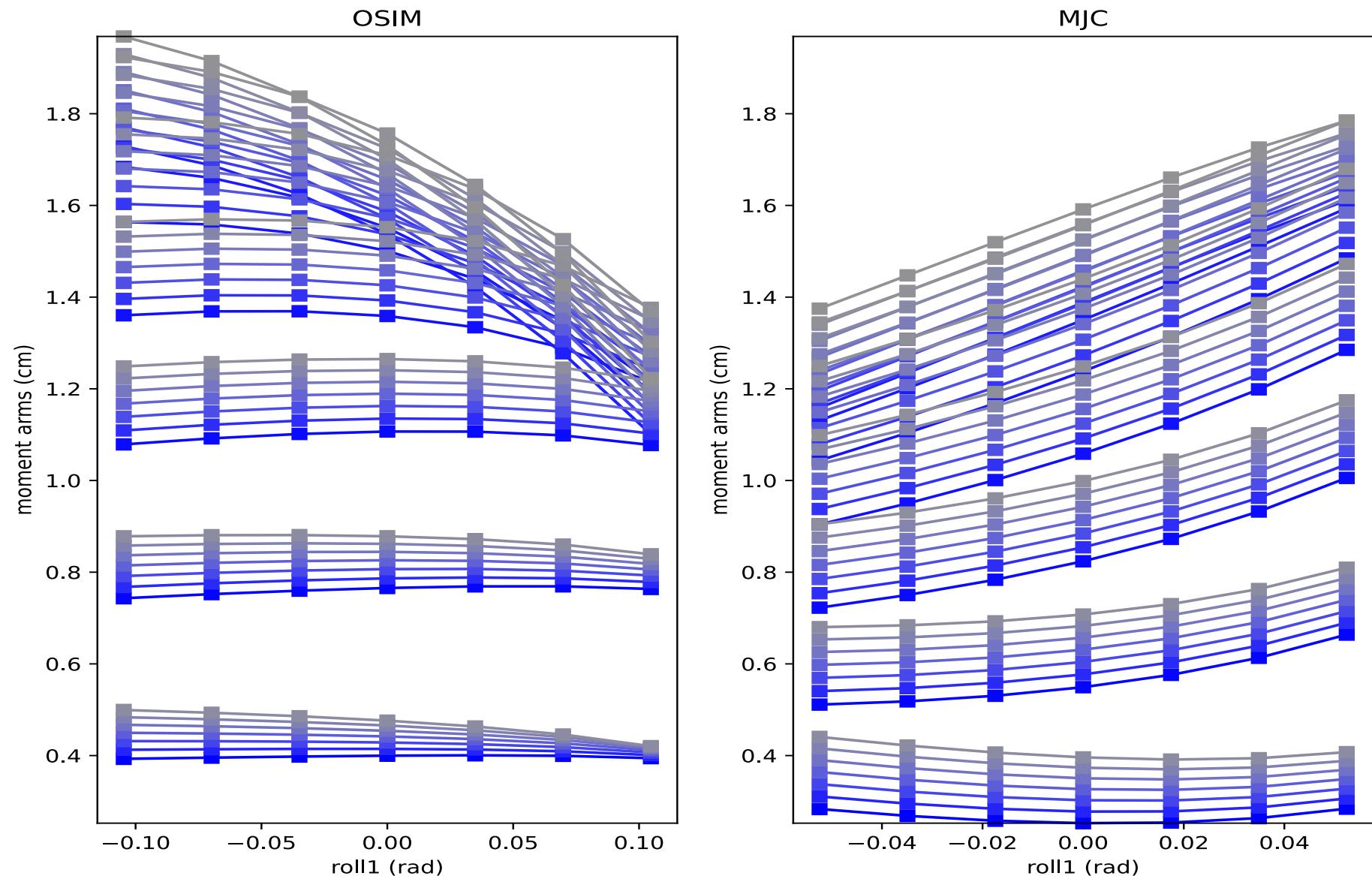
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid_L - pitch1 - roll1 - yaw1



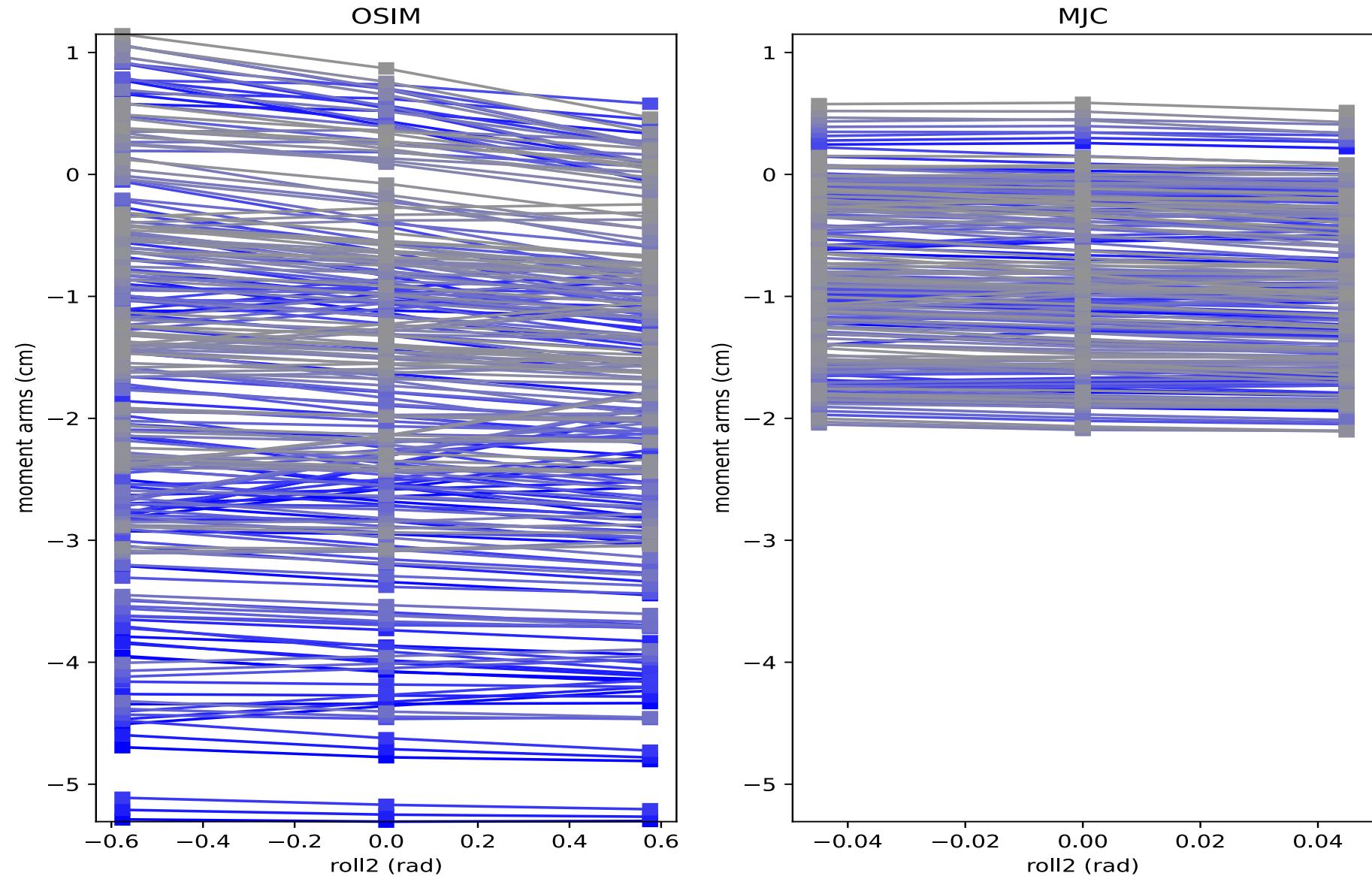
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj - pitch1 - roll1 - yaw1



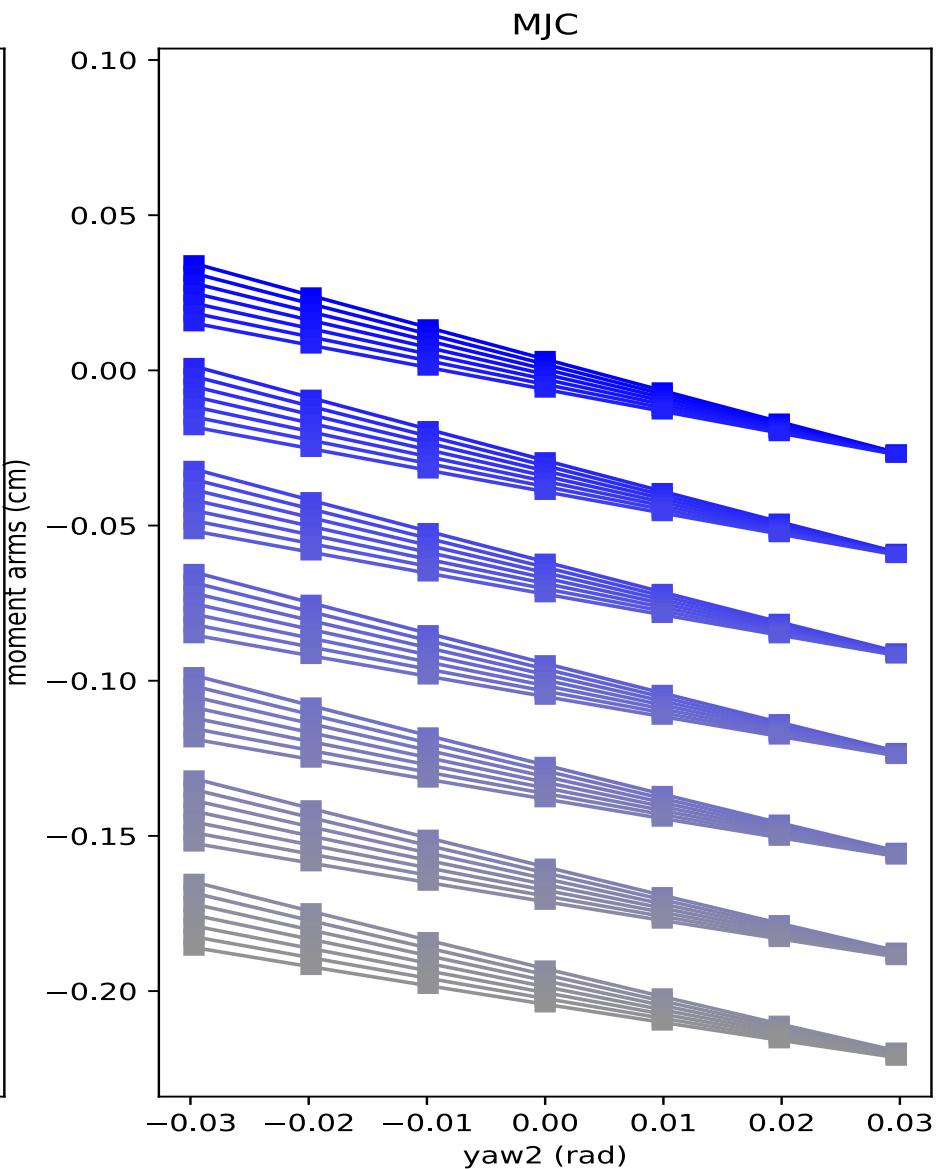
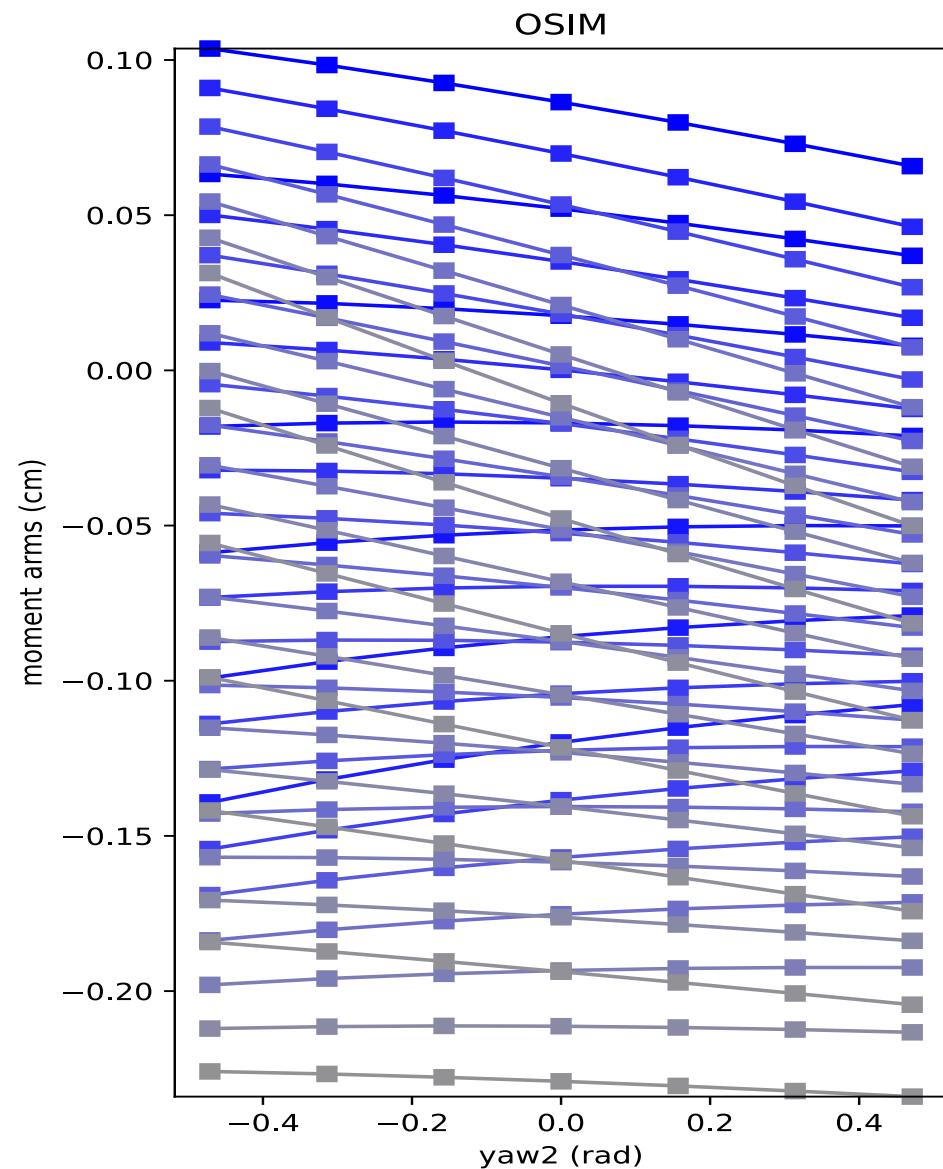
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



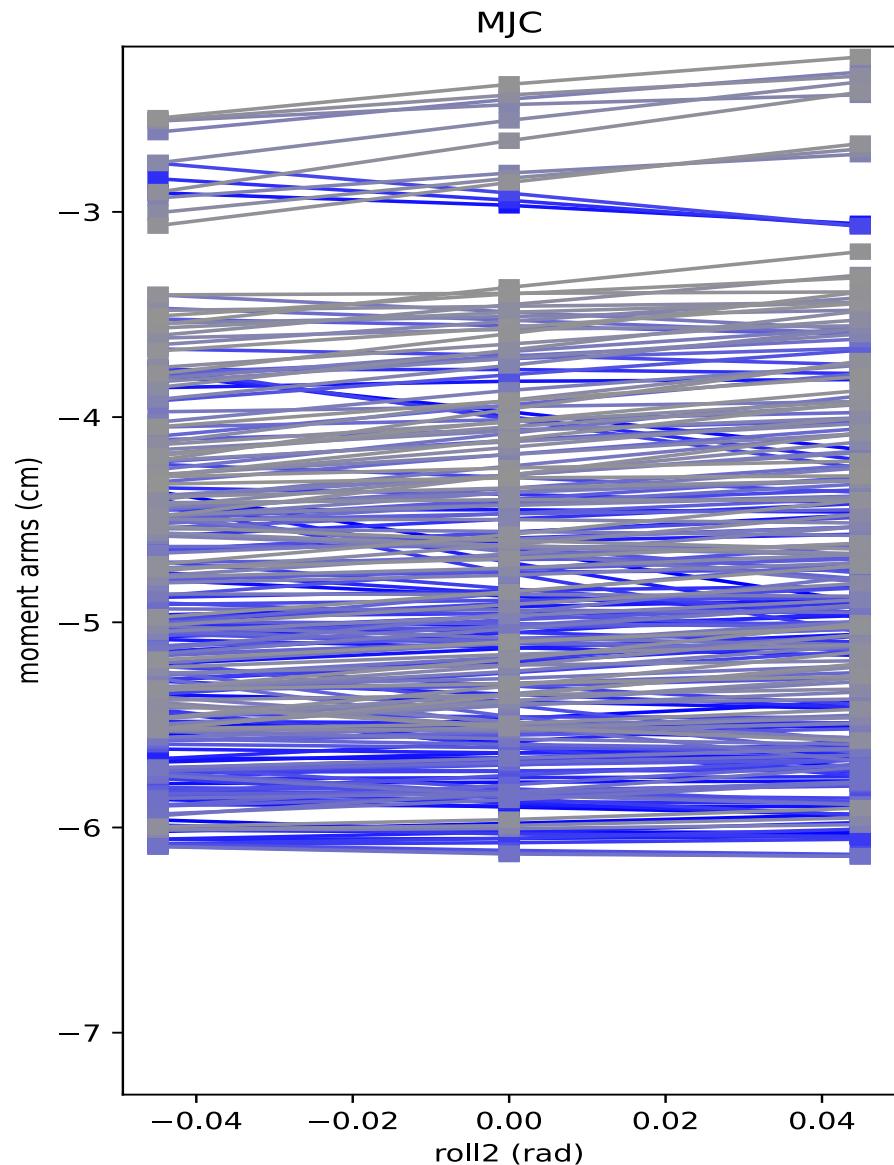
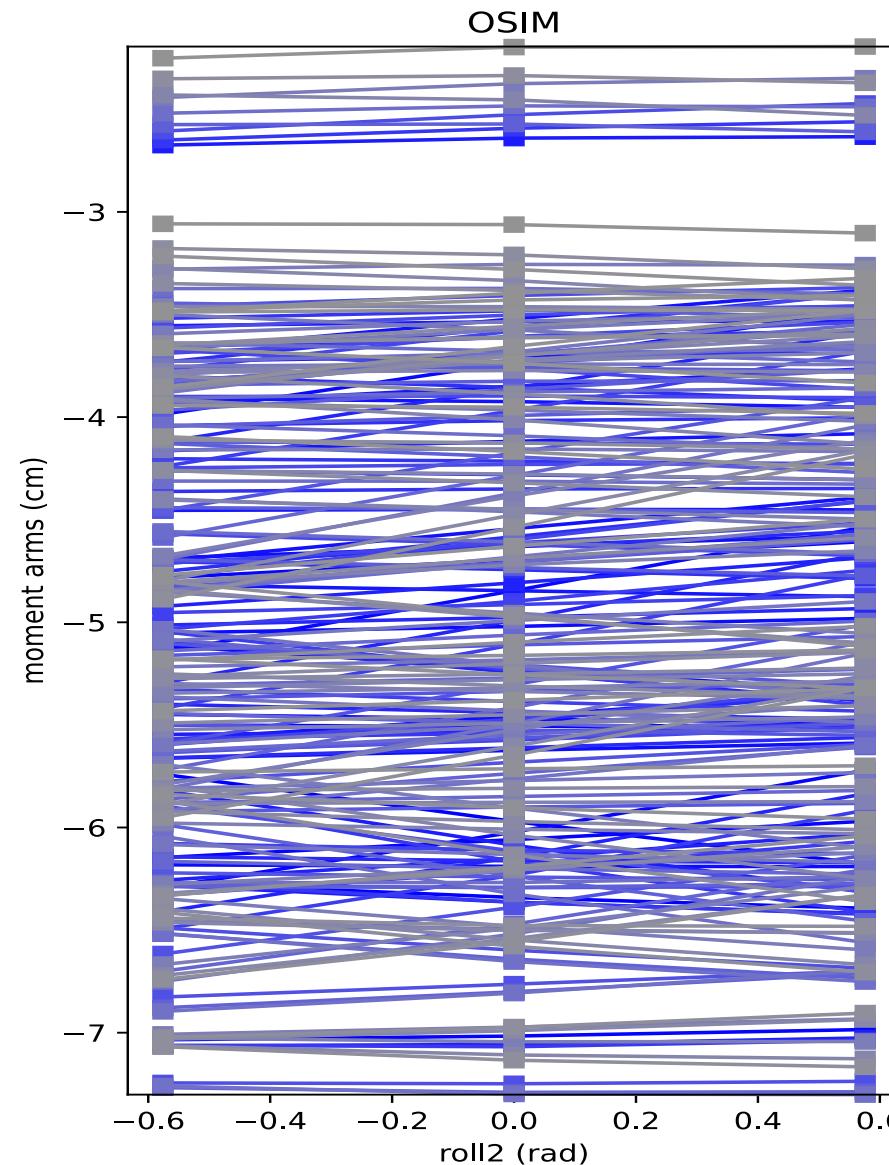
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch2 - roll2 - yaw2



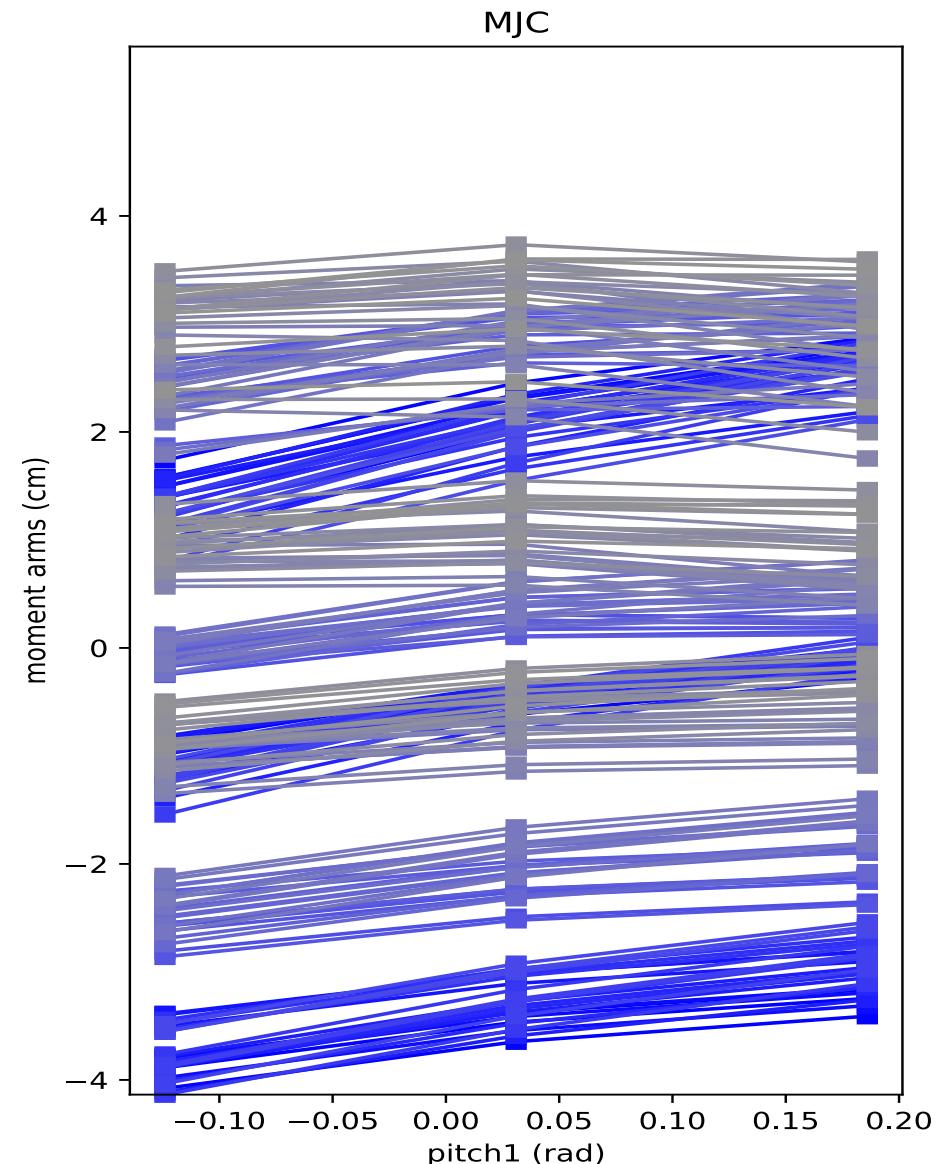
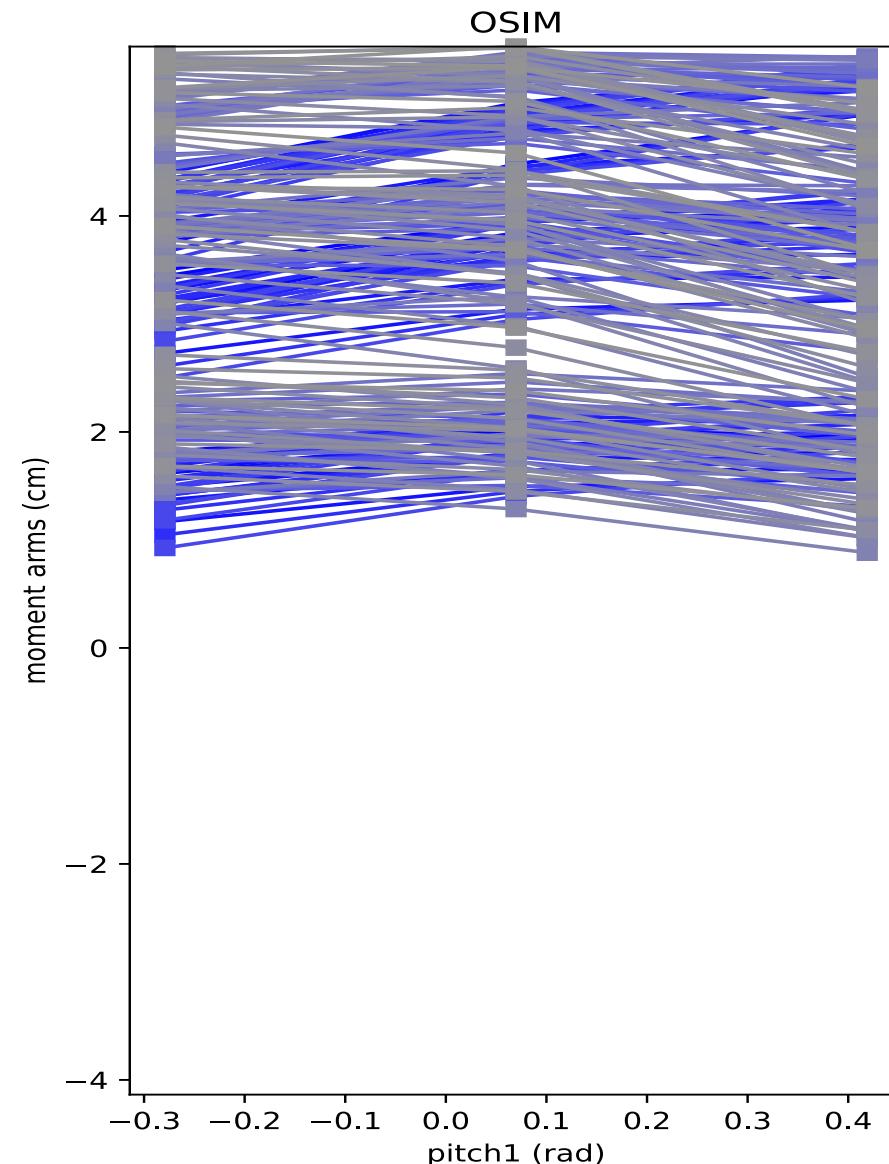
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



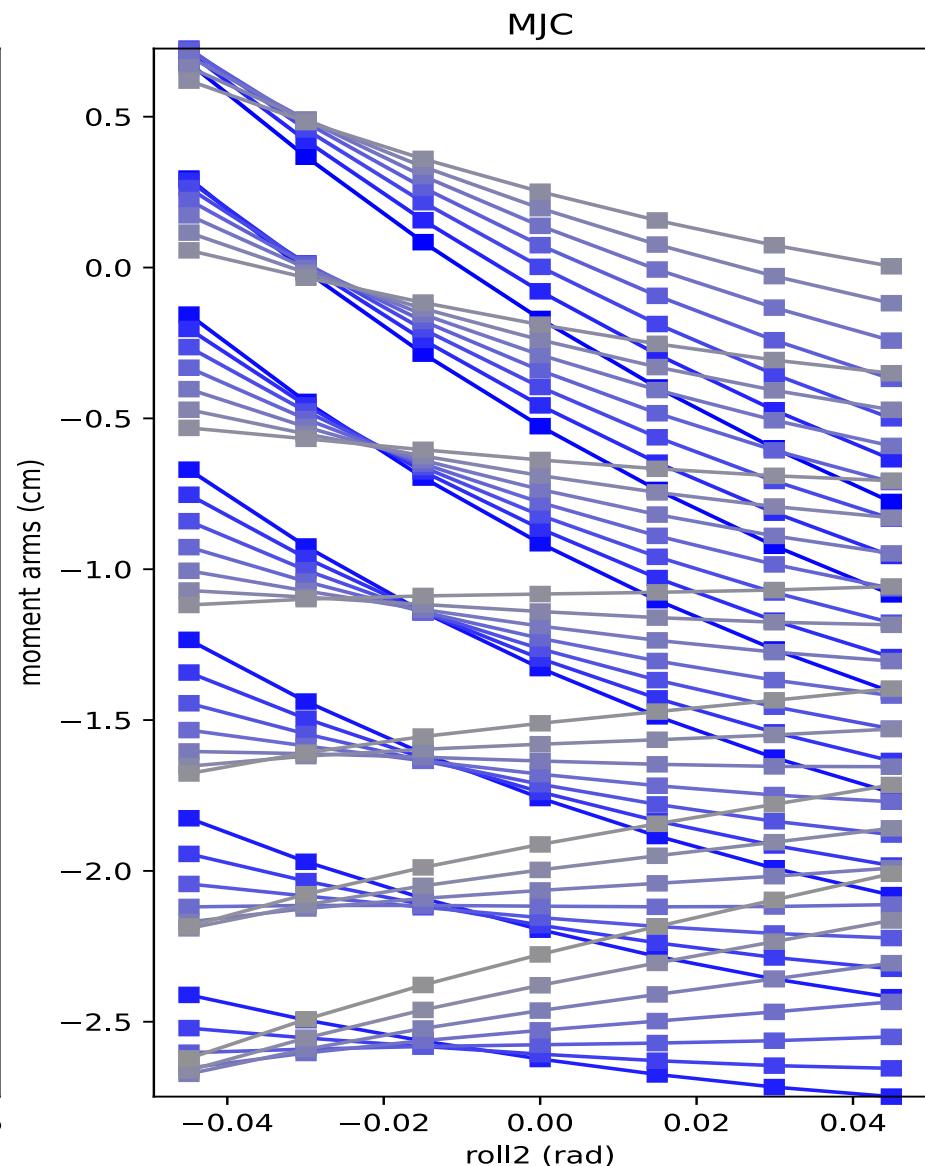
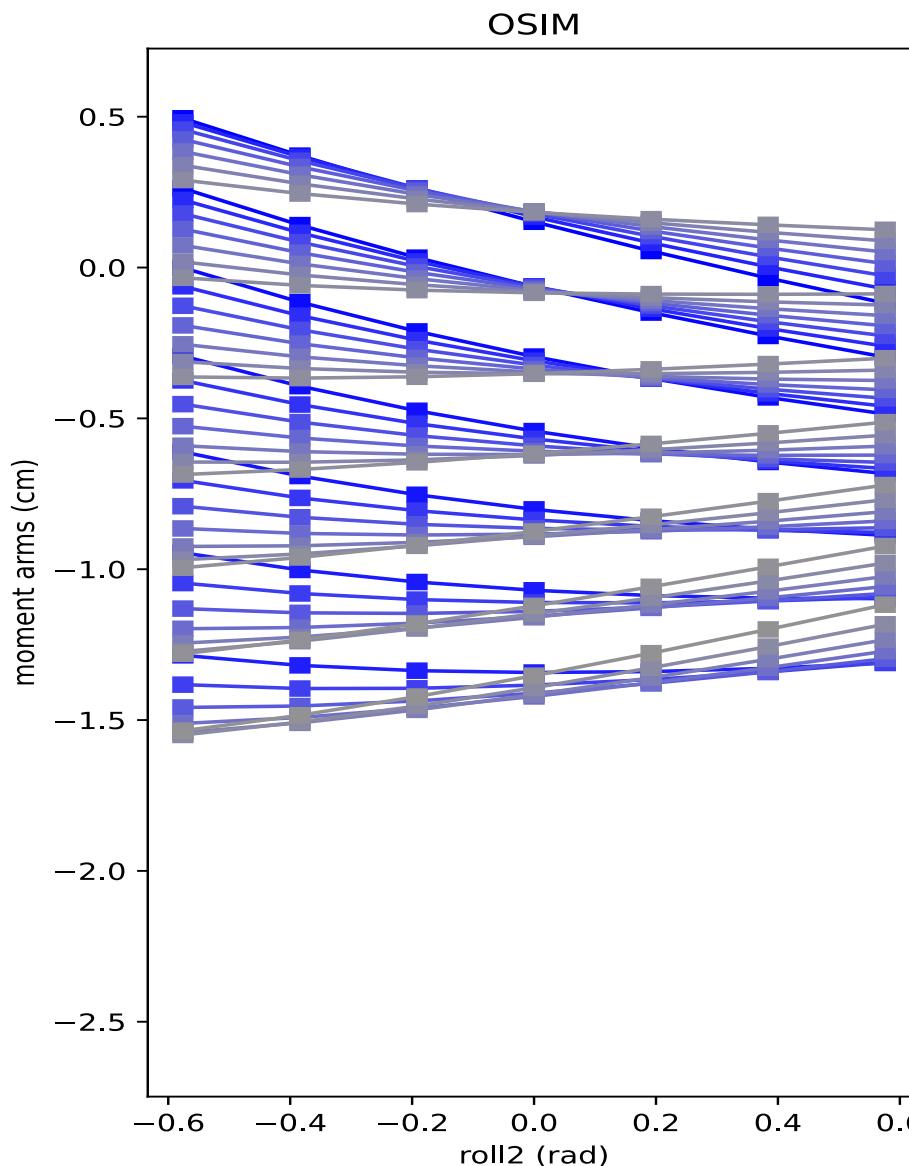
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



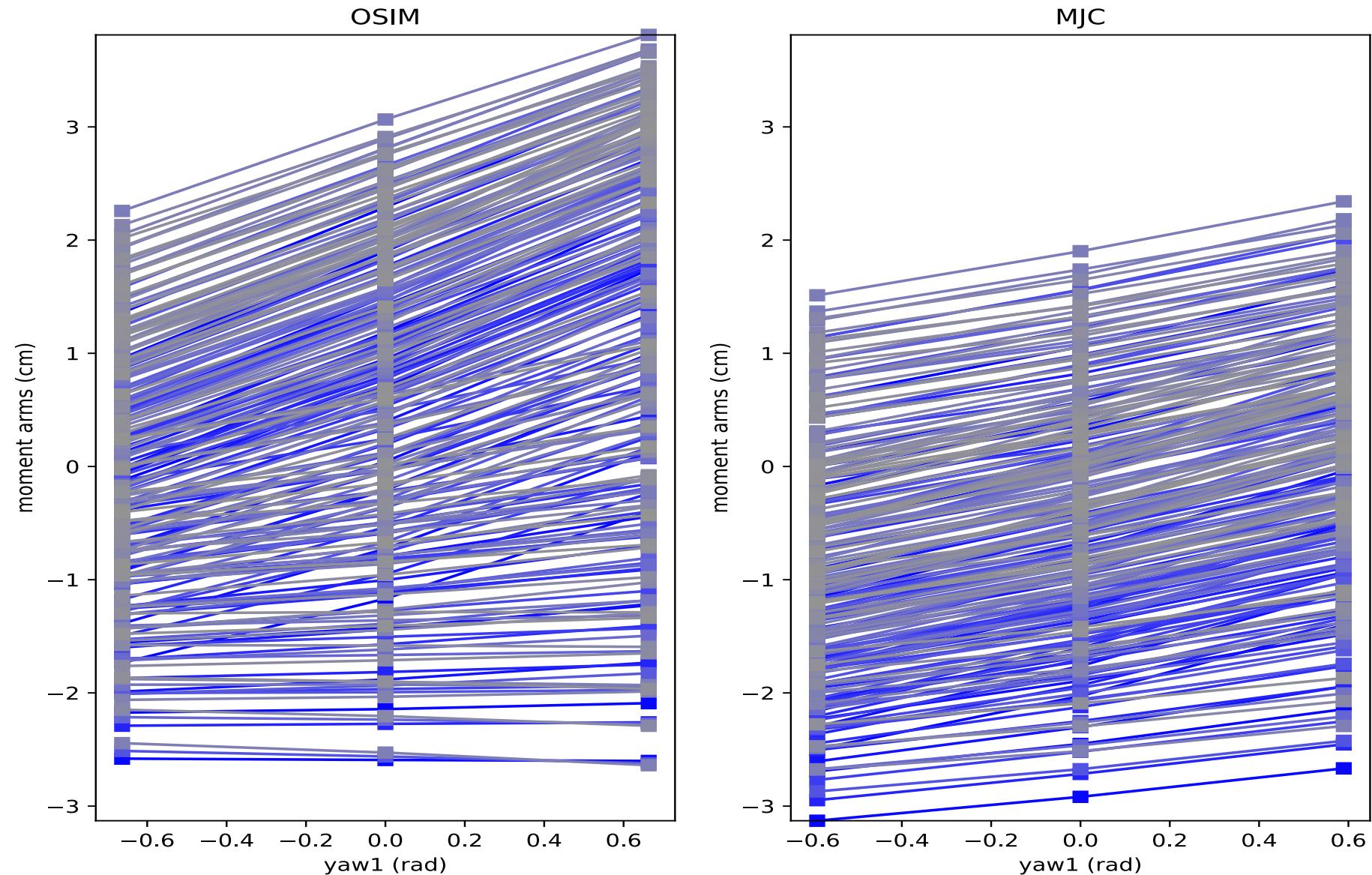
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid_L - pitch2 - roll2 - yaw2



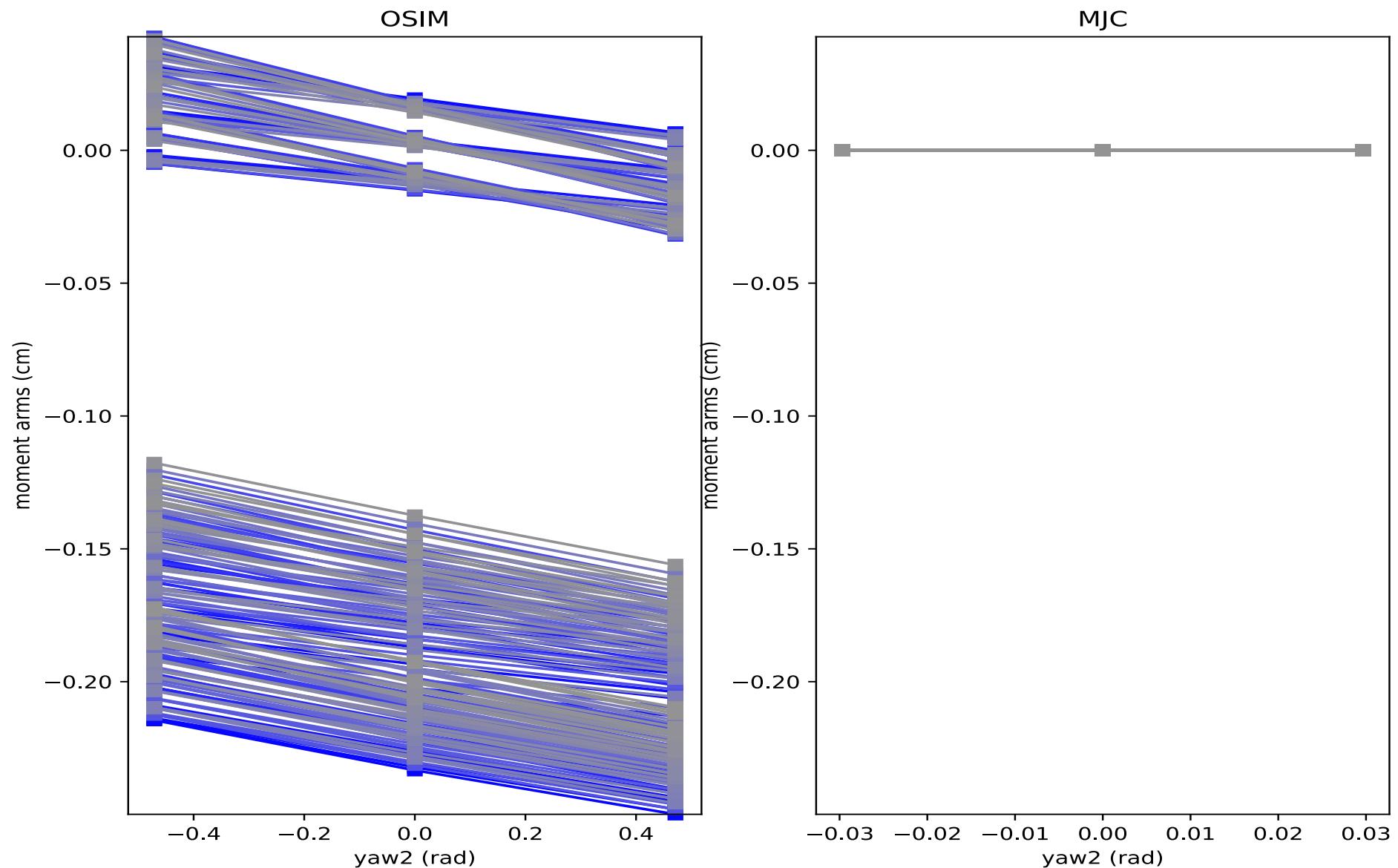
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



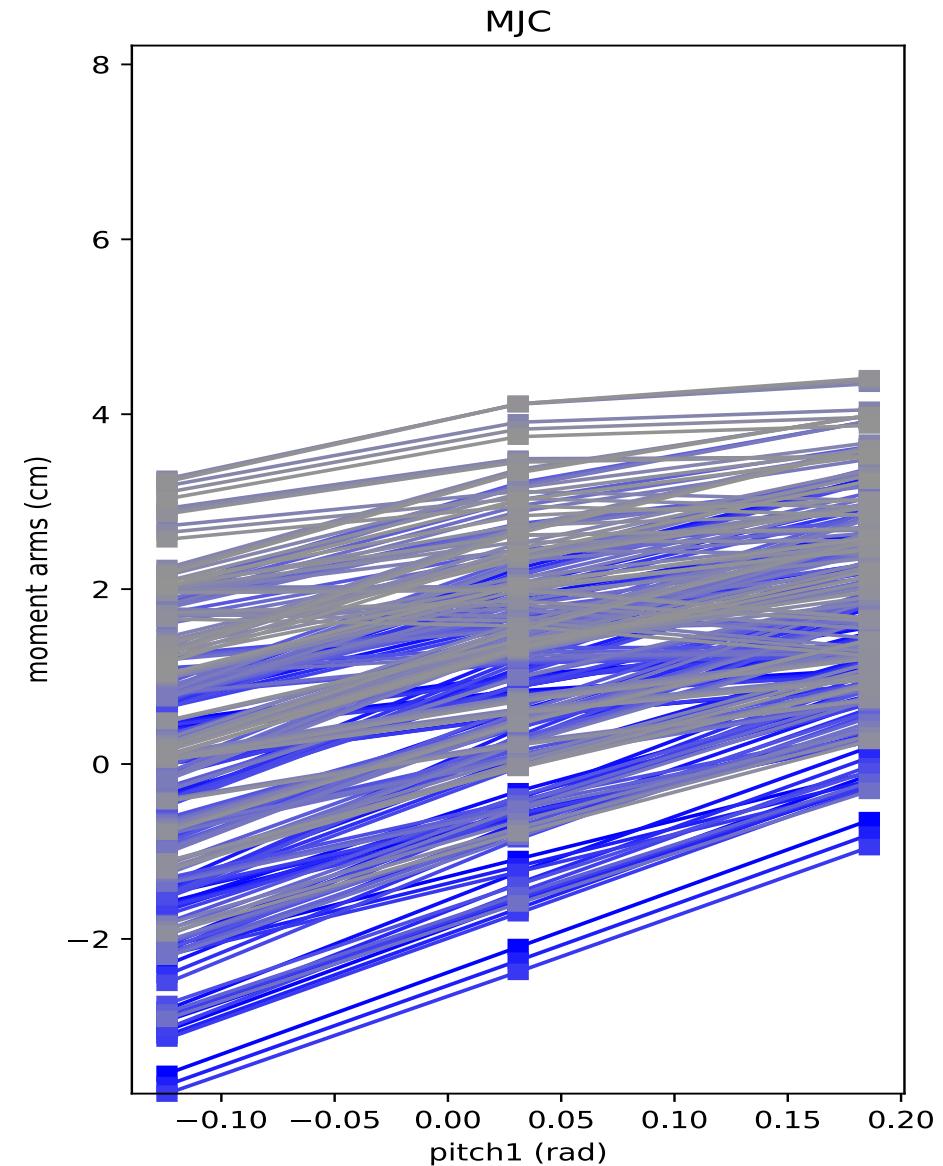
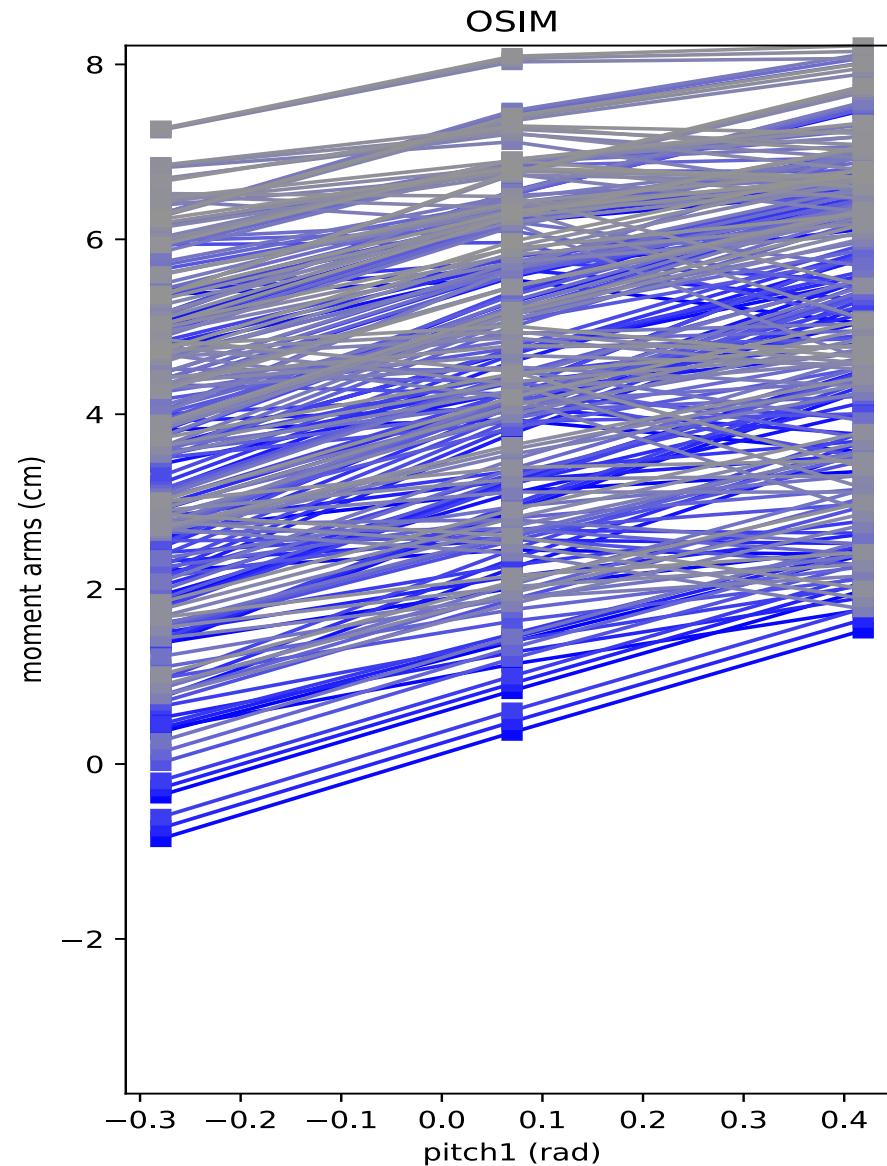
Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



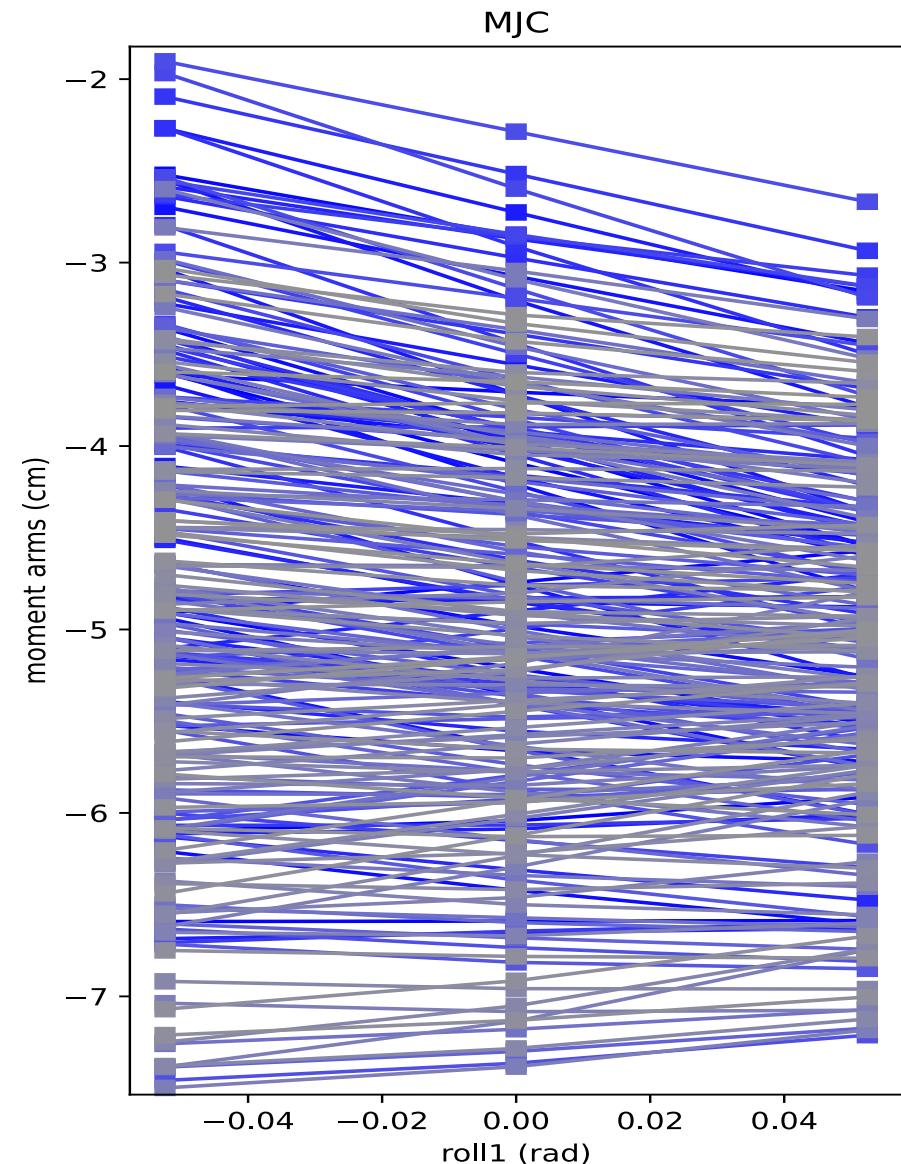
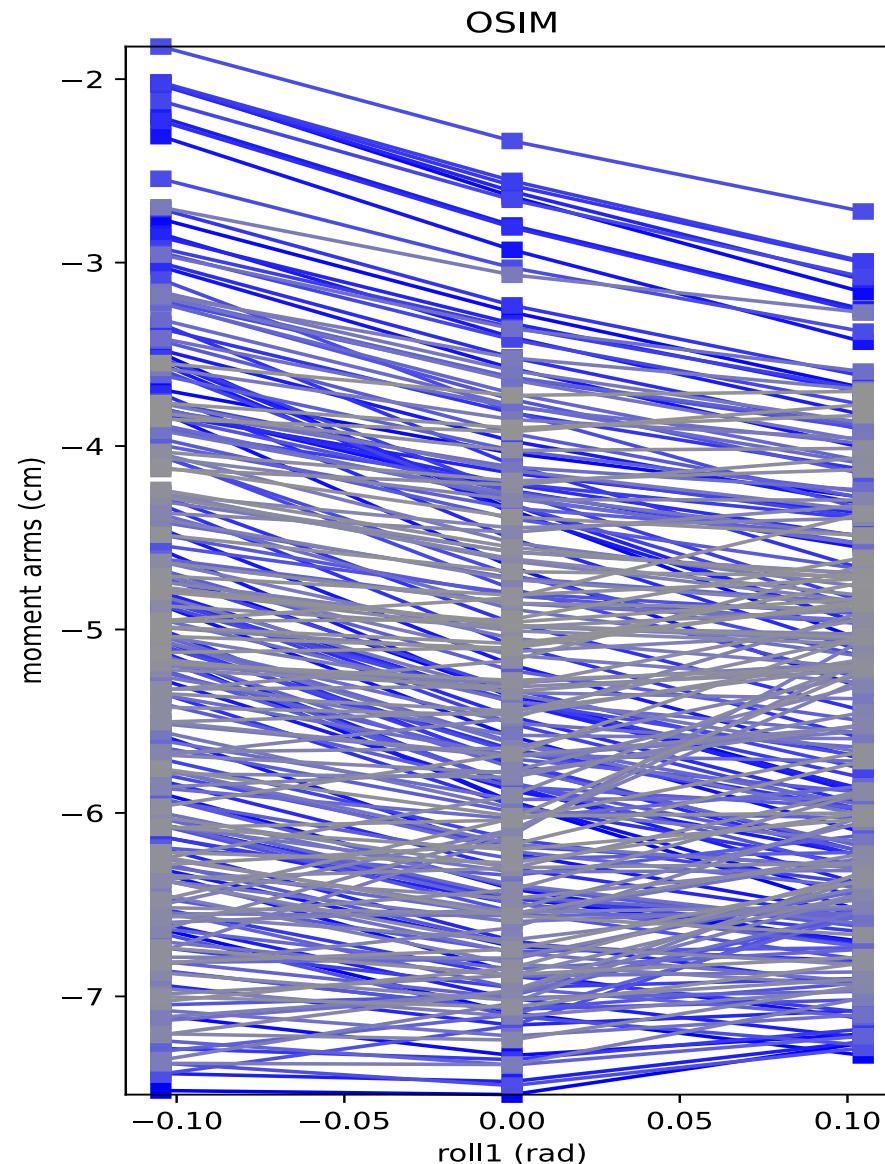
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



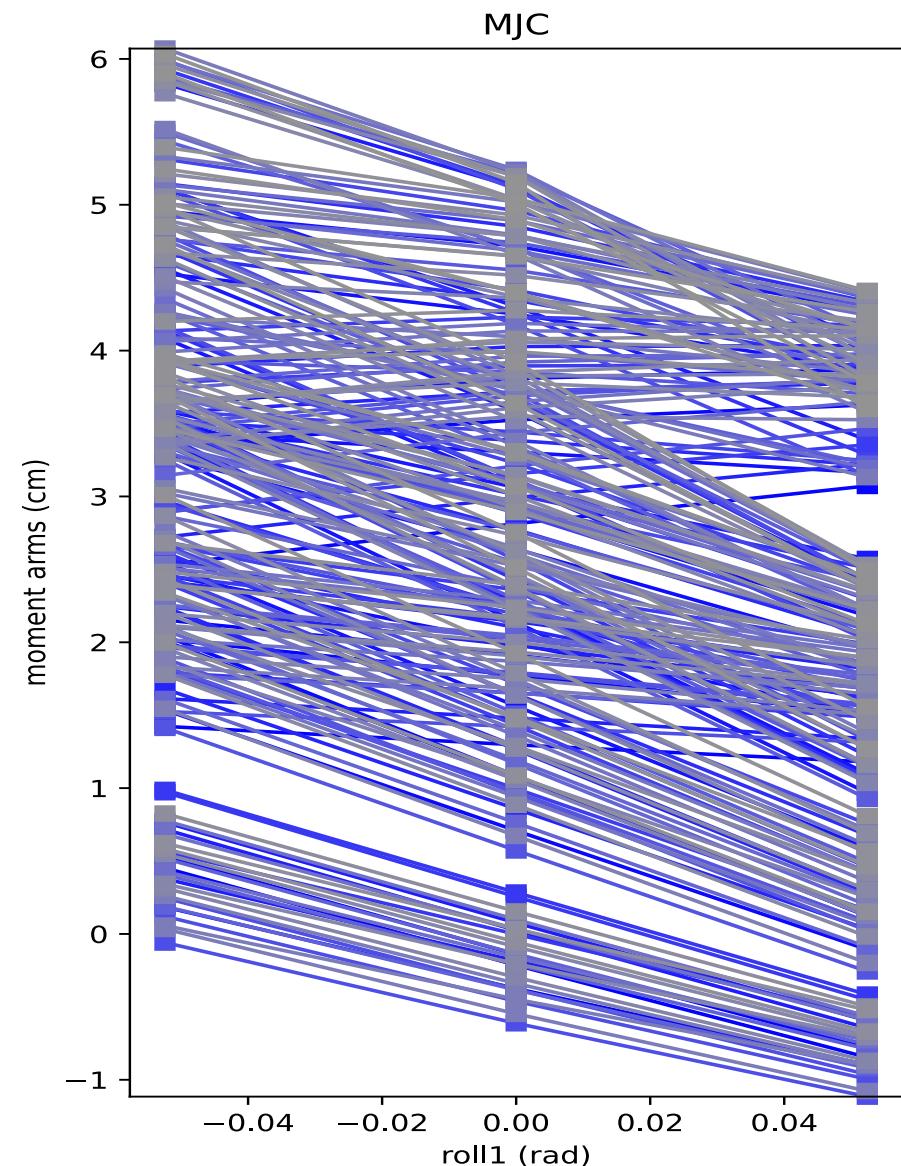
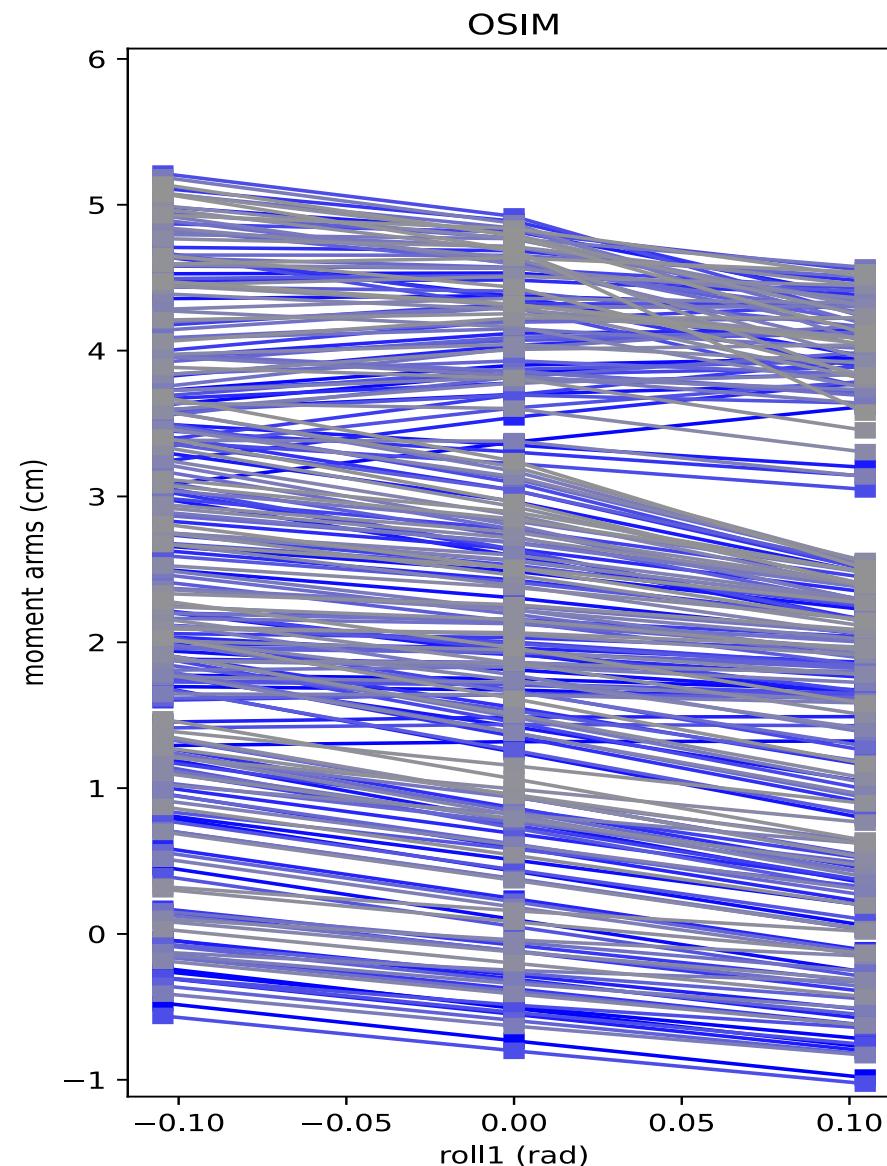
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



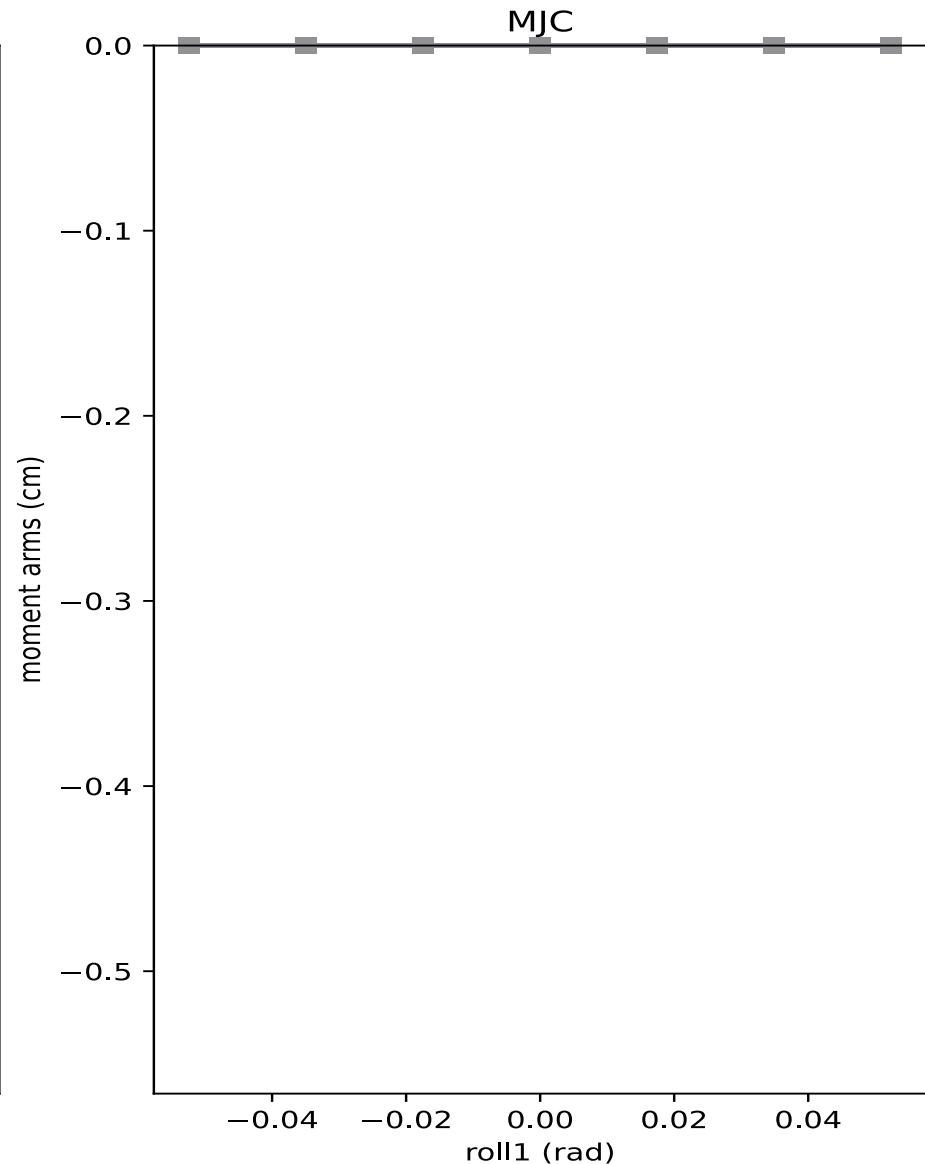
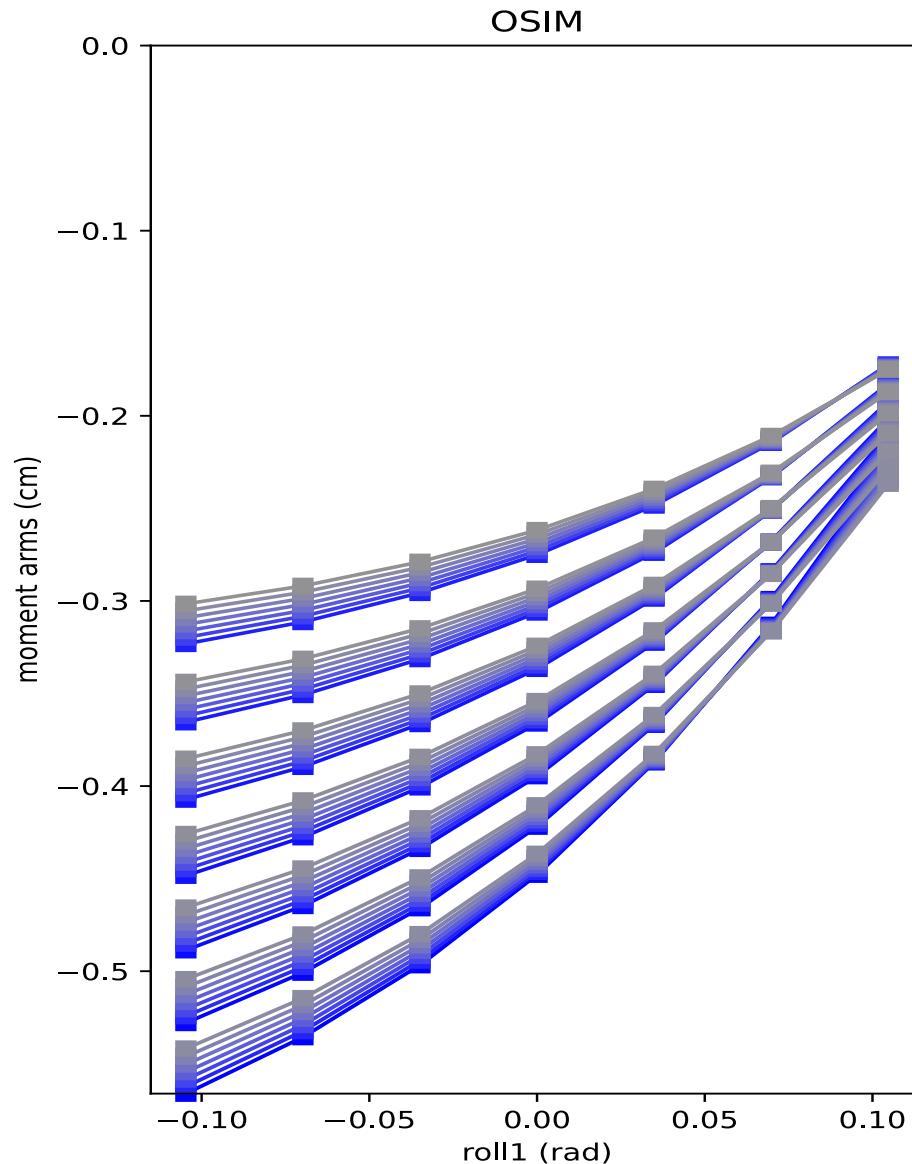
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



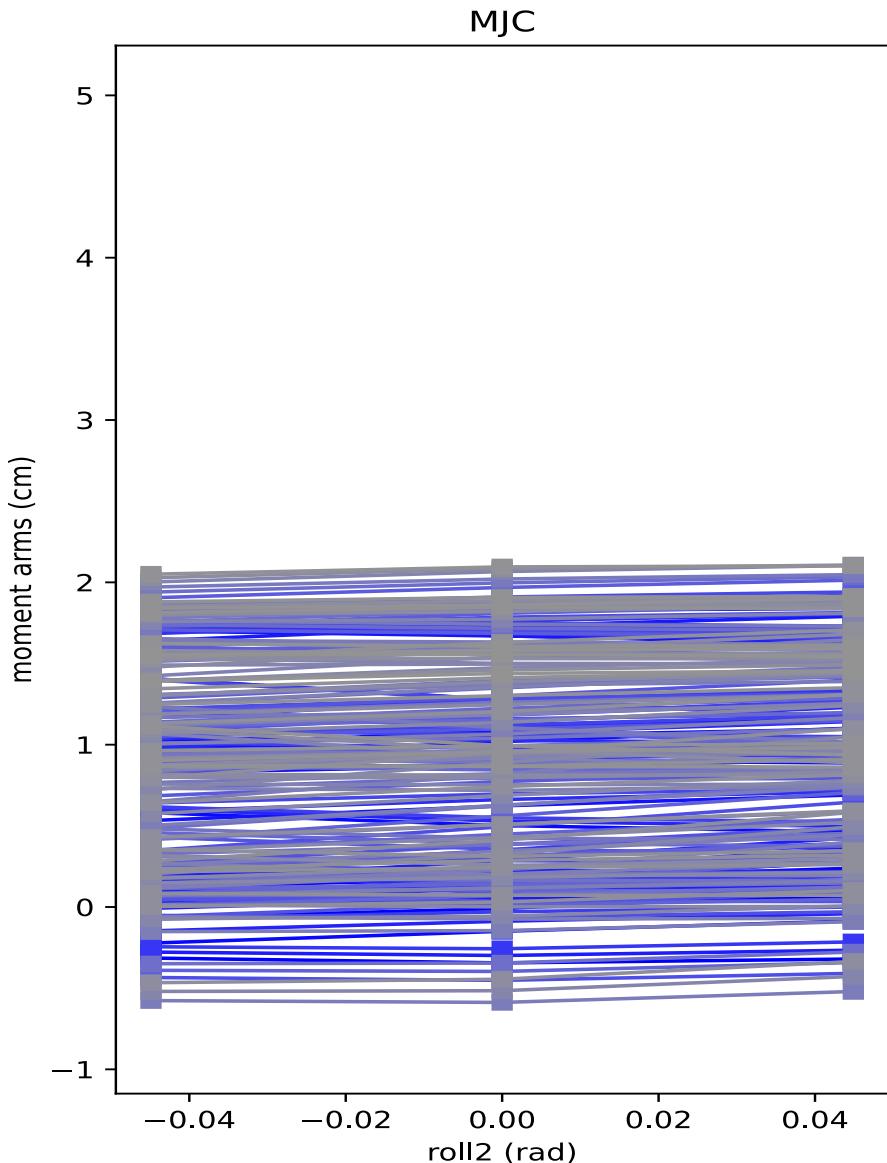
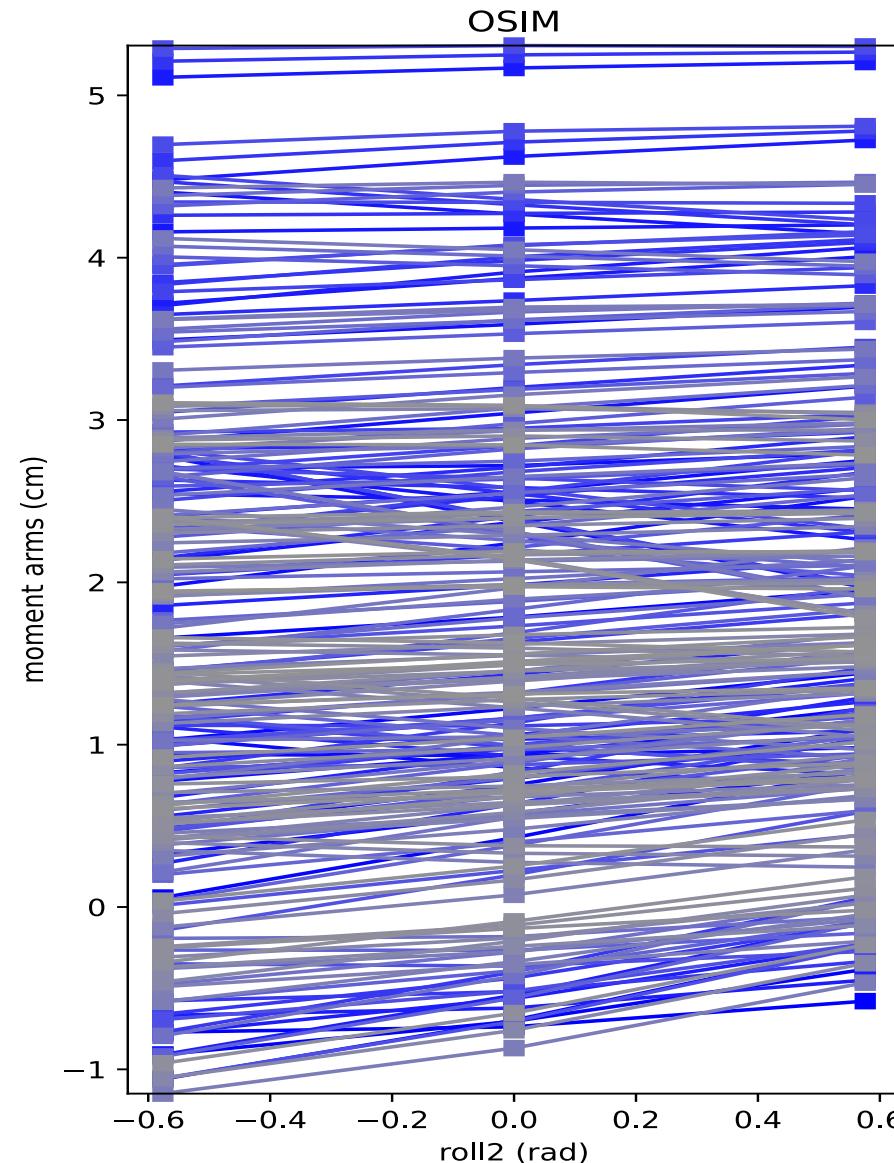
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min_L - pitch1 - roll1 - yaw1



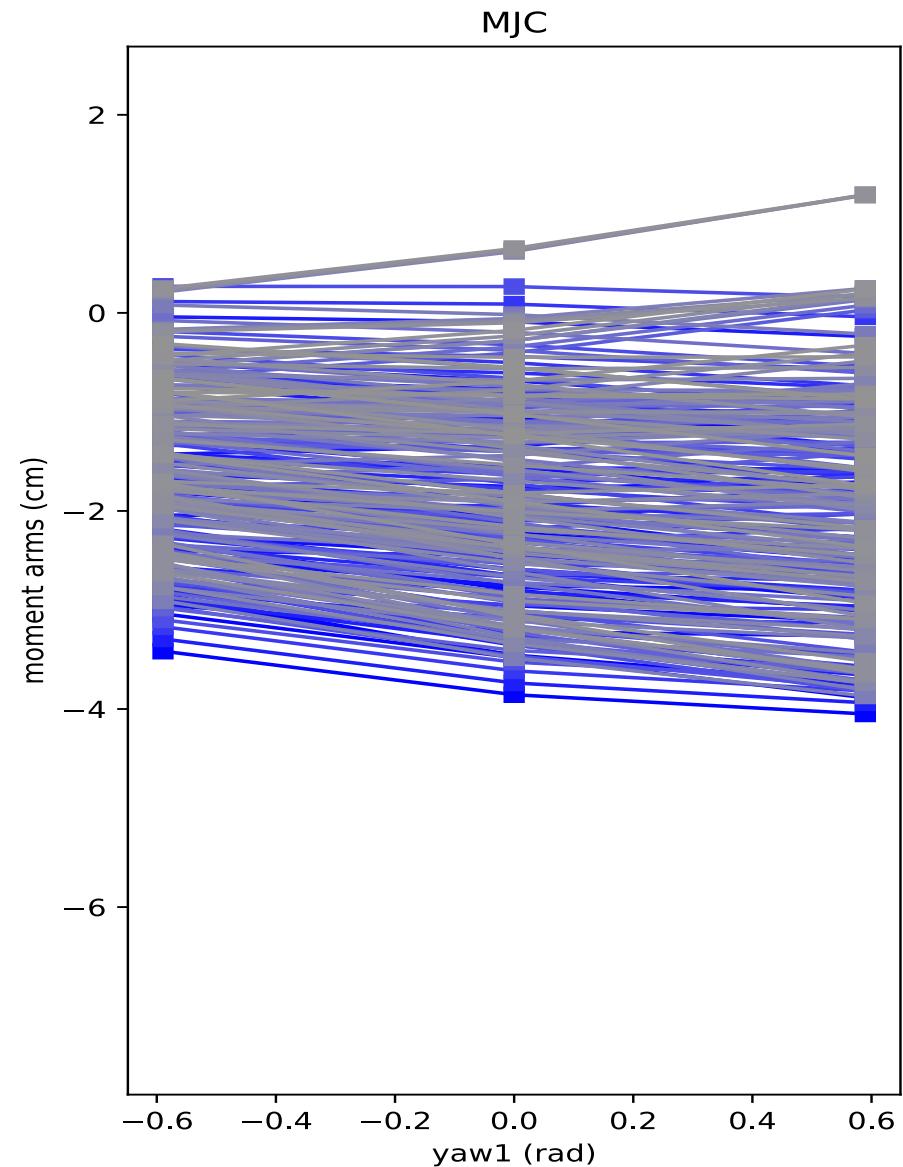
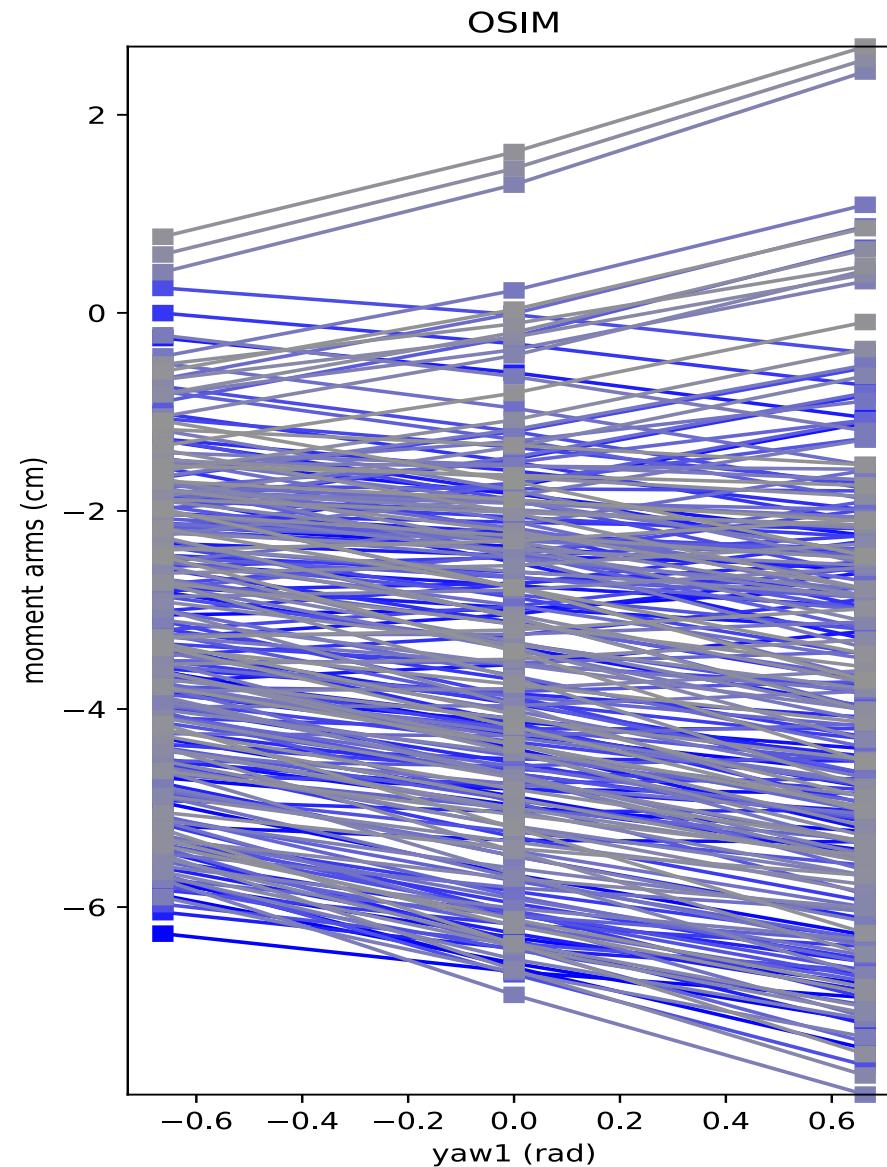
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



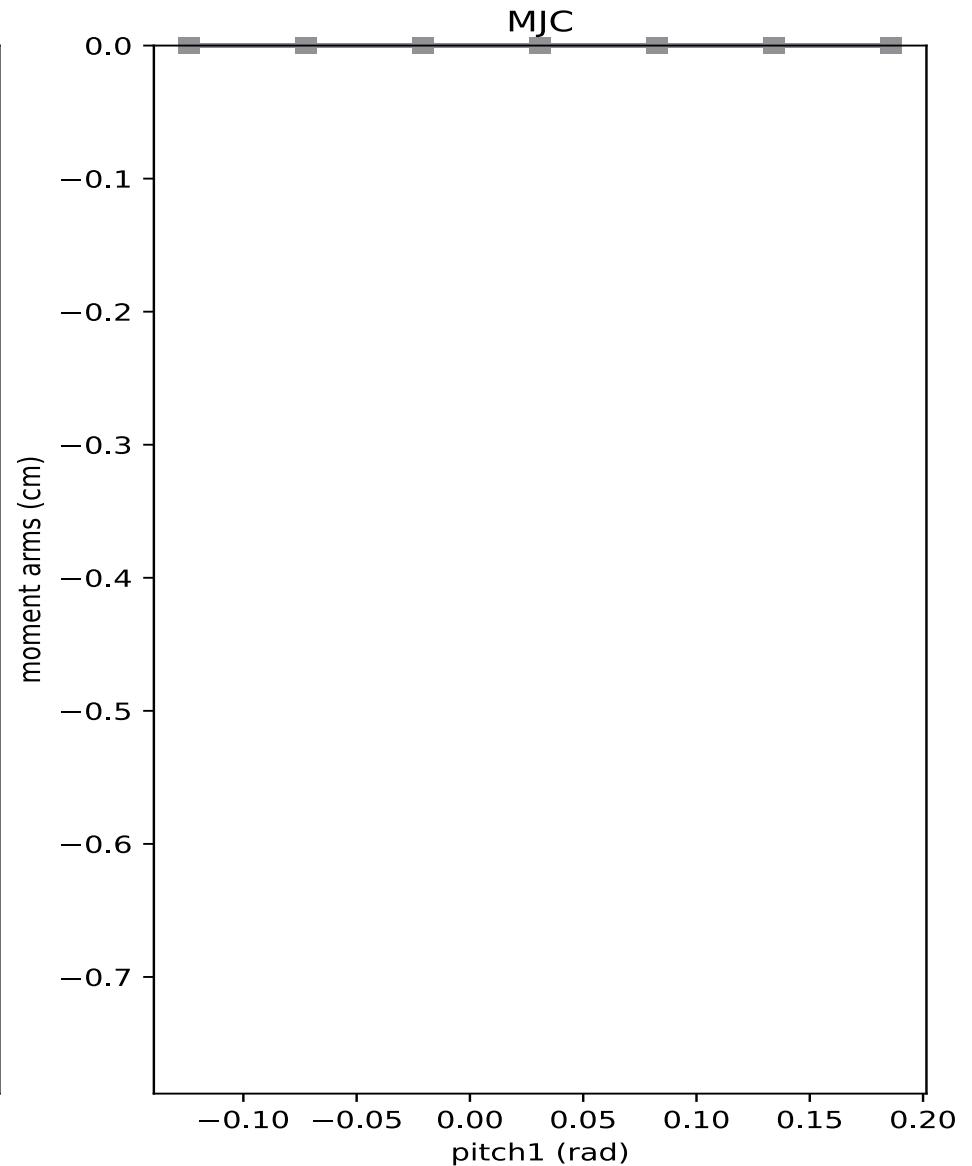
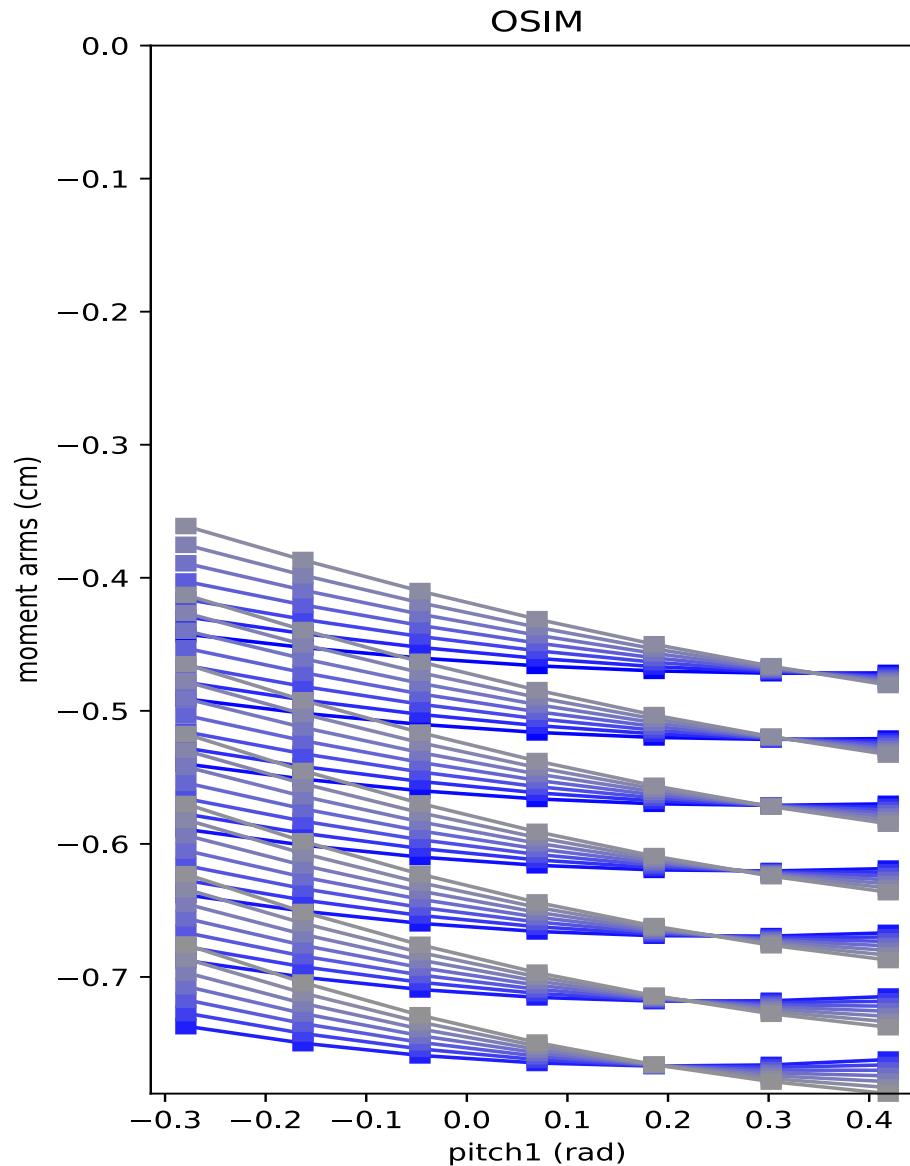
Muscle specific moment arm comparison with Osim model after optimization

trap_cI_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



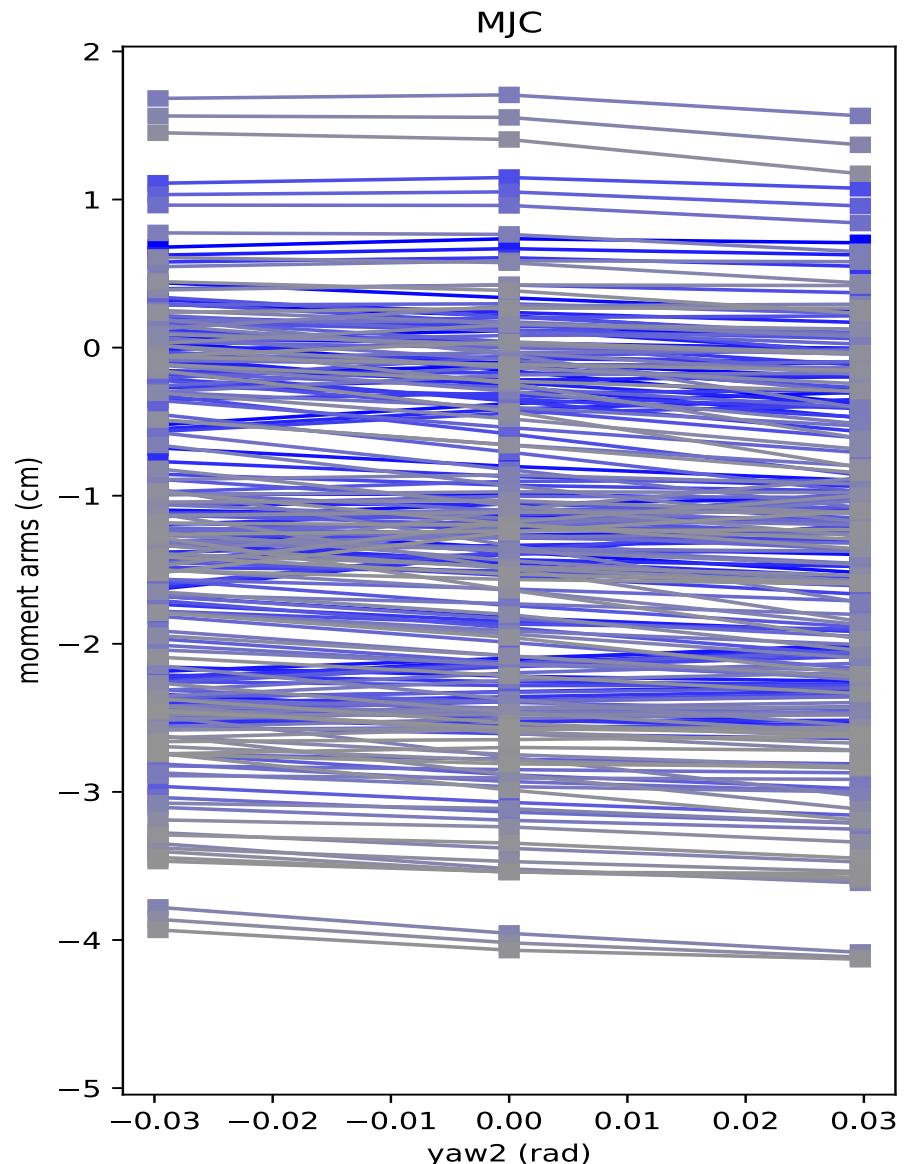
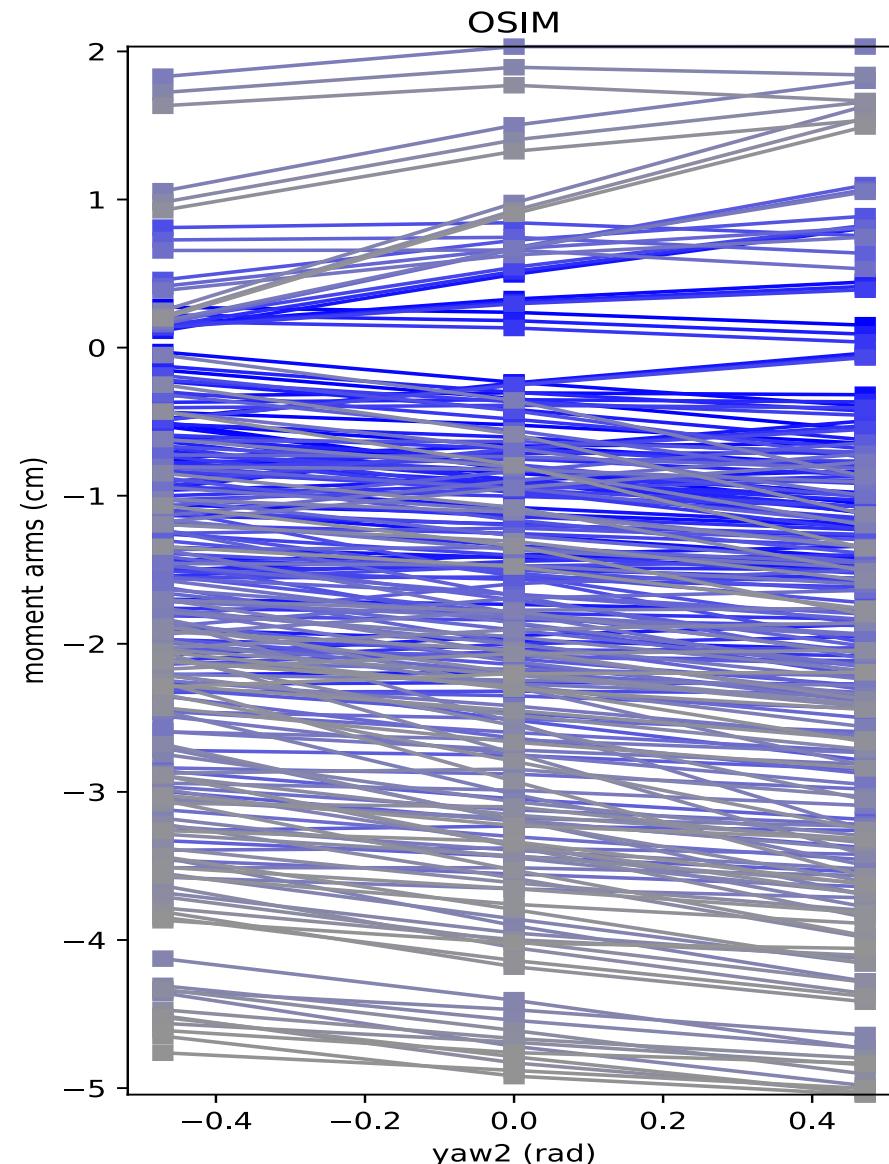
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med - pitch1 - roll1 - yaw1



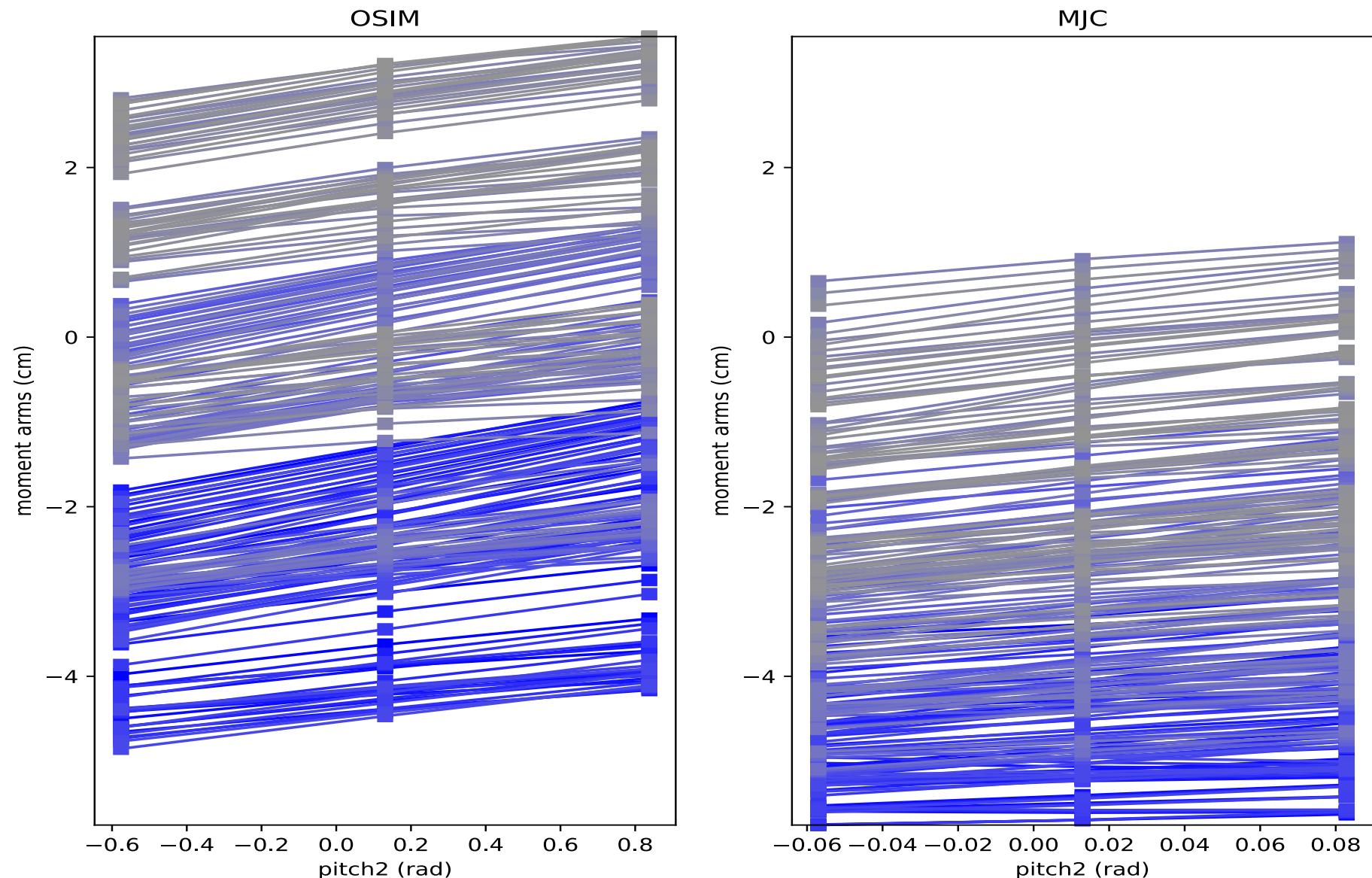
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_skIthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



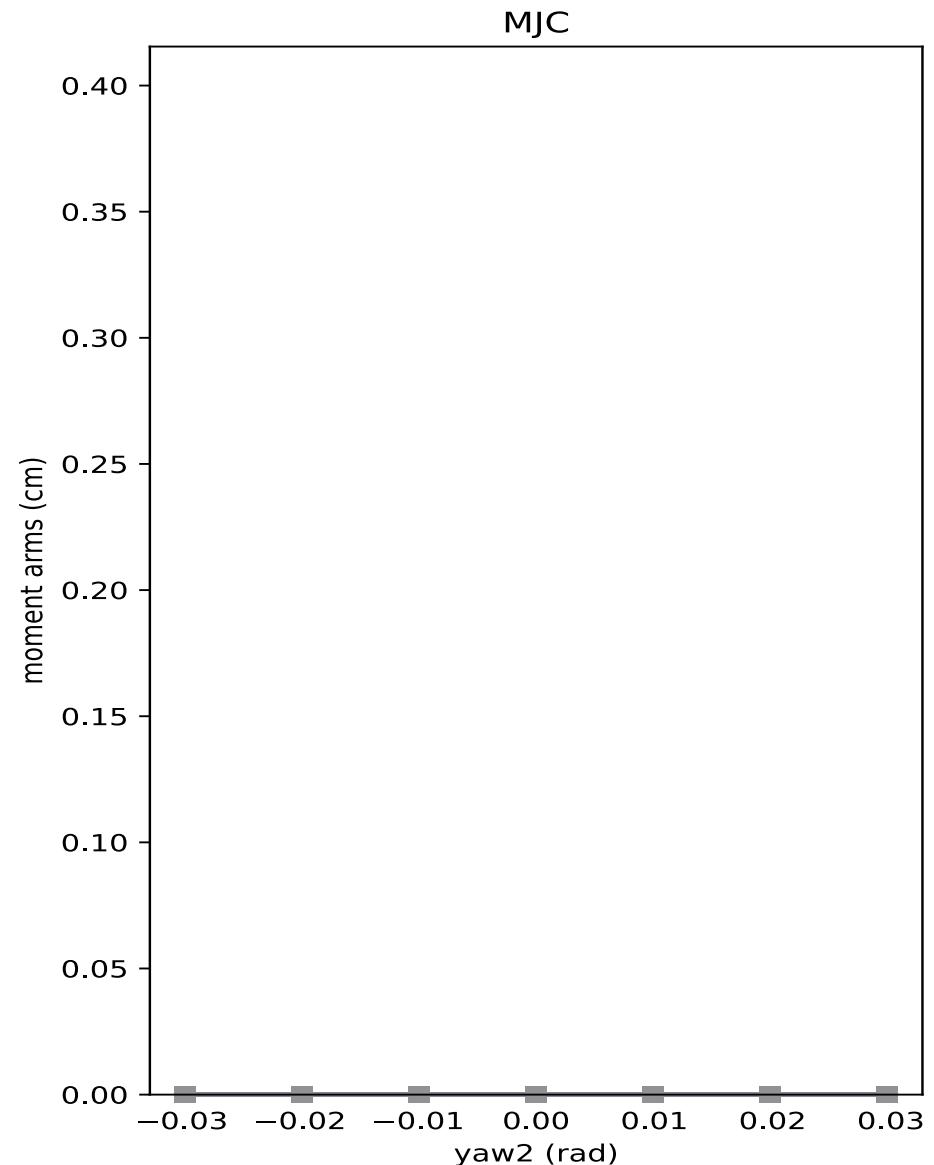
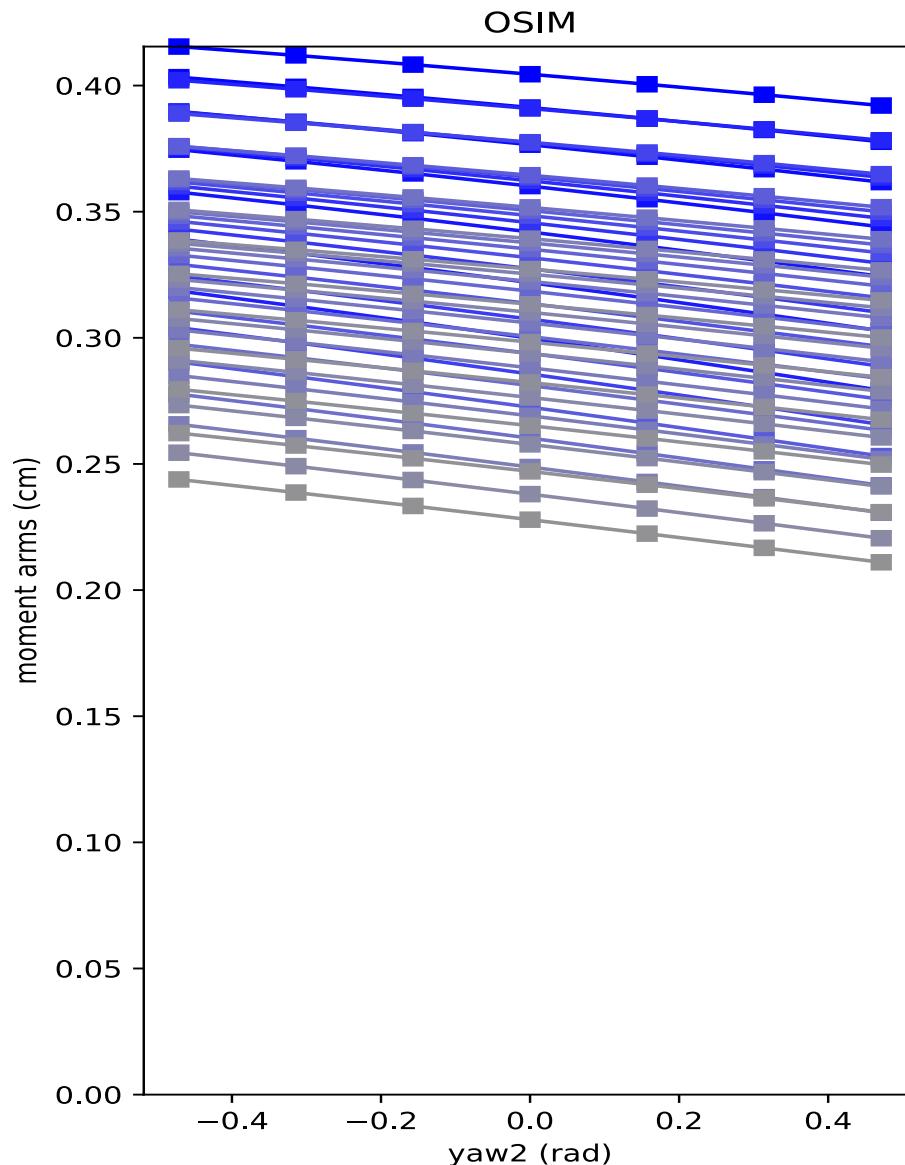
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



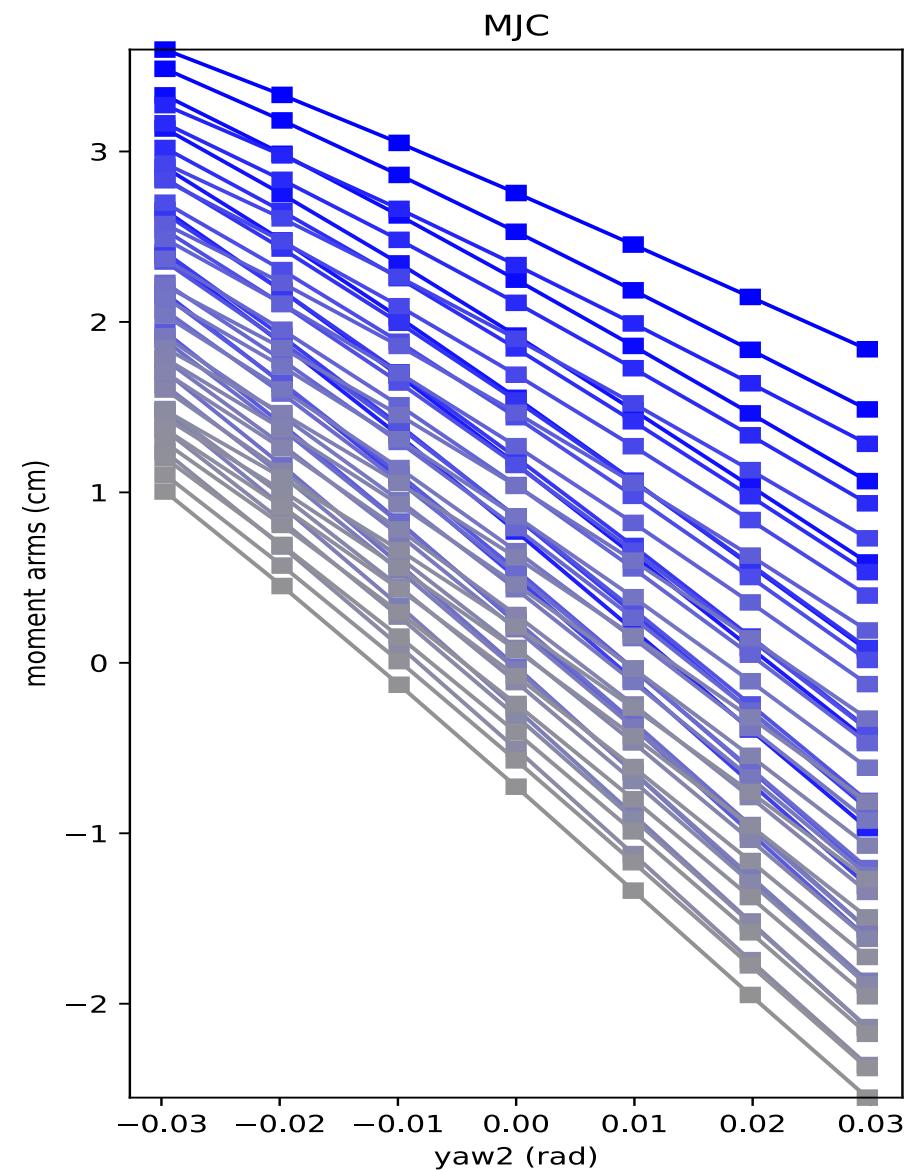
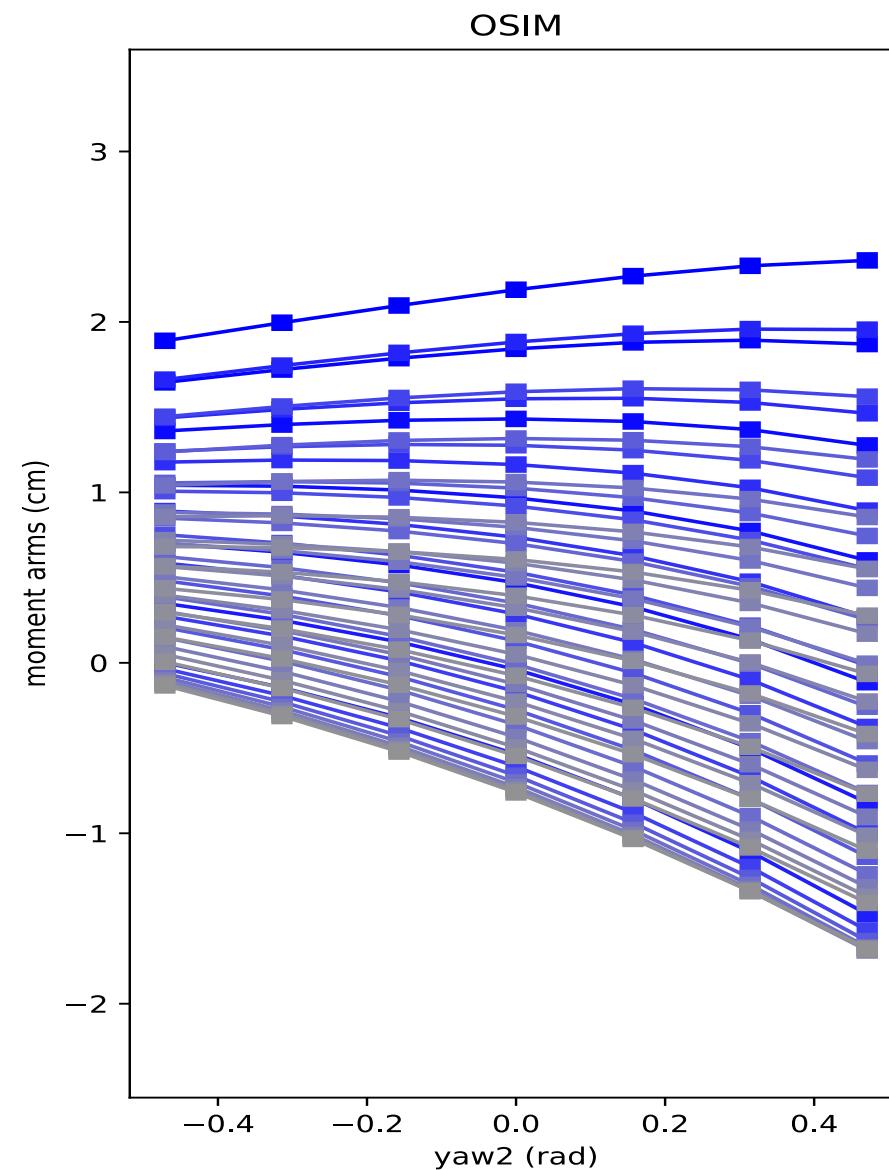
Muscle specific moment arm comparison with Osim model after optimization

long_cap_skIc4_L - pitch2 - roll2 - yaw2



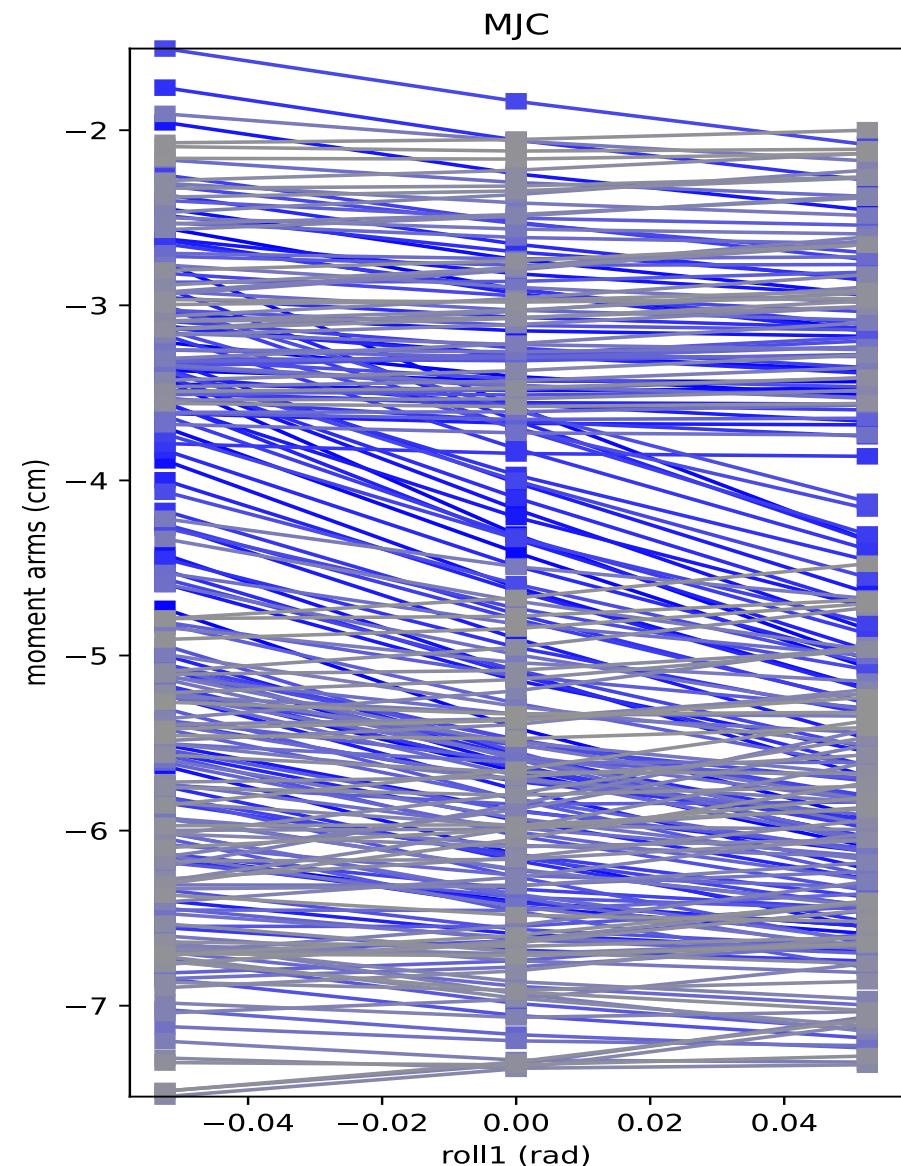
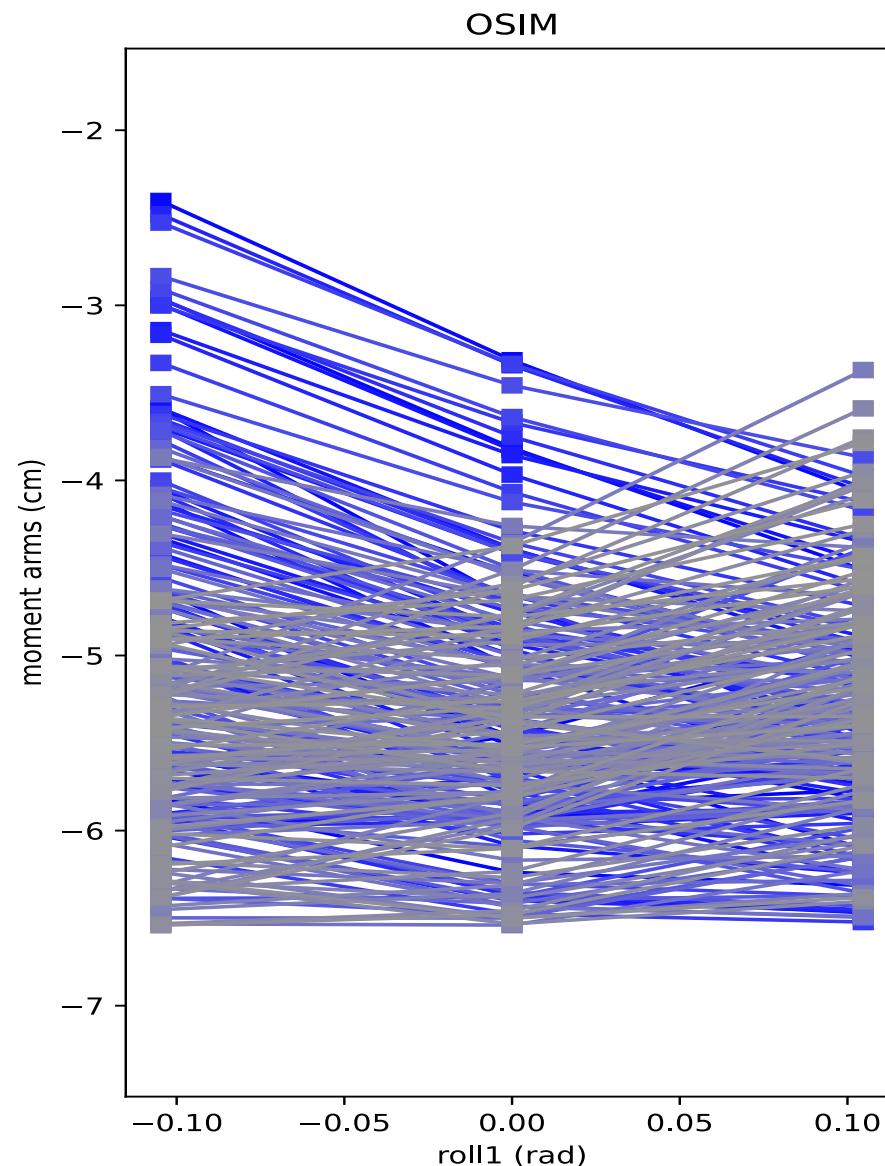
Muscle specific moment arm comparison with Osim model after optimization

levator_scap_L - pitch2 - roll2 - yaw2



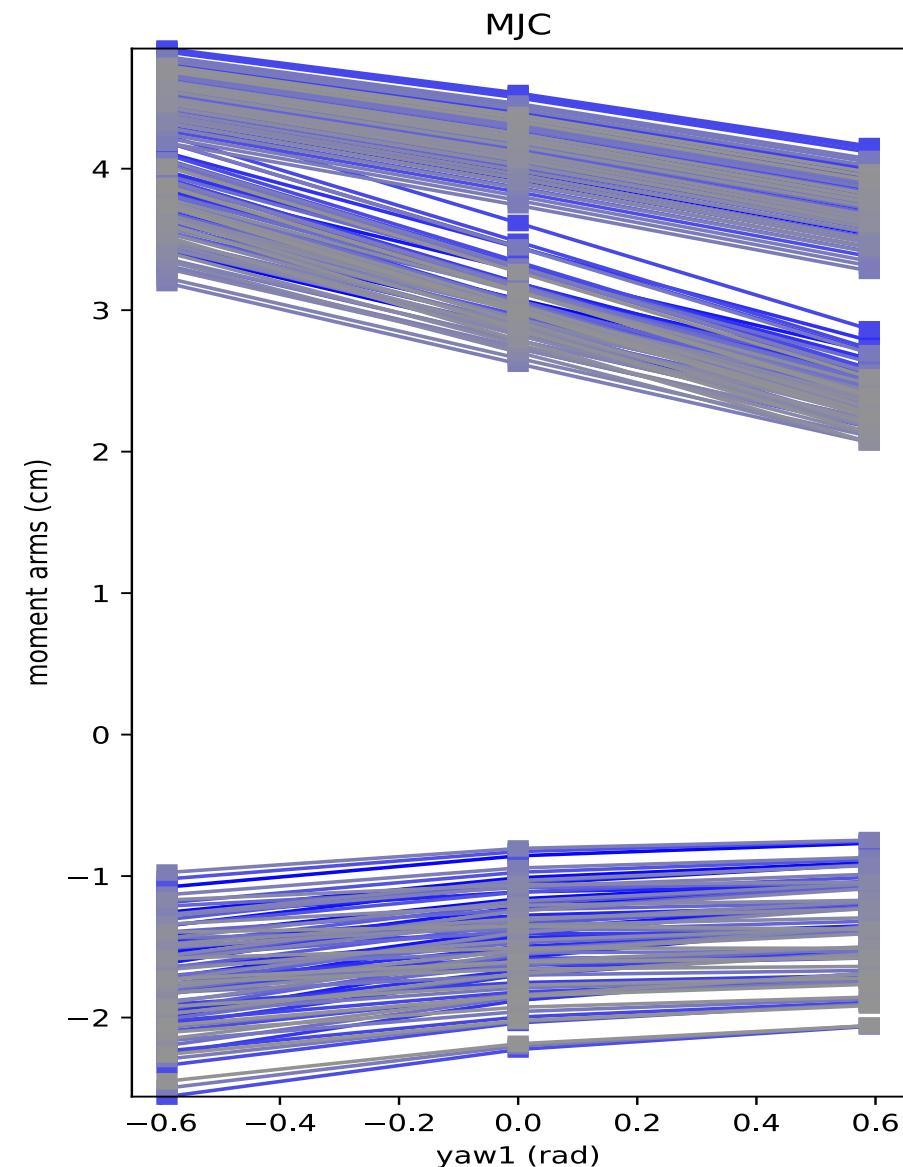
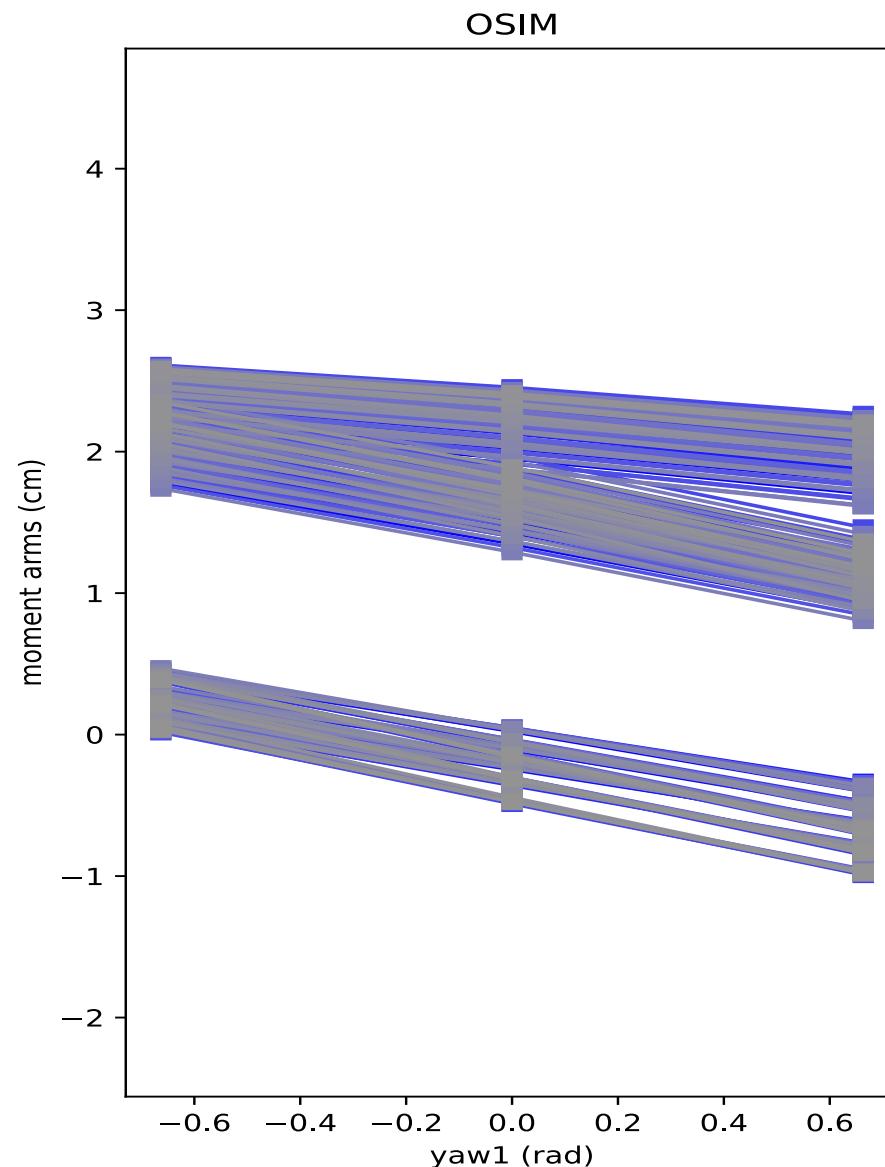
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



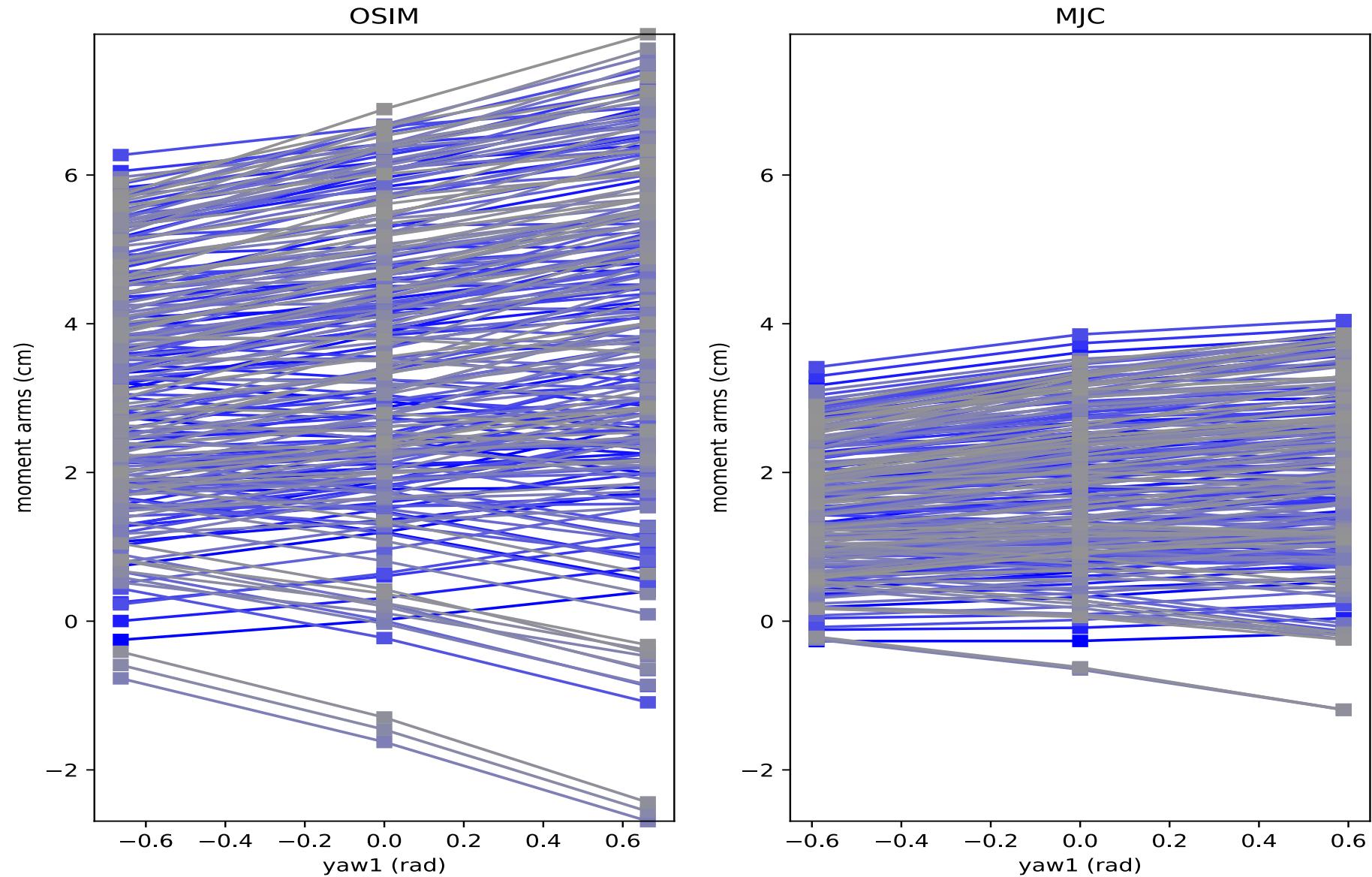
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



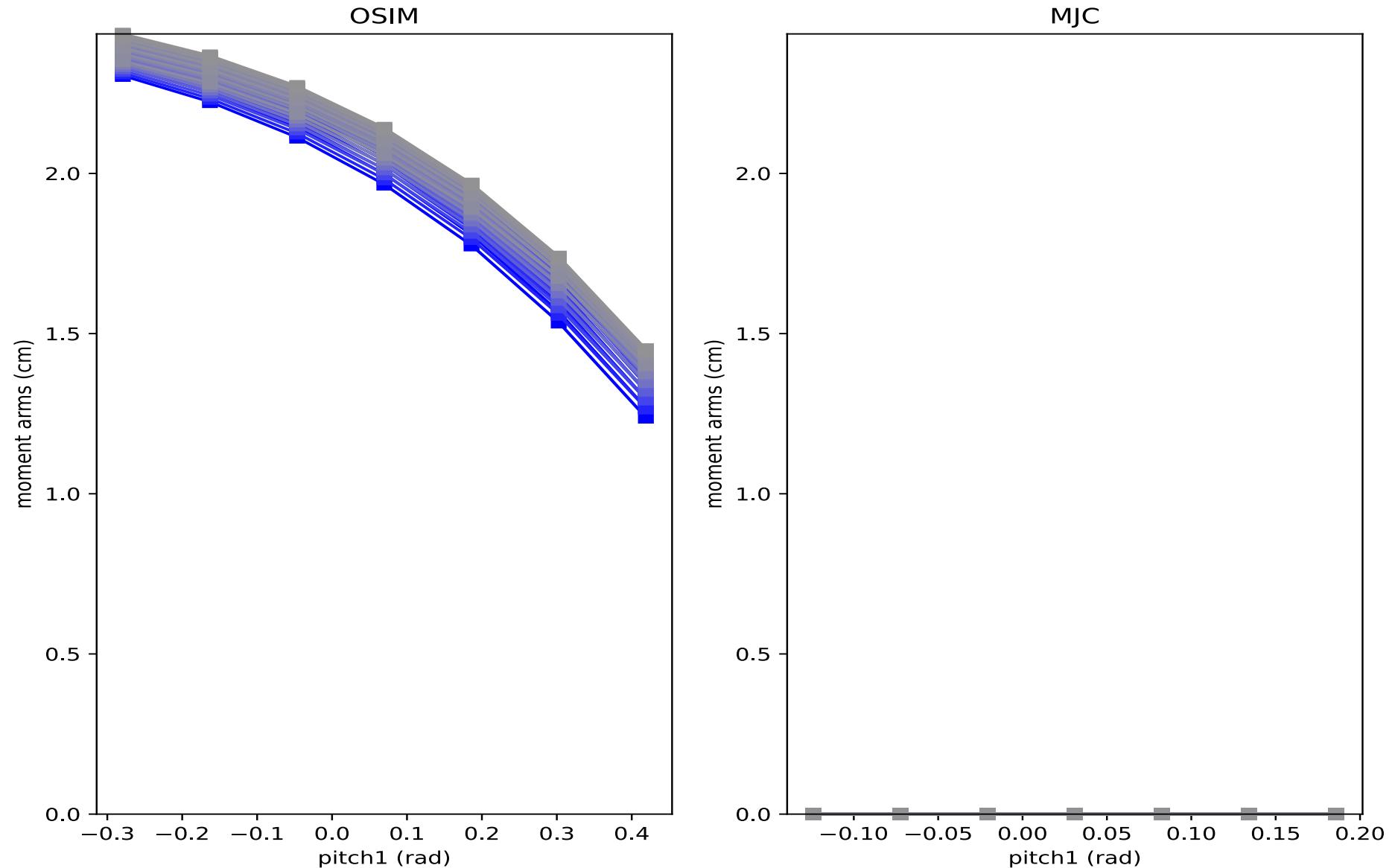
Muscle specific moment arm comparison with Osim model after optimization

trap_cl - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



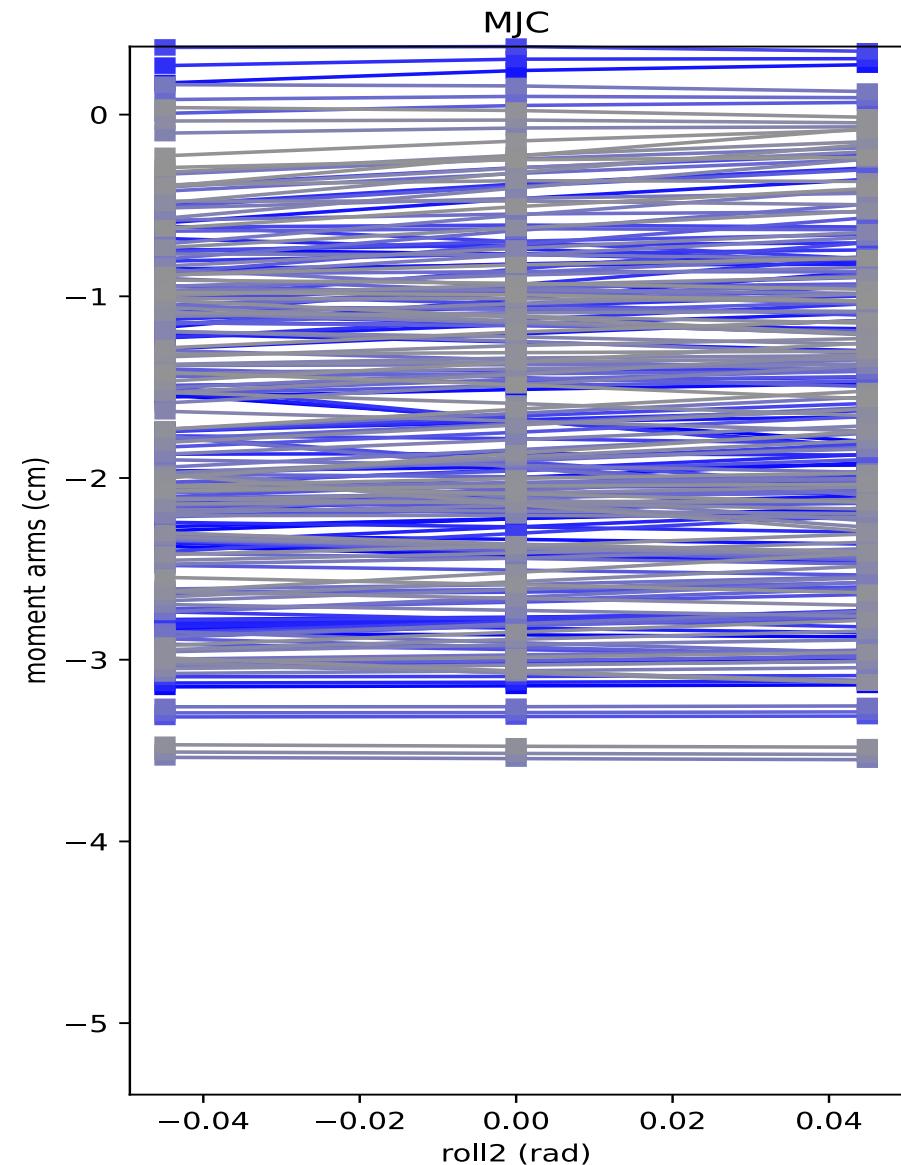
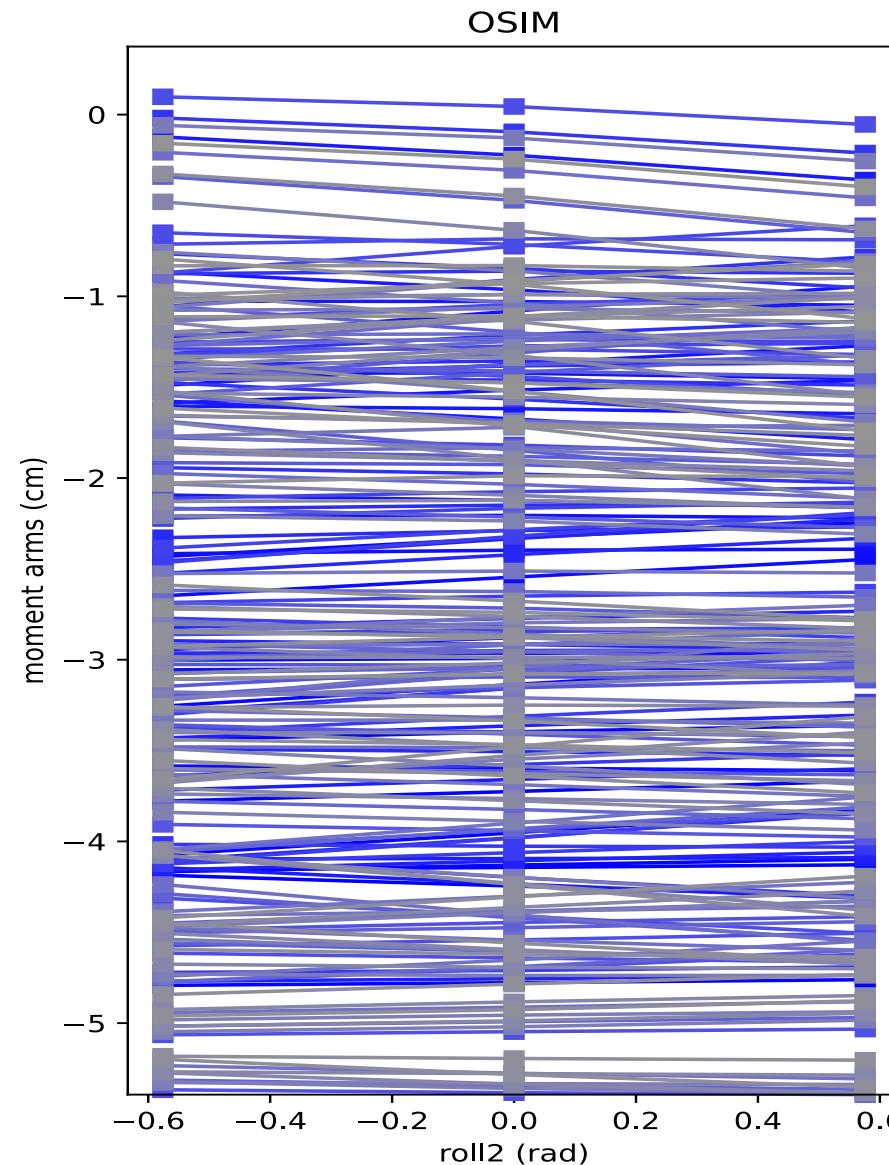
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_min_L - pitch1 - roll1 - yaw1



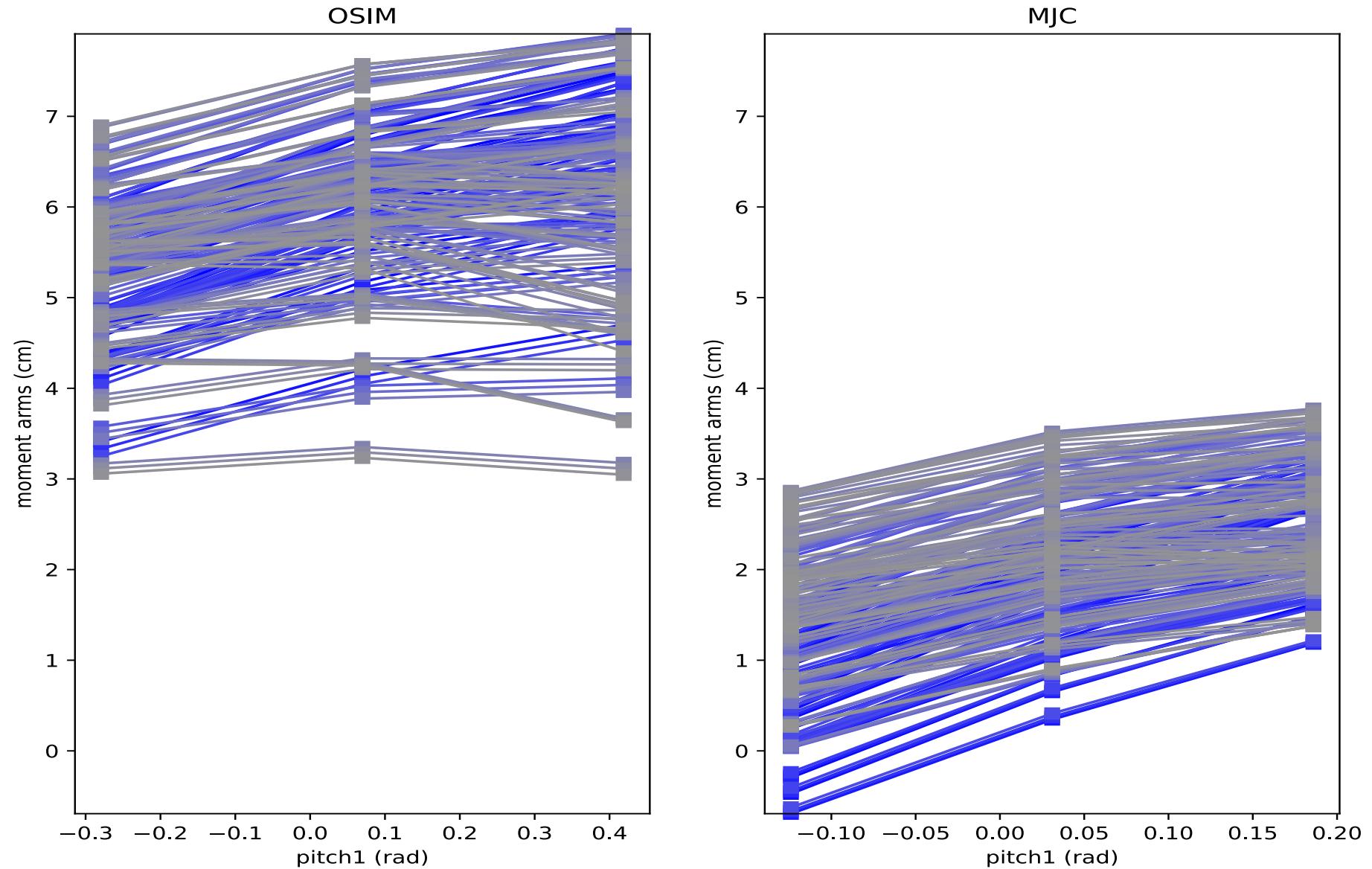
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



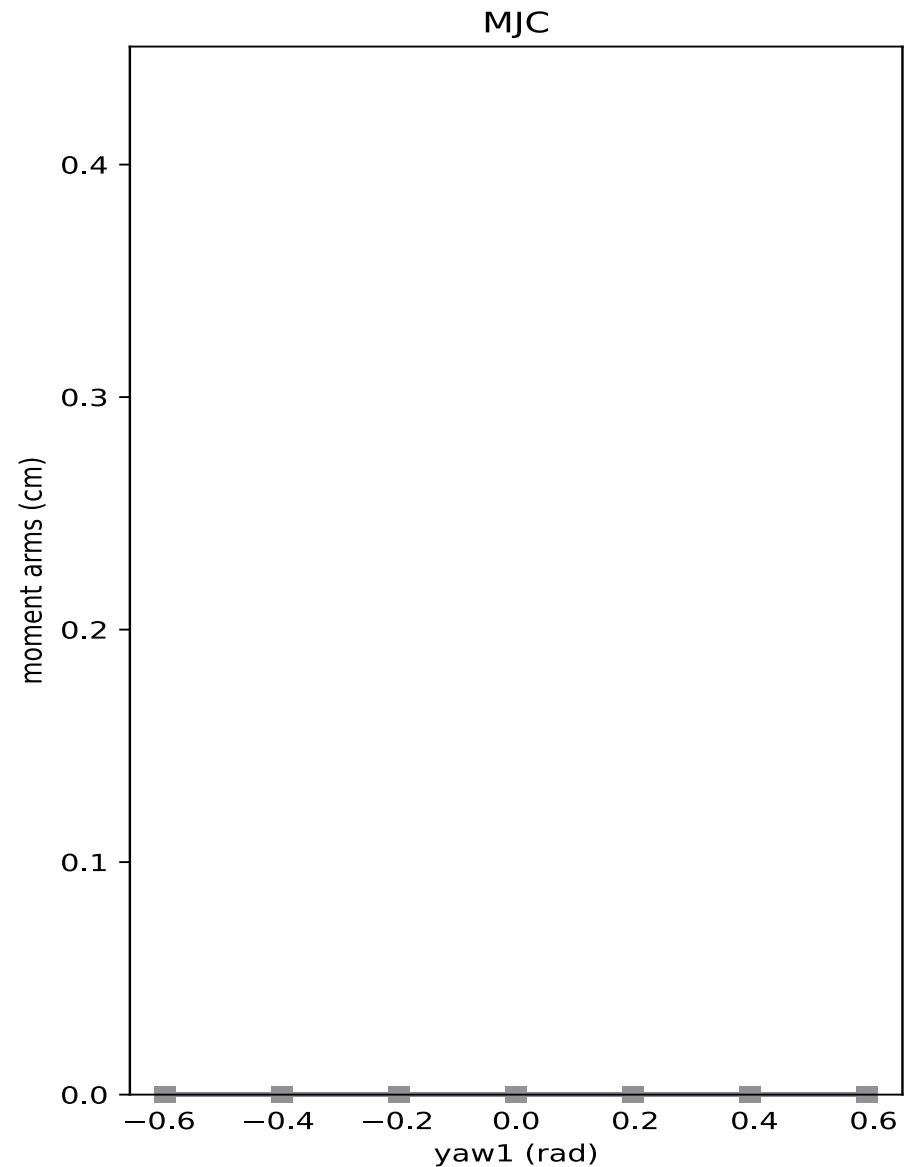
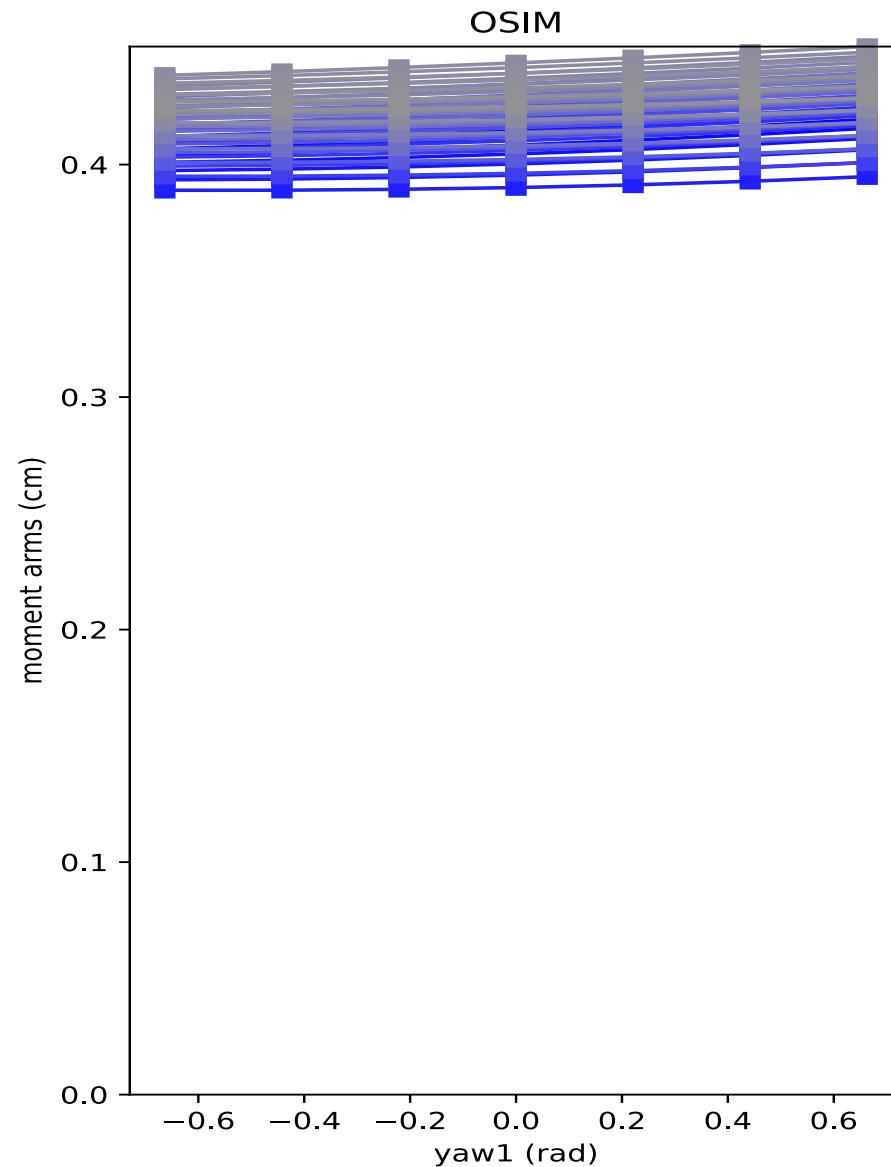
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



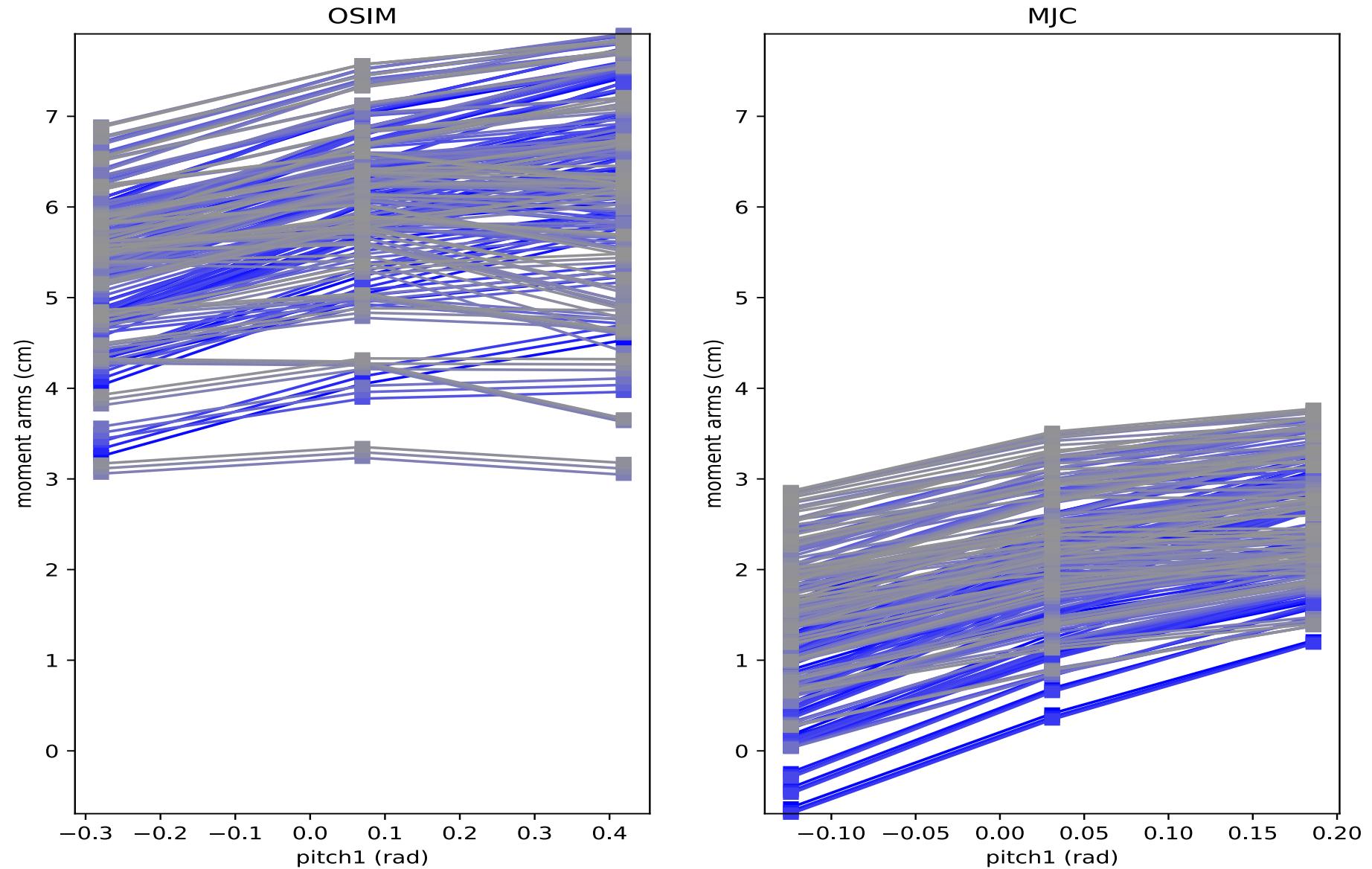
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_sup - pitch1 - roll1 - yaw1



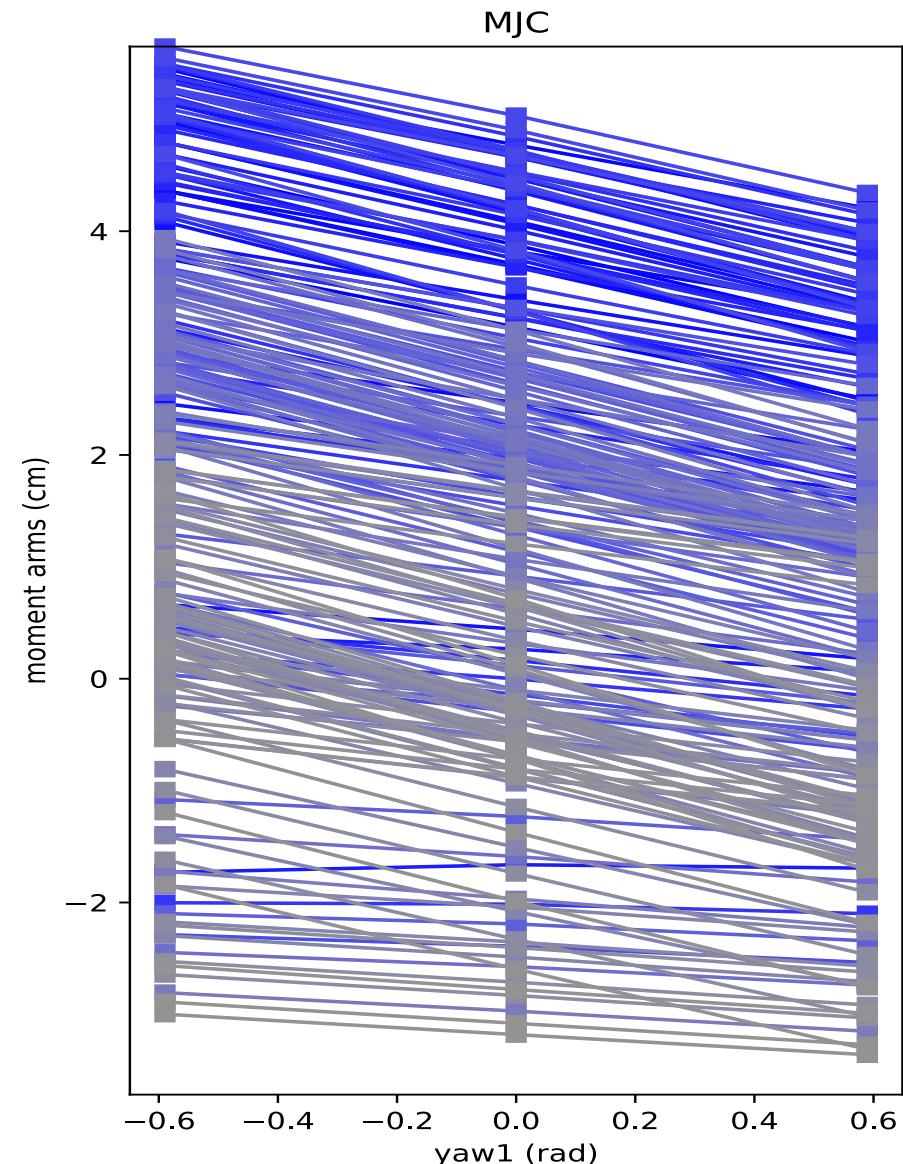
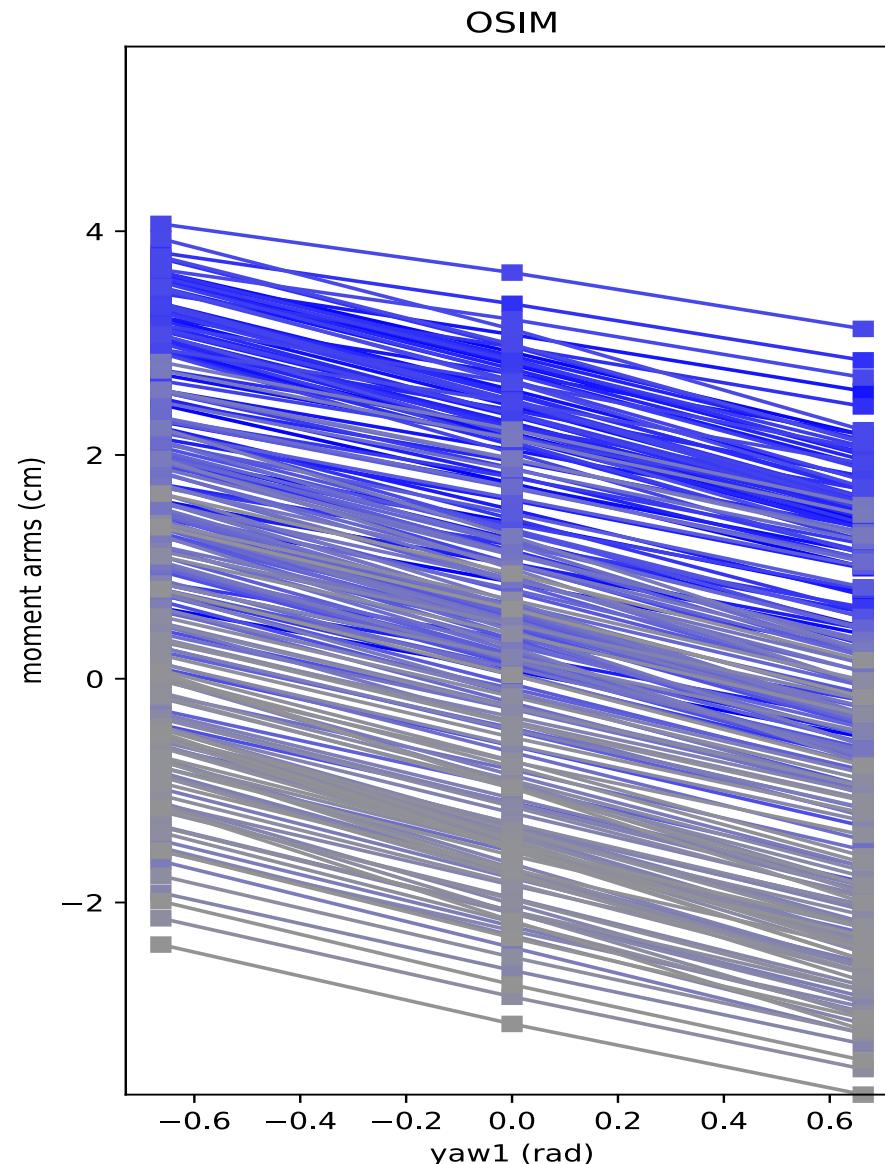
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



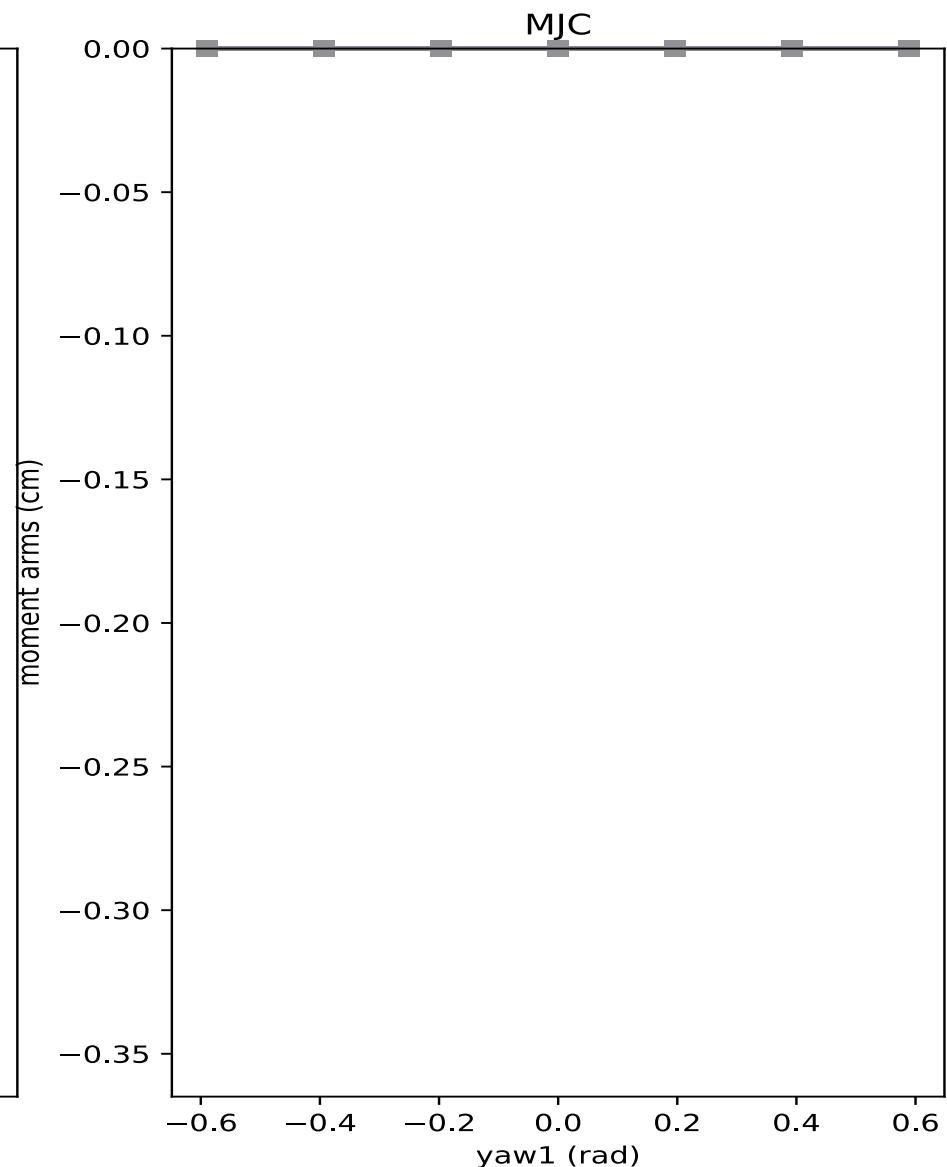
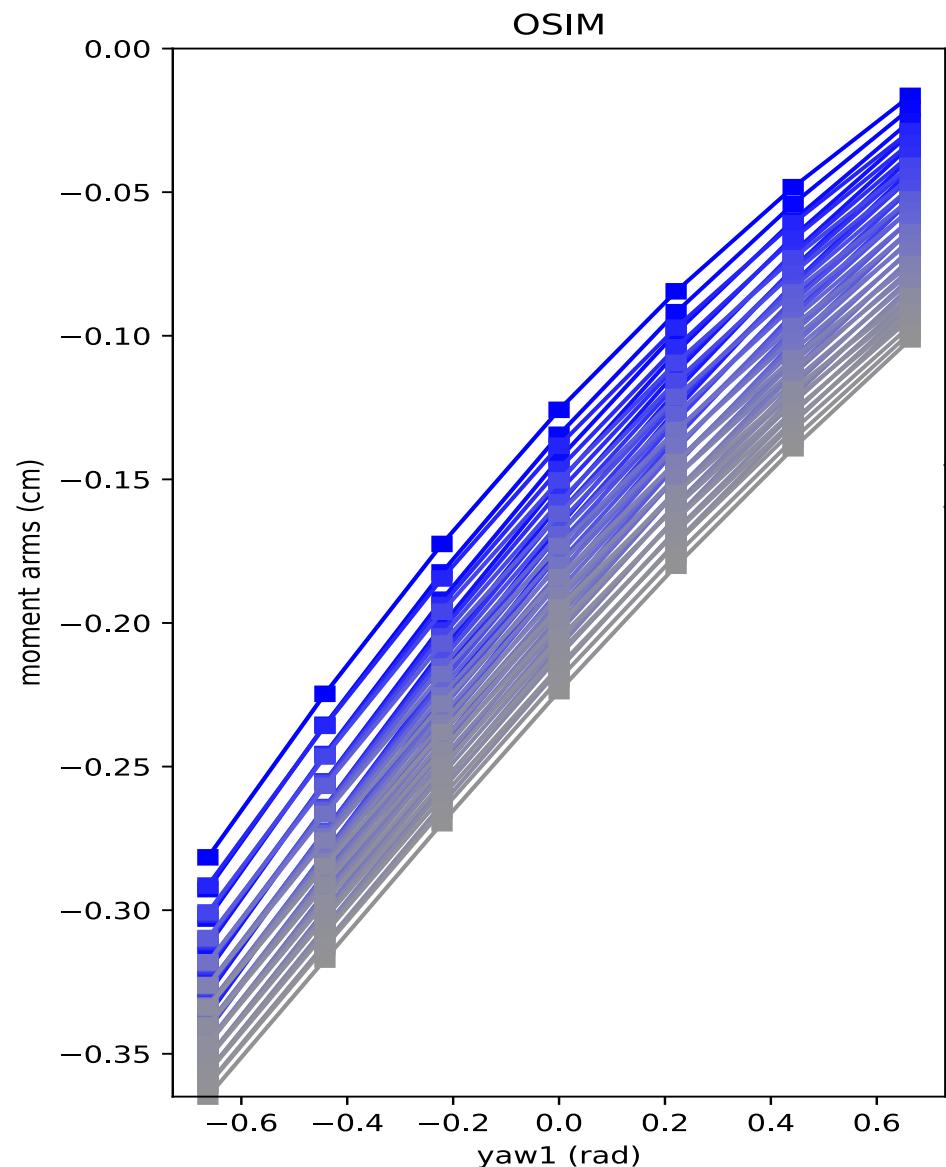
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



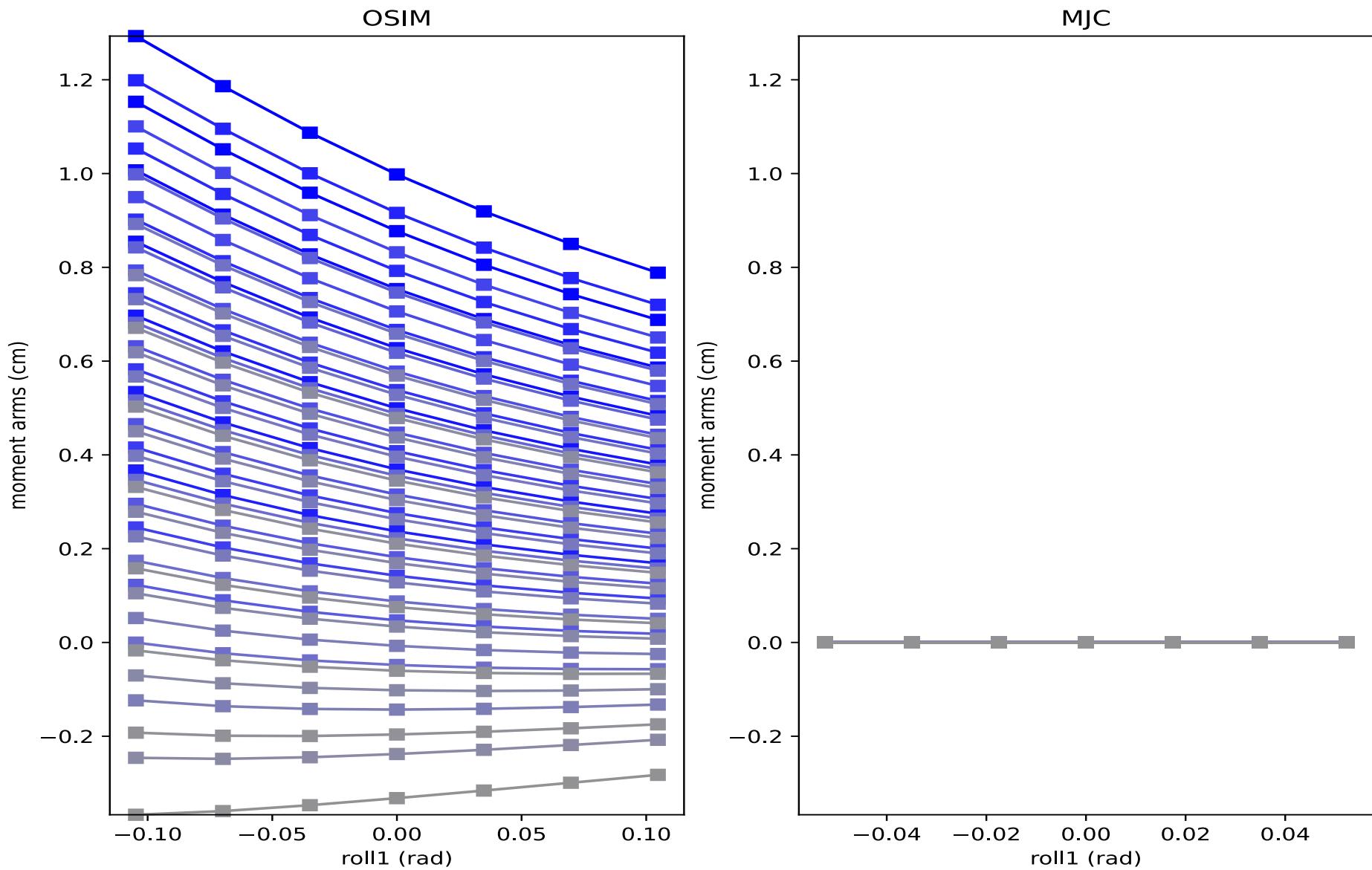
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post_L - pitch1 - roll1 - yaw1



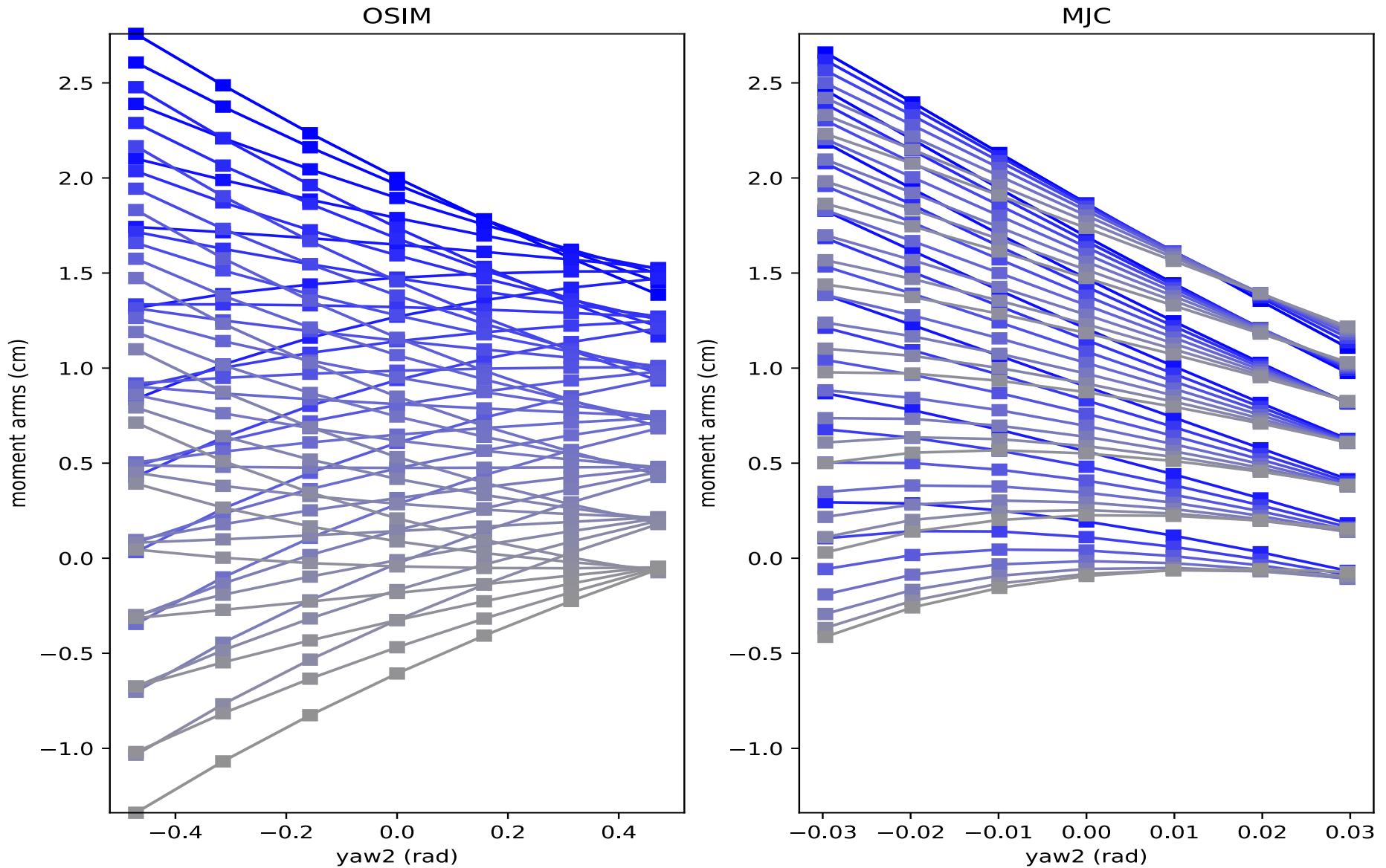
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid_L - pitch1 - roll1 - yaw1



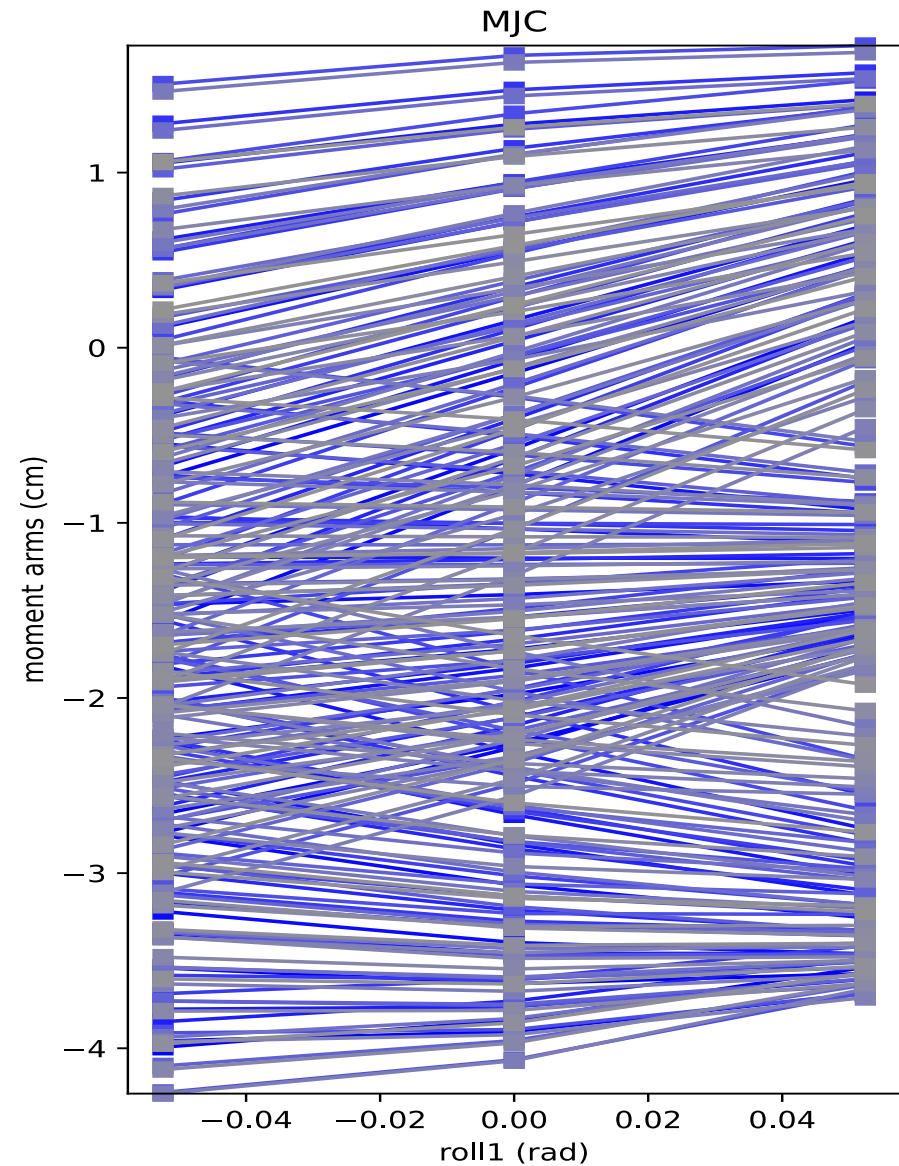
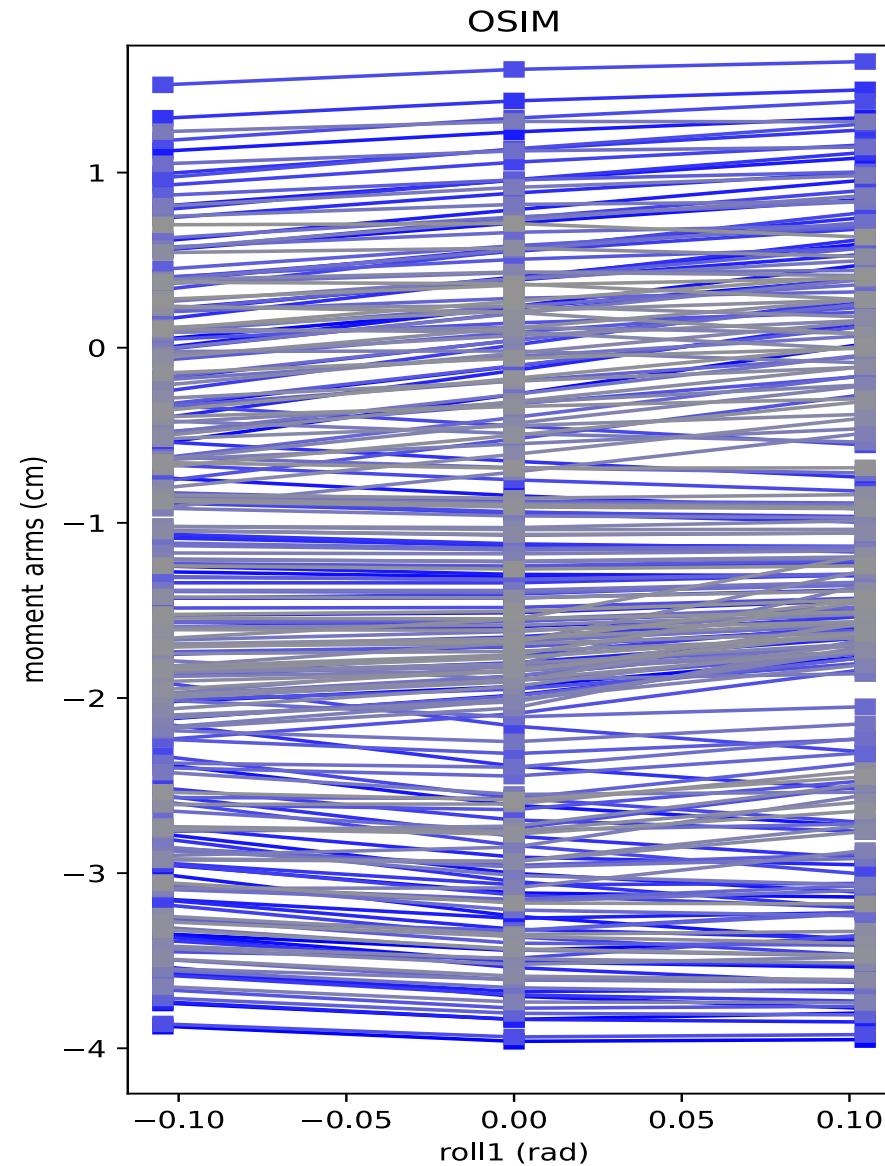
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid_L - pitch2 - roll2 - yaw2



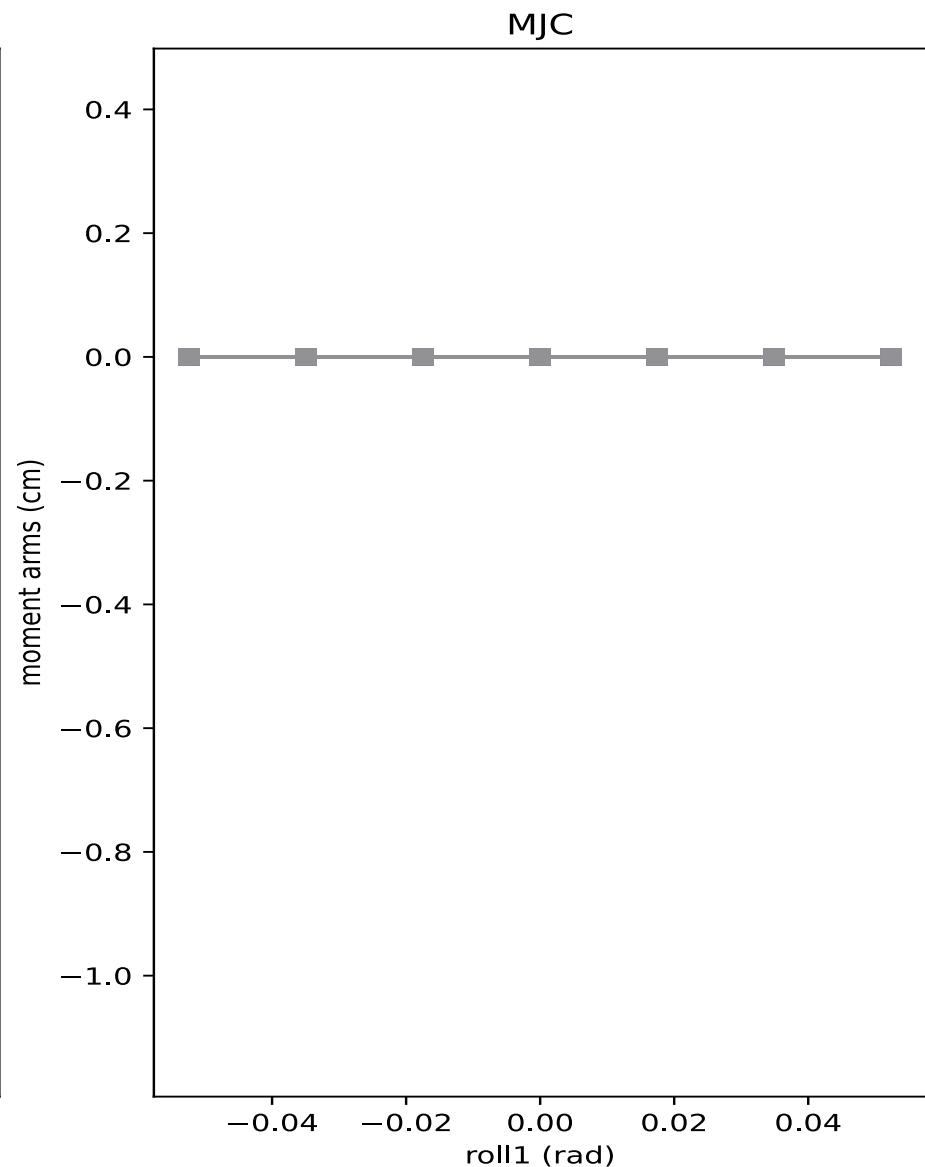
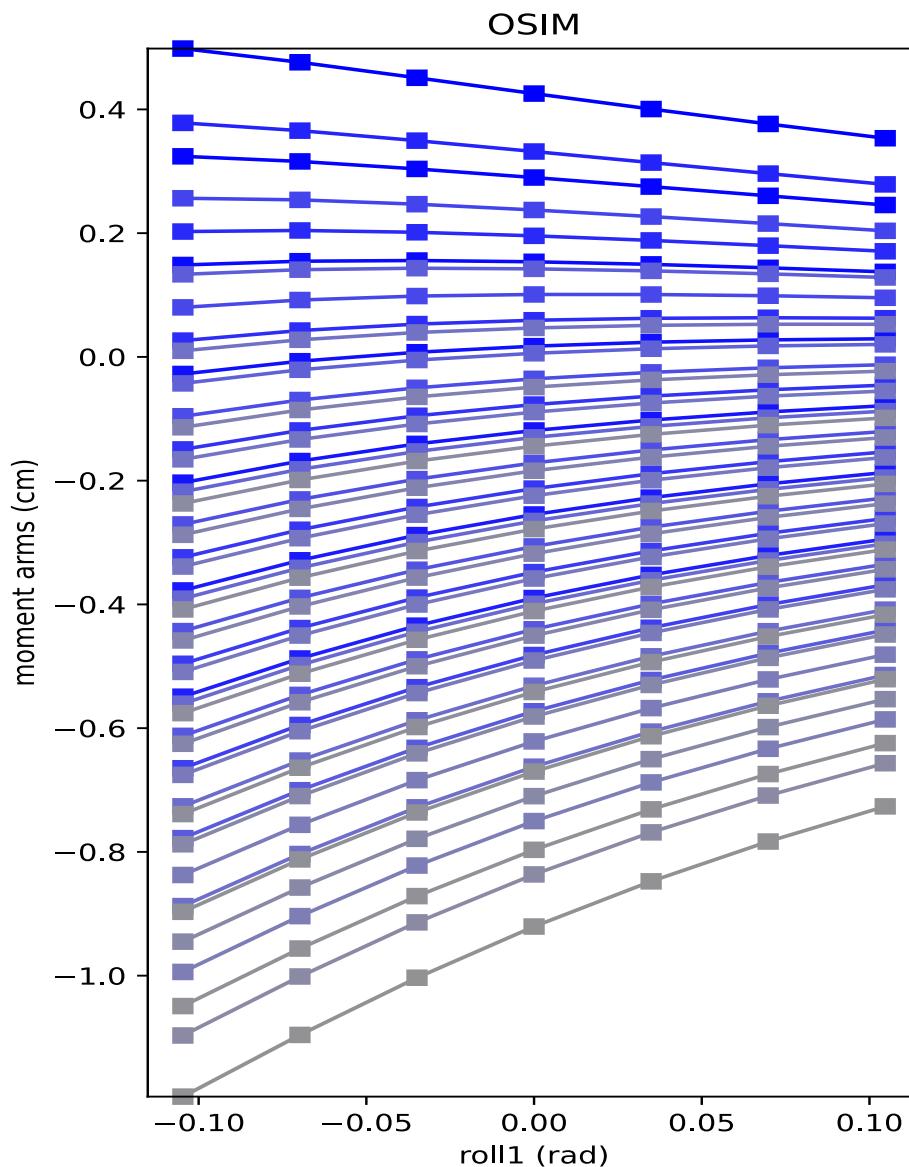
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_skLthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



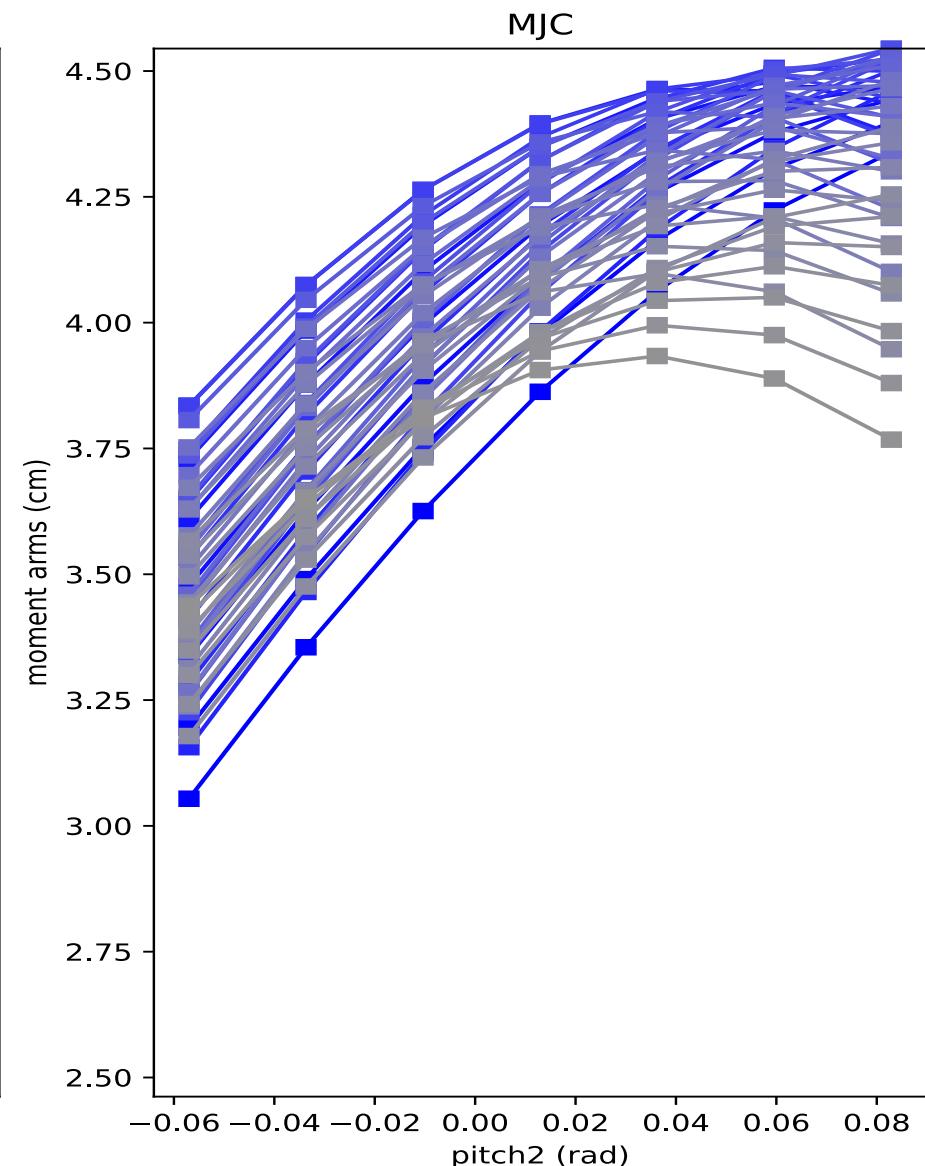
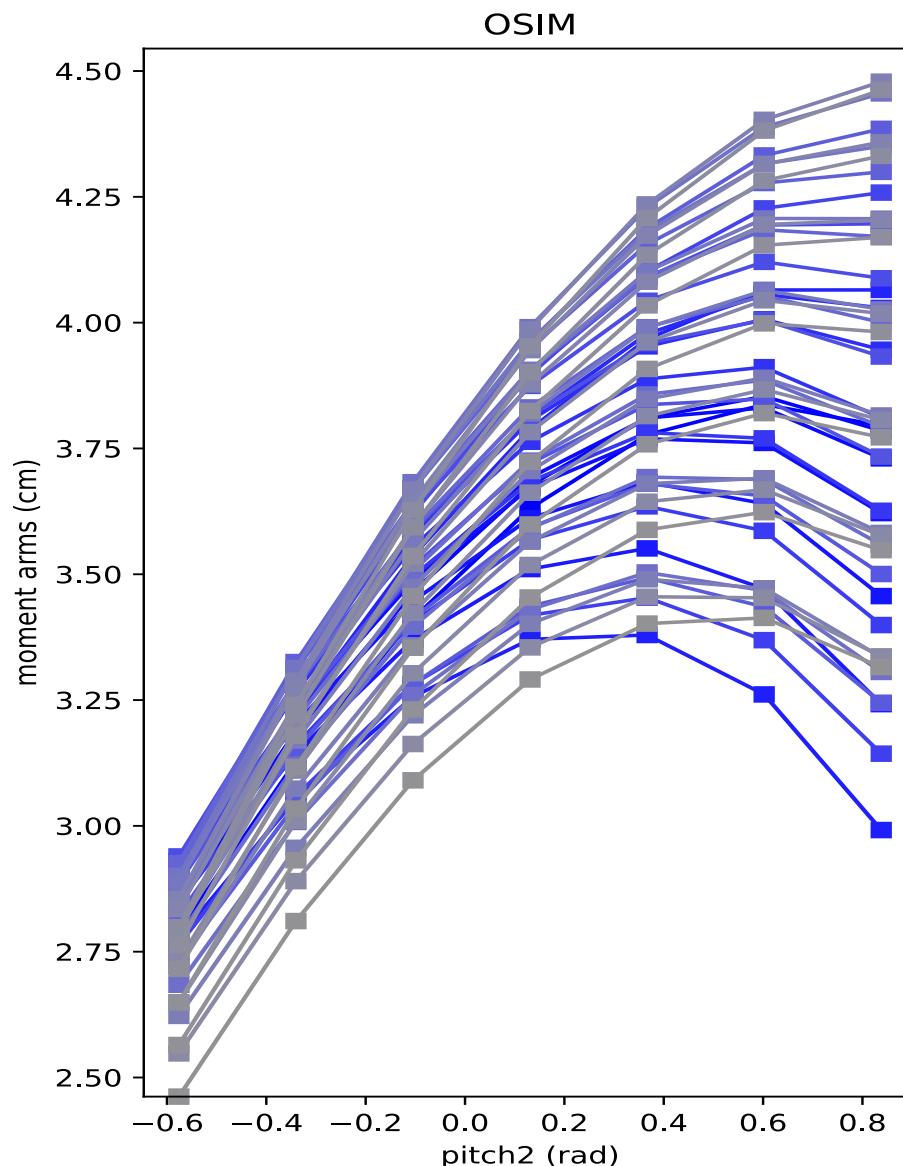
Muscle specific moment arm comparison with Osim model after optimization

Geniohyoid - pitch1 - roll1 - yaw1



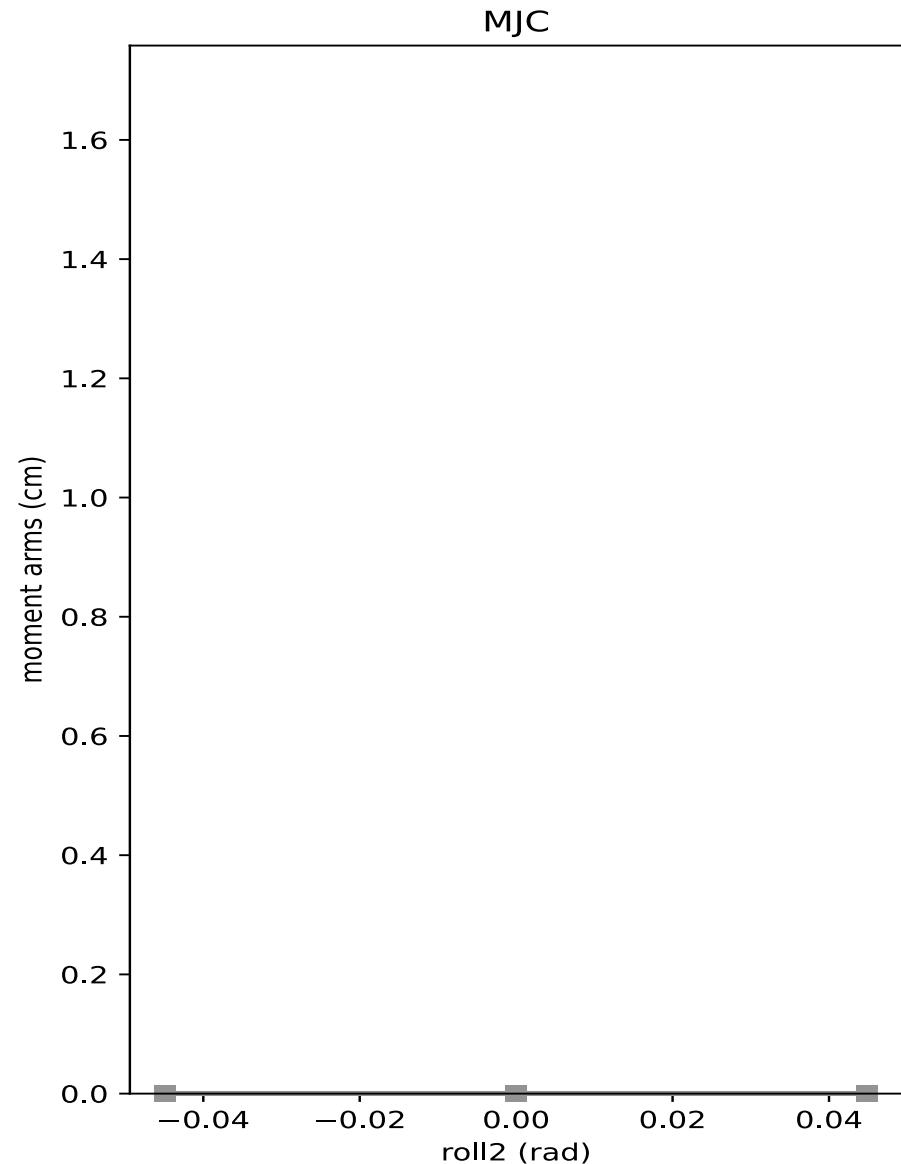
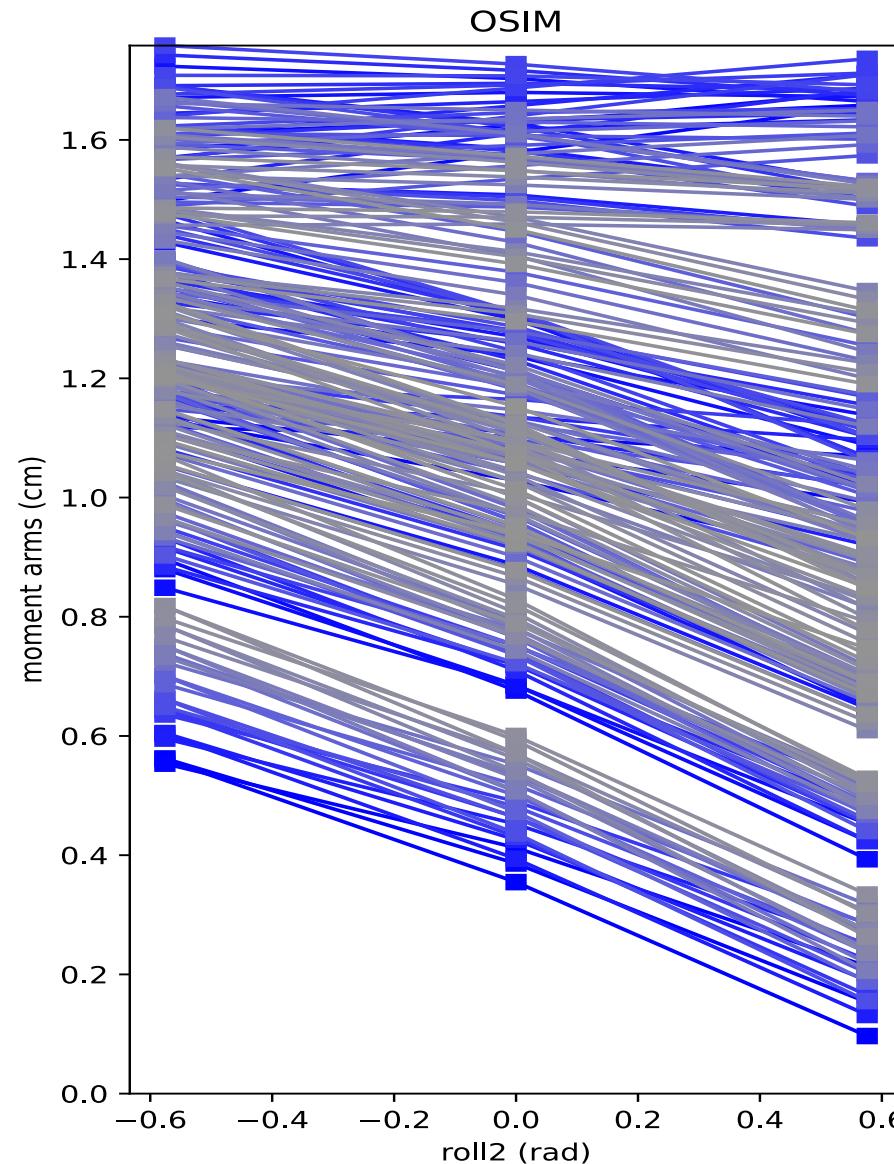
Muscle specific moment arm comparison with Osim model after optimization

levator_scap_L - pitch2 - roll2 - yaw2



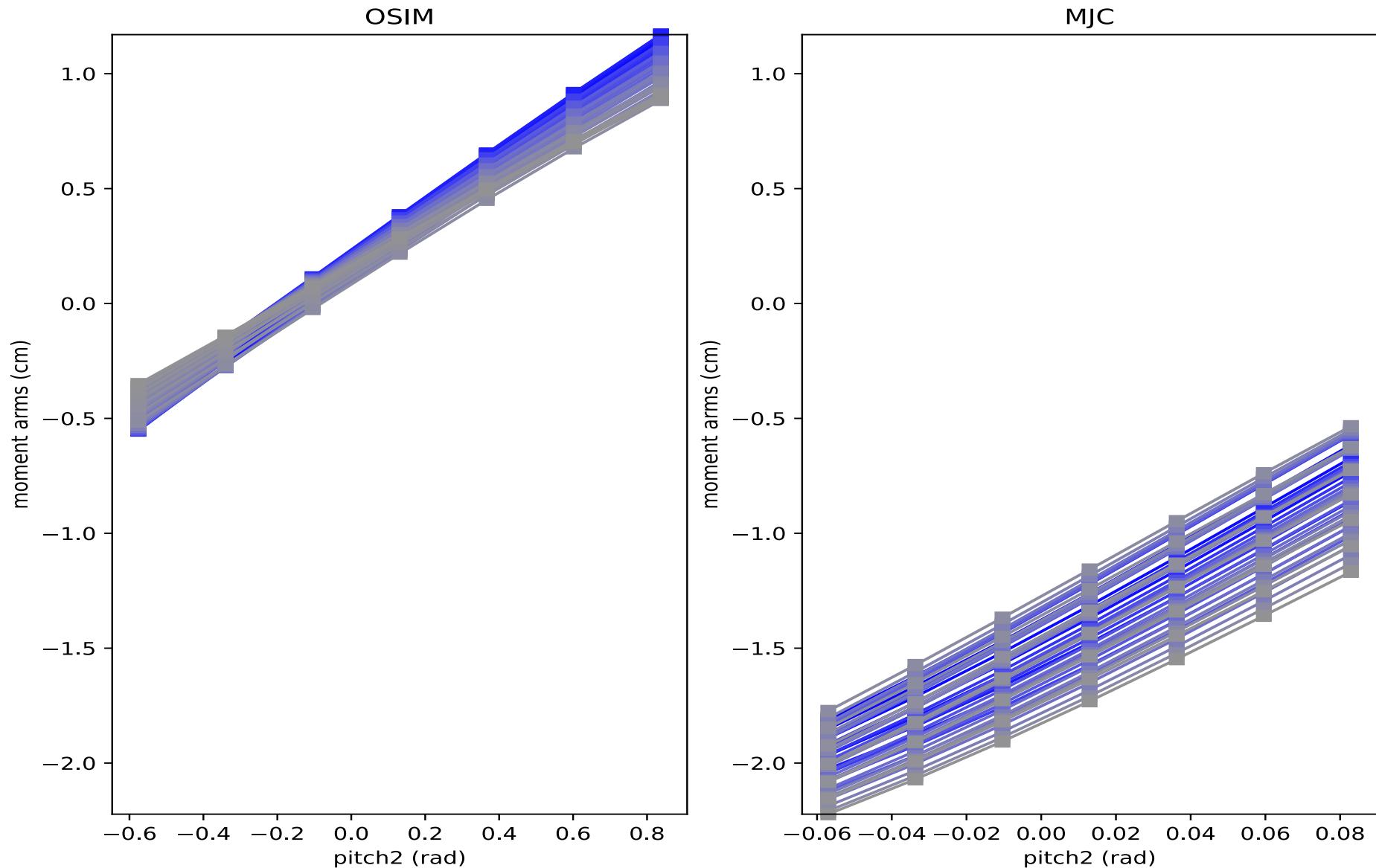
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



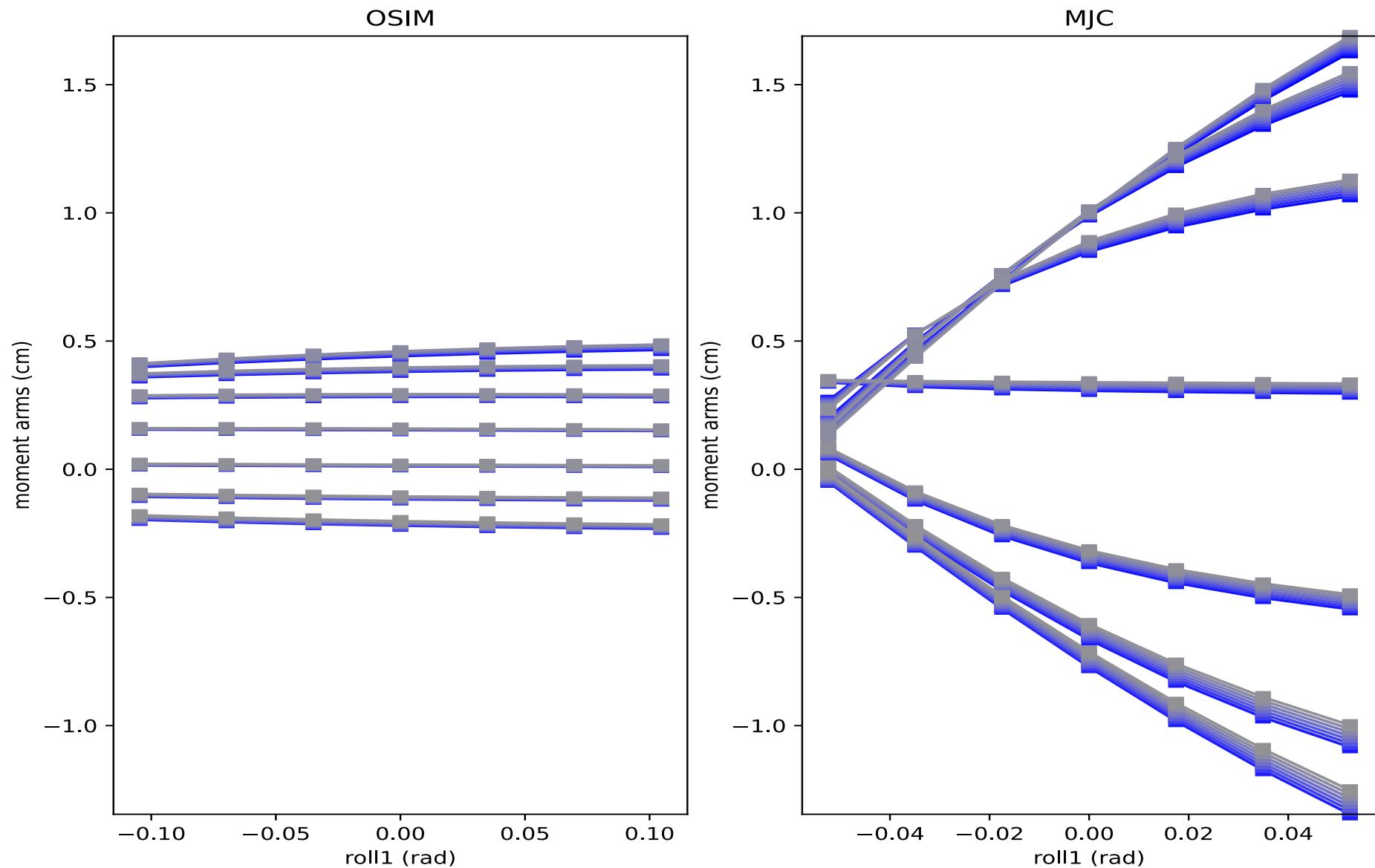
Muscle specific moment arm comparison with Osim model after optimization

scalenus_med - pitch2 - roll2 - yaw2



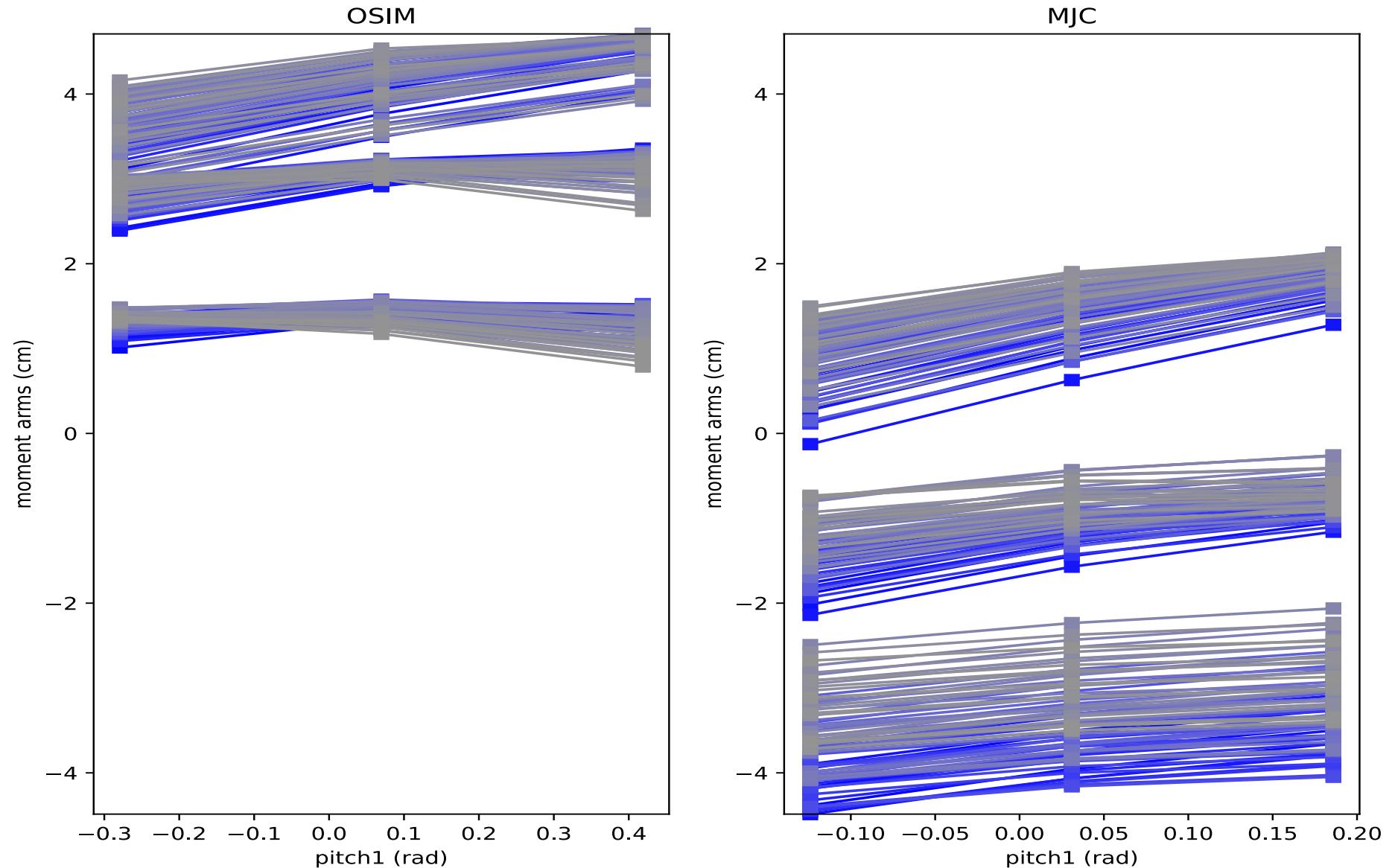
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch1 - roll1 - yaw1



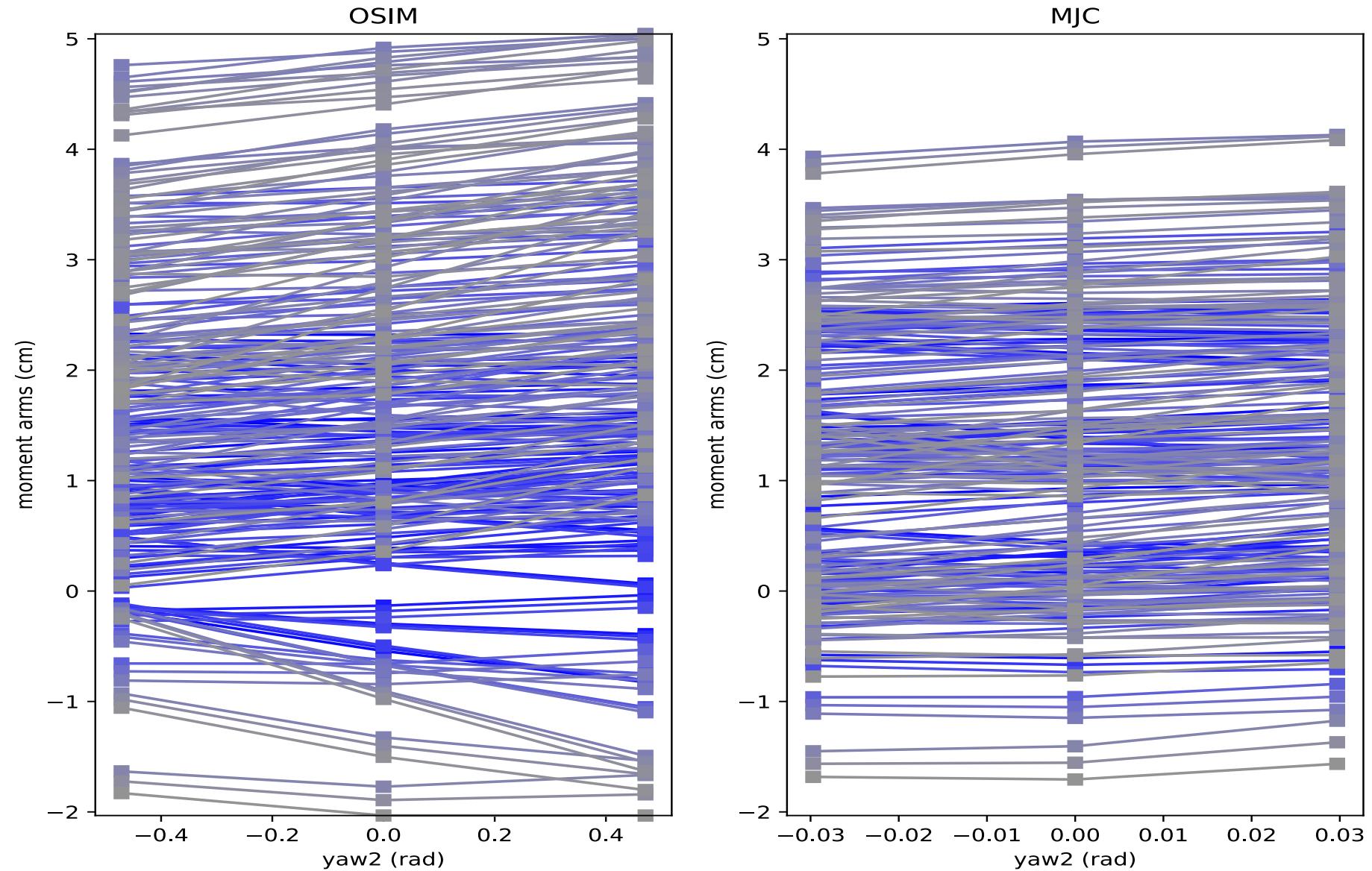
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



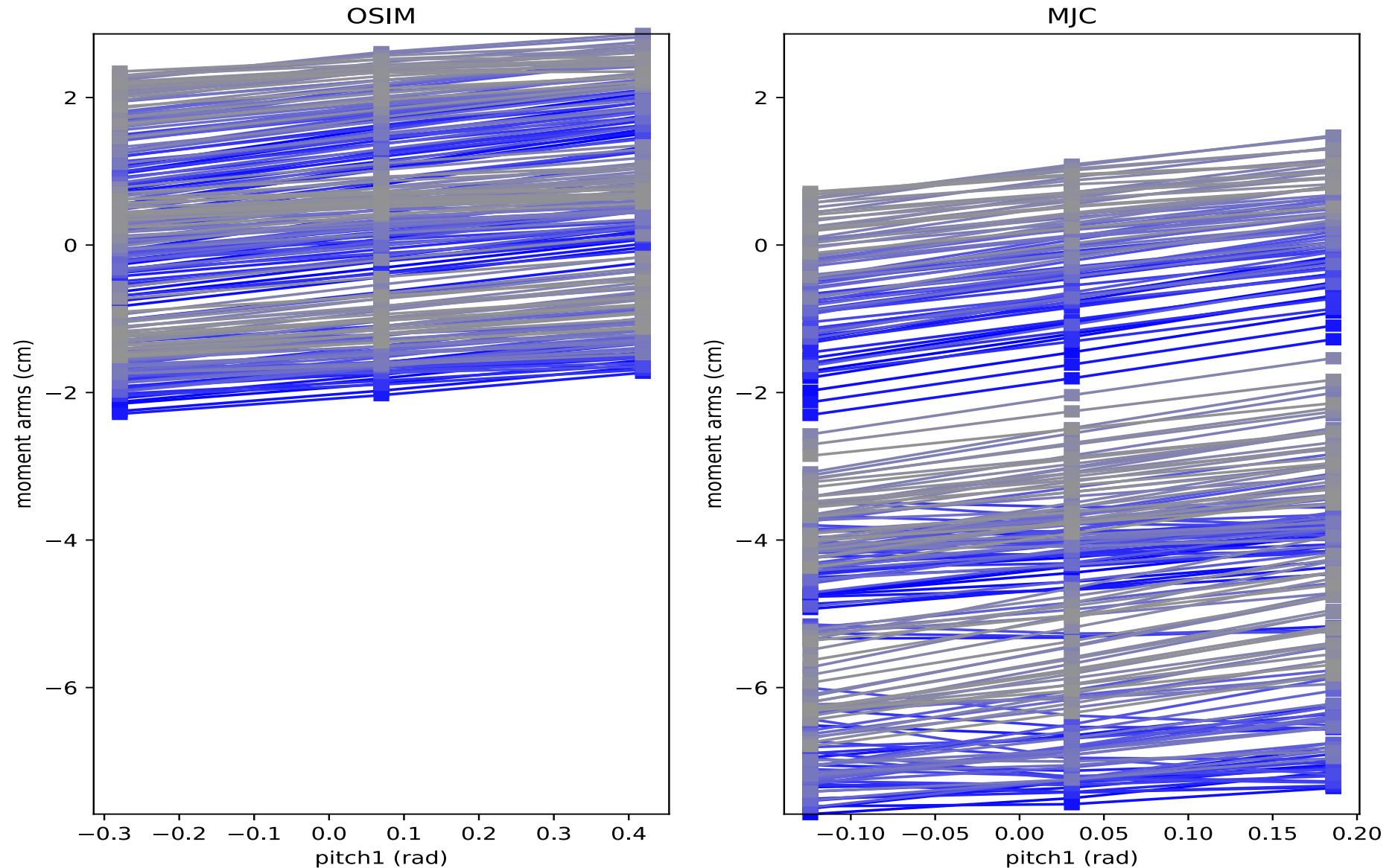
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



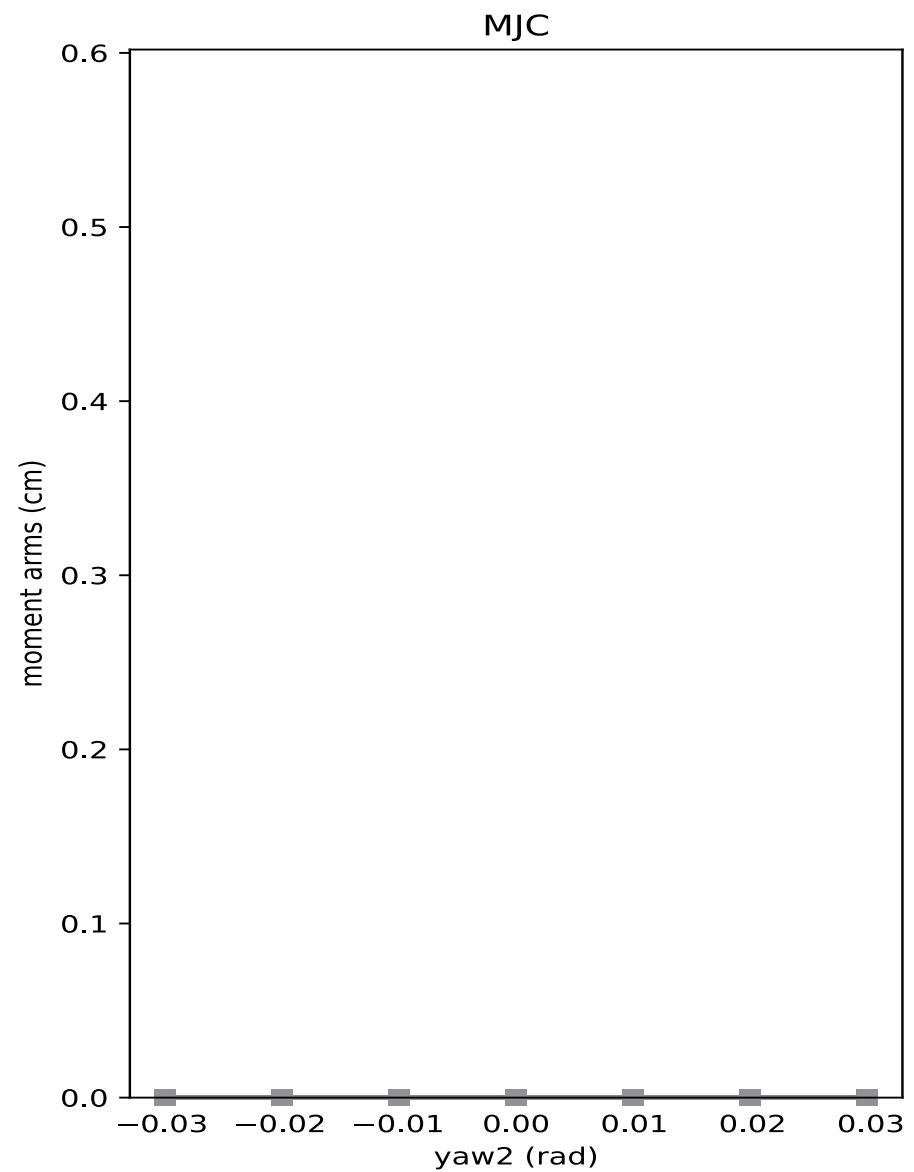
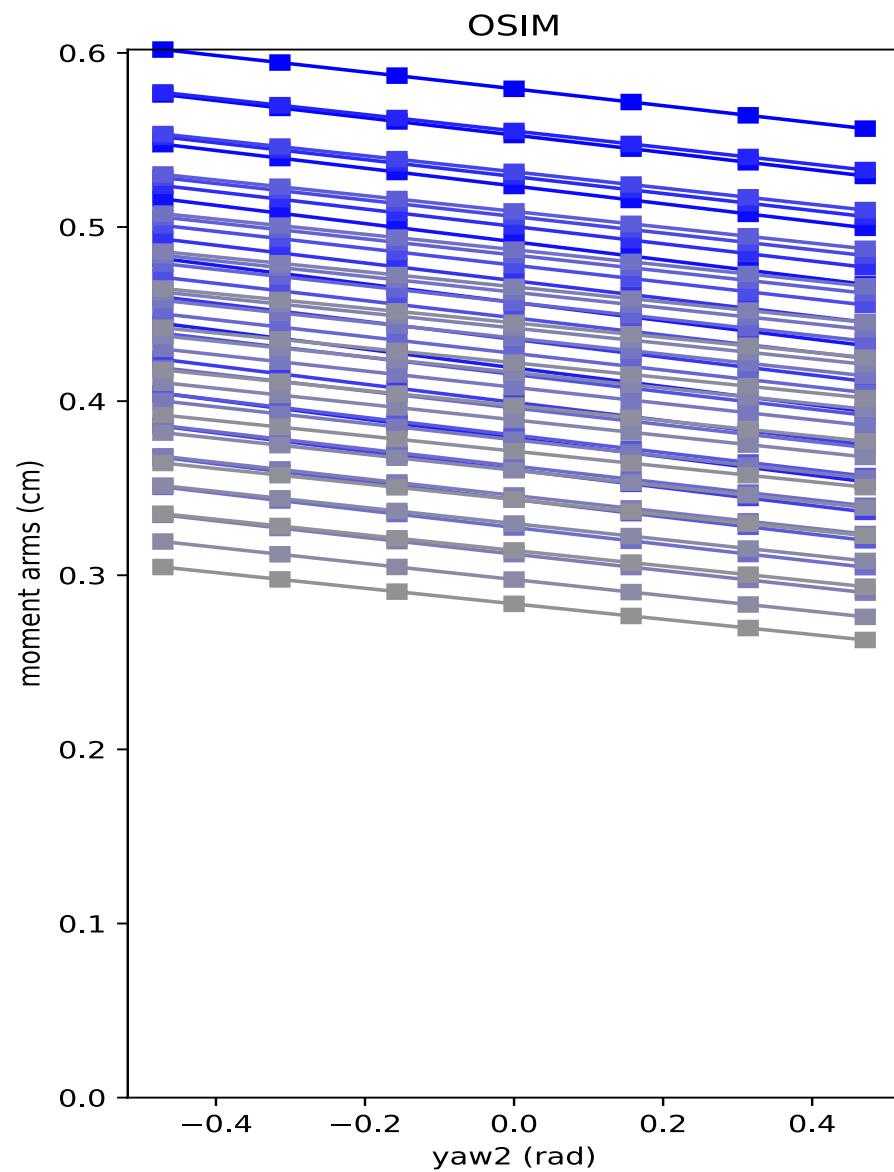
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



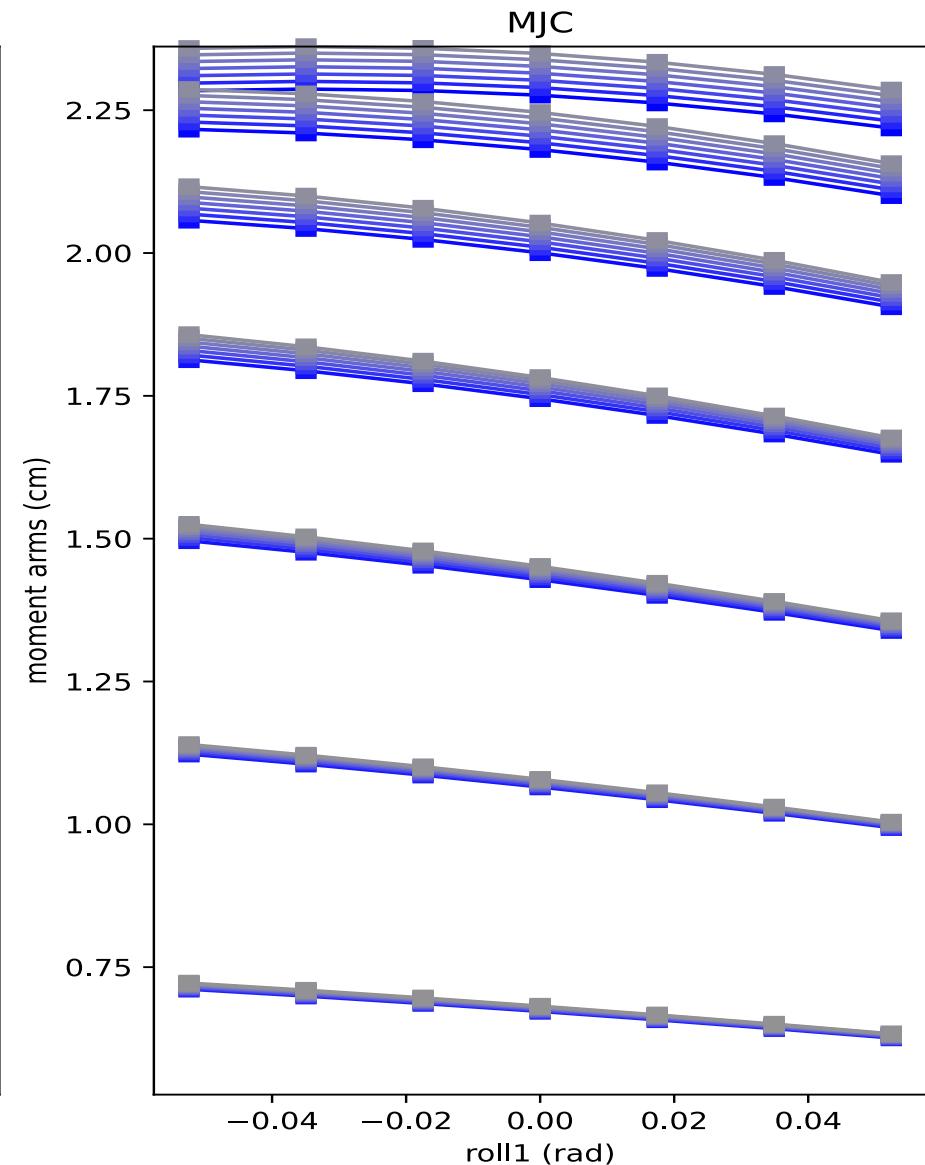
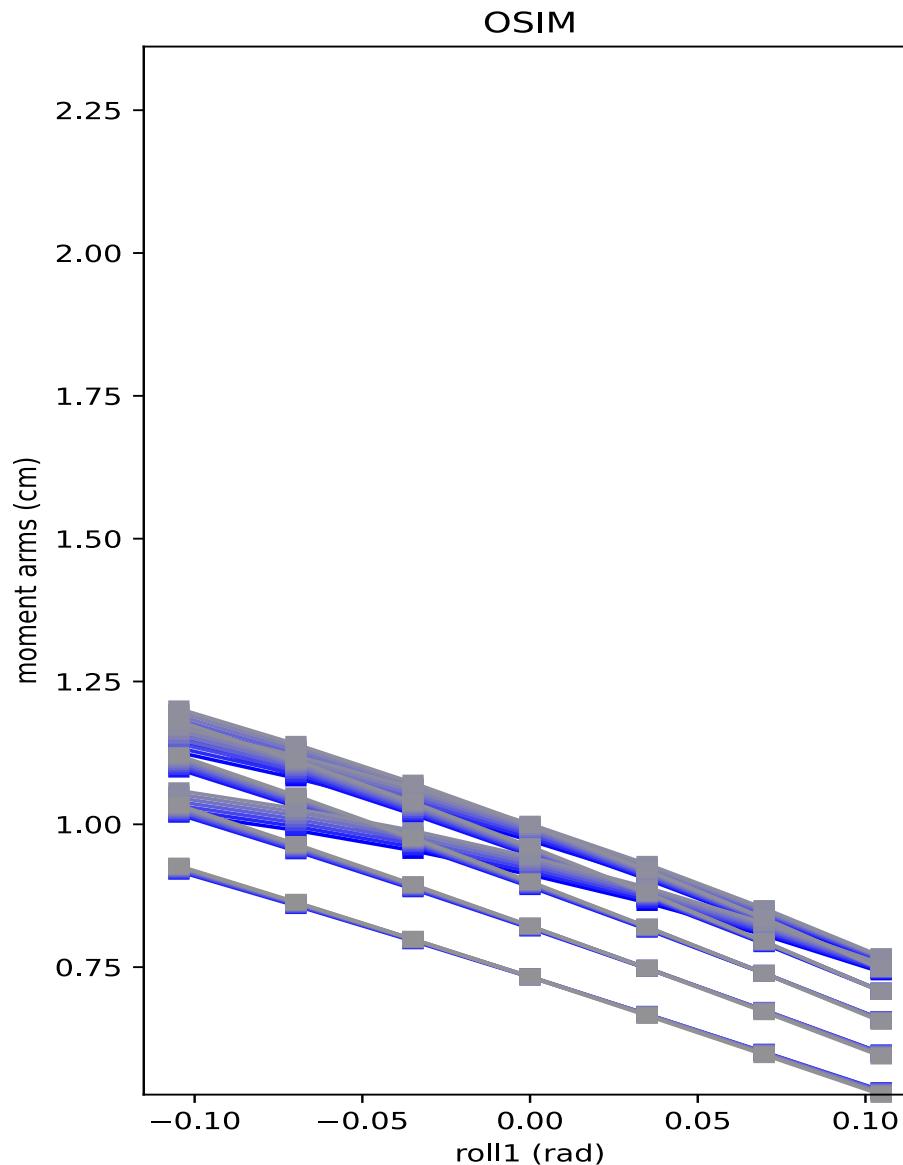
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch2 - roll2 - yaw2



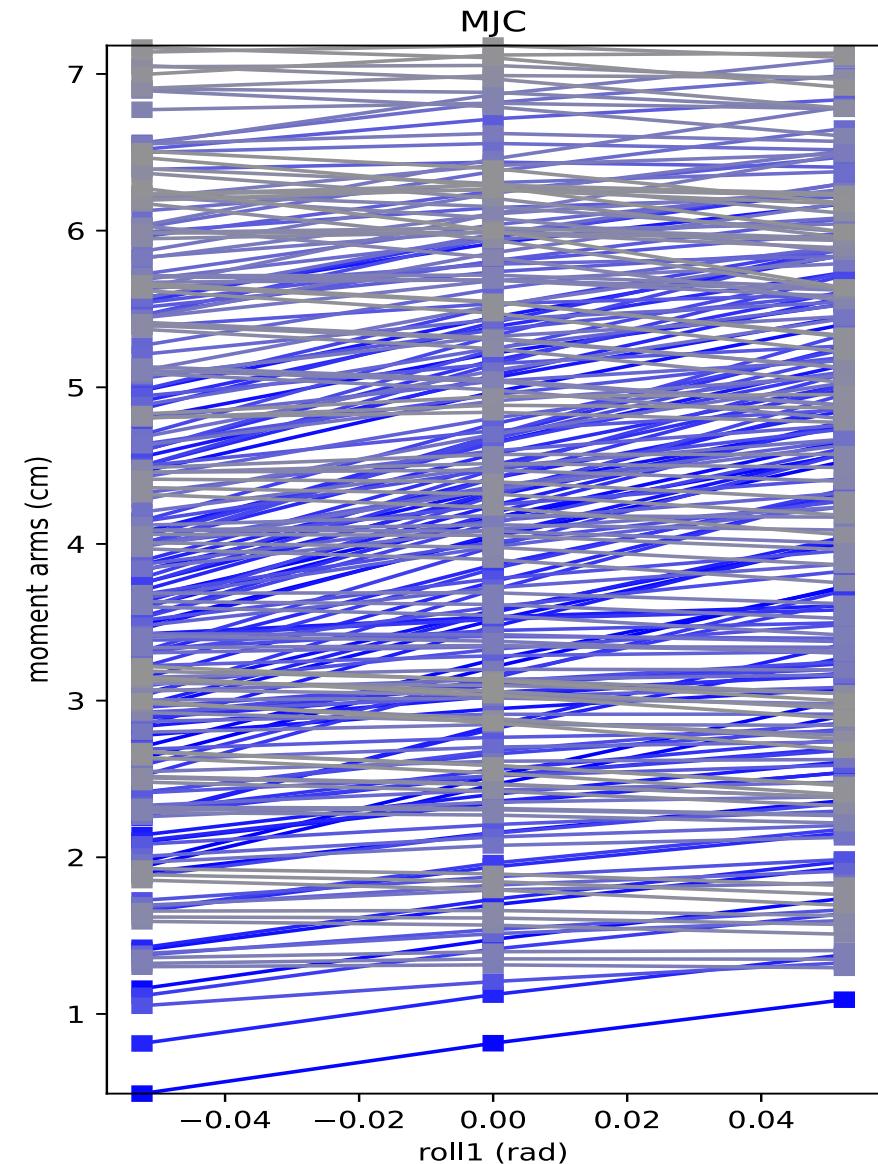
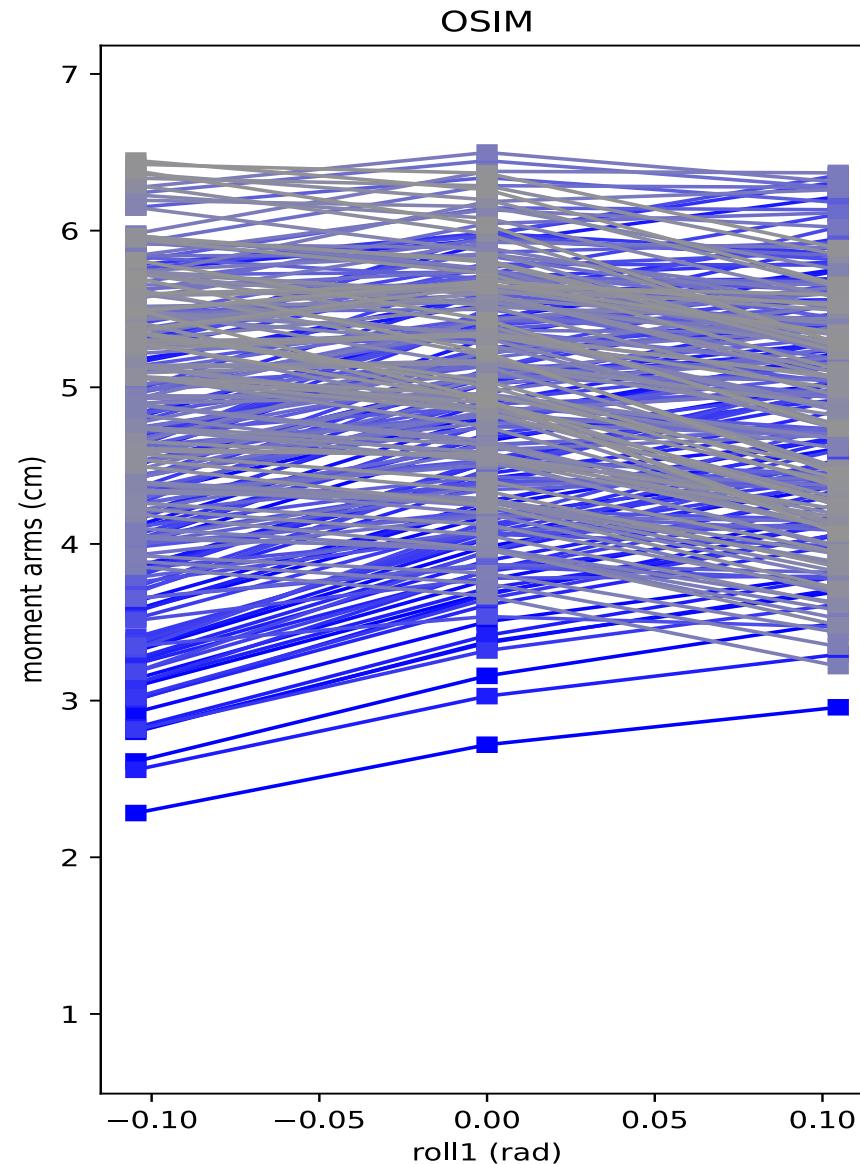
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_inf - pitch1 - roll1 - yaw1



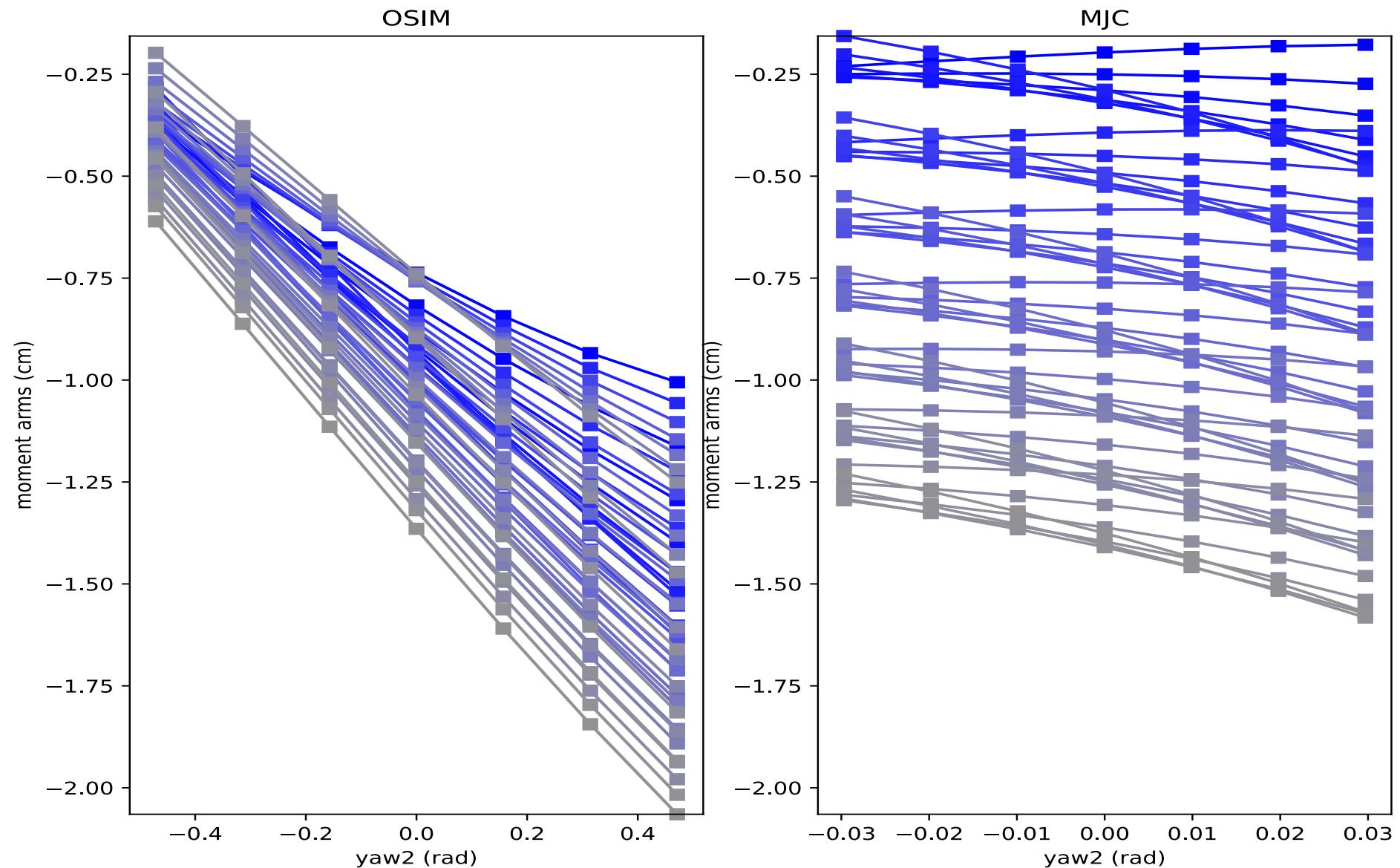
Muscle specific moment arm comparison with Osim model after optimization

stern_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



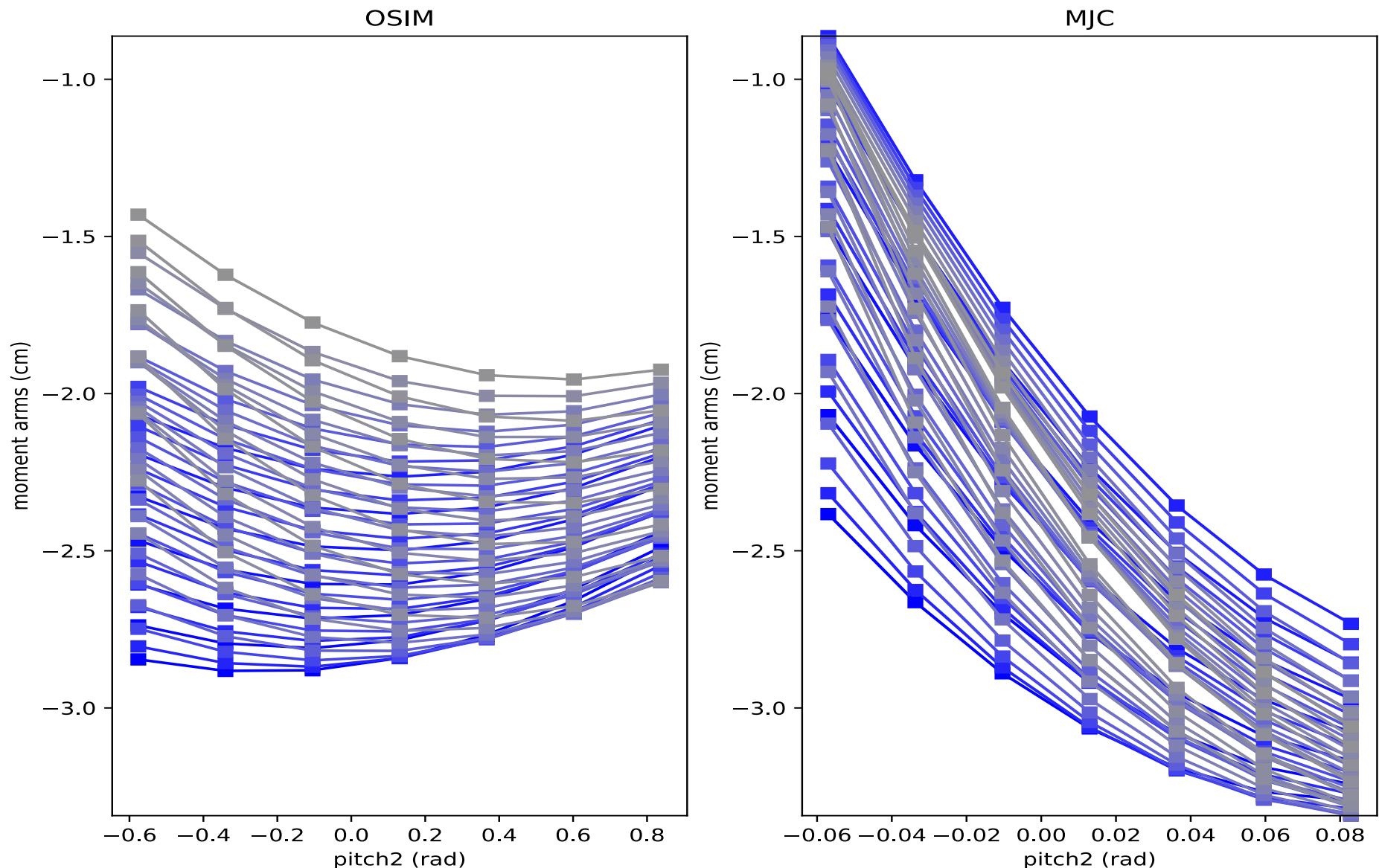
Muscle specific moment arm comparison with Osim model after optimization

splen_cerv_c3thx - pitch2 - roll2 - yaw2



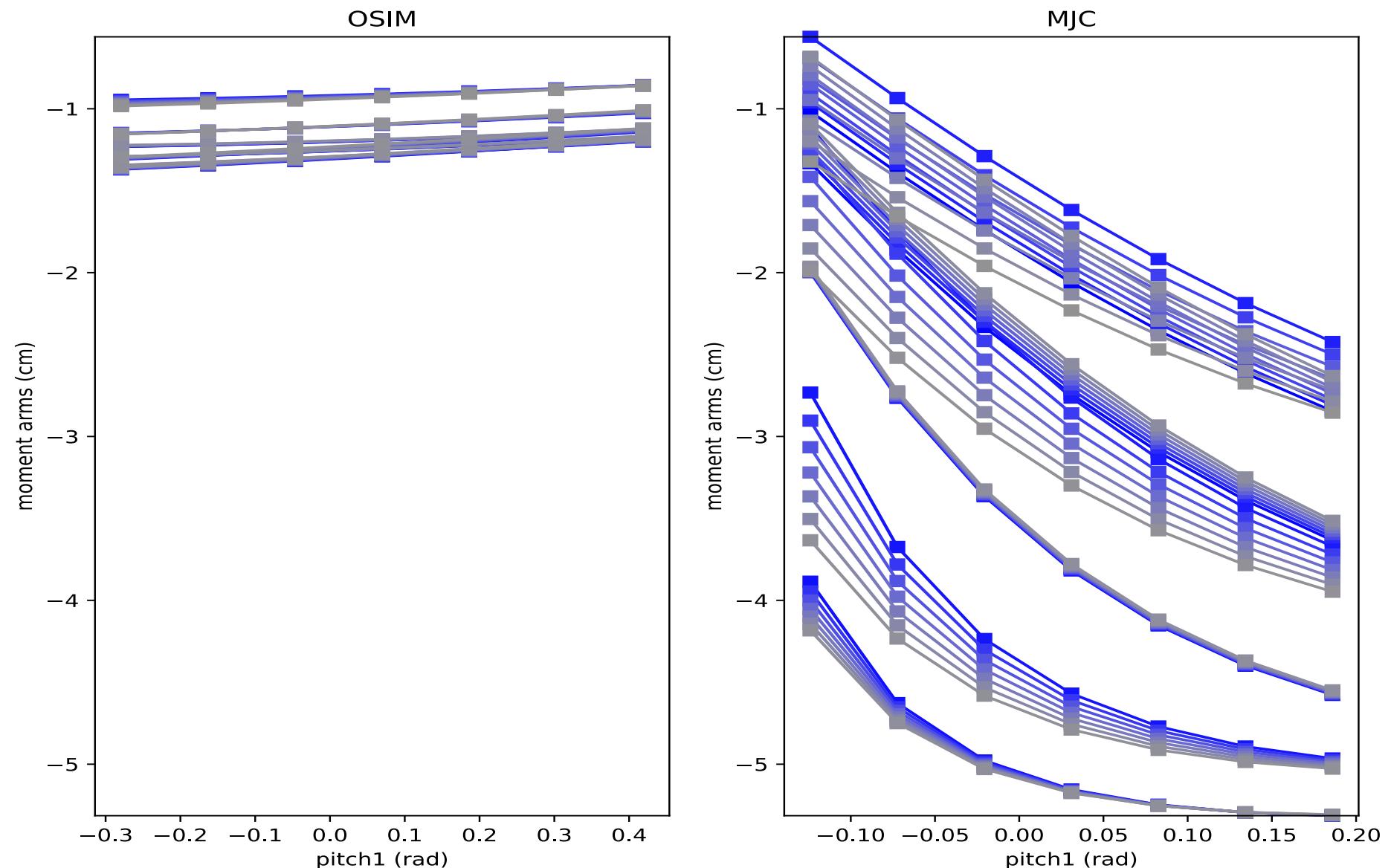
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyoid - pitch2 - roll2 - yaw2



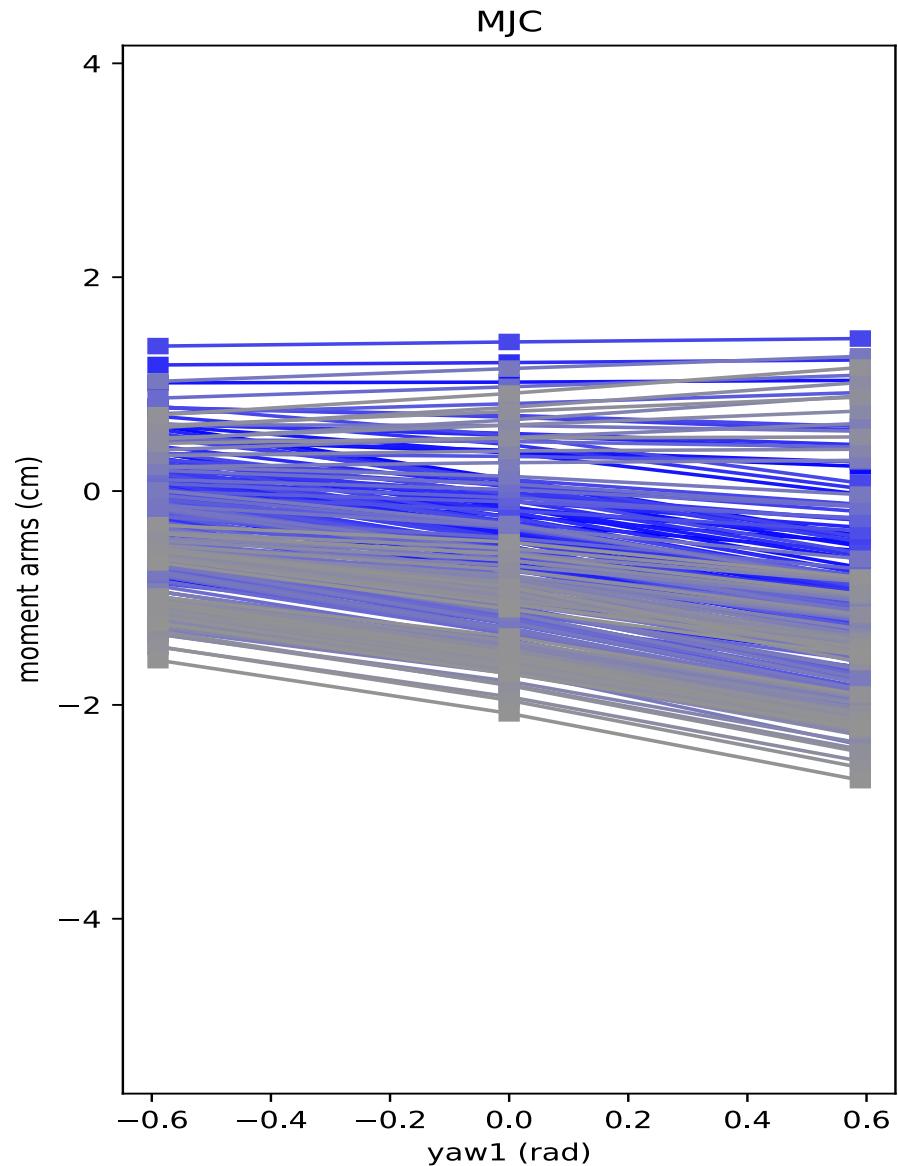
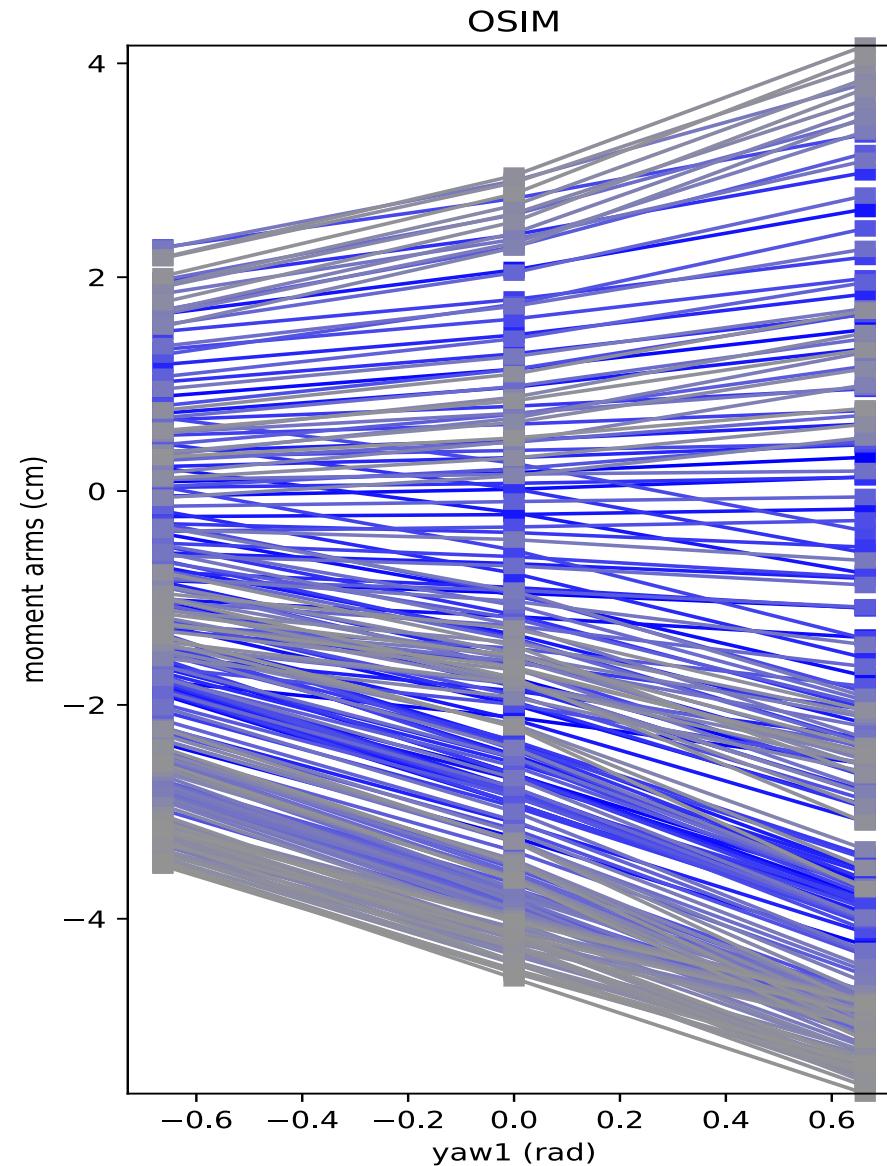
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4_L - pitch1 - roll1 - yaw1



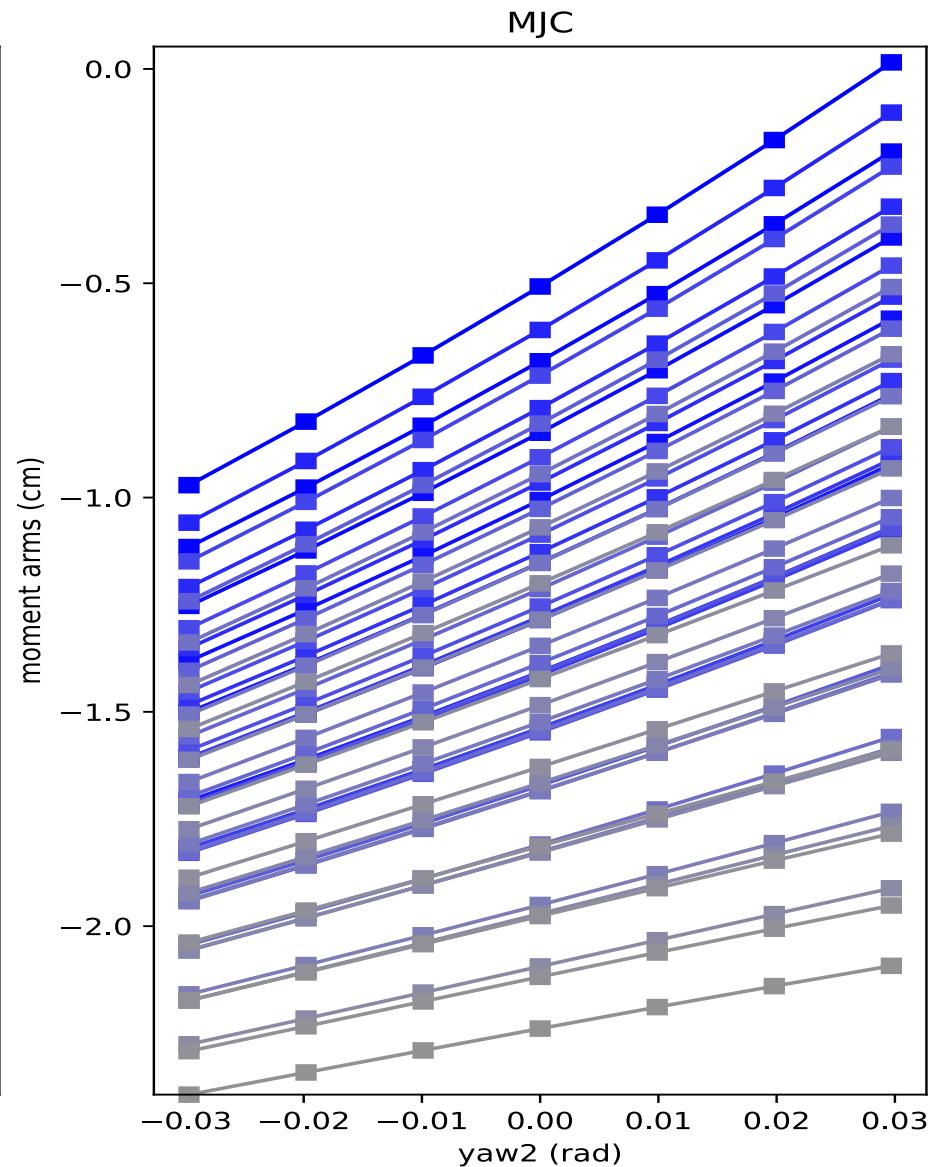
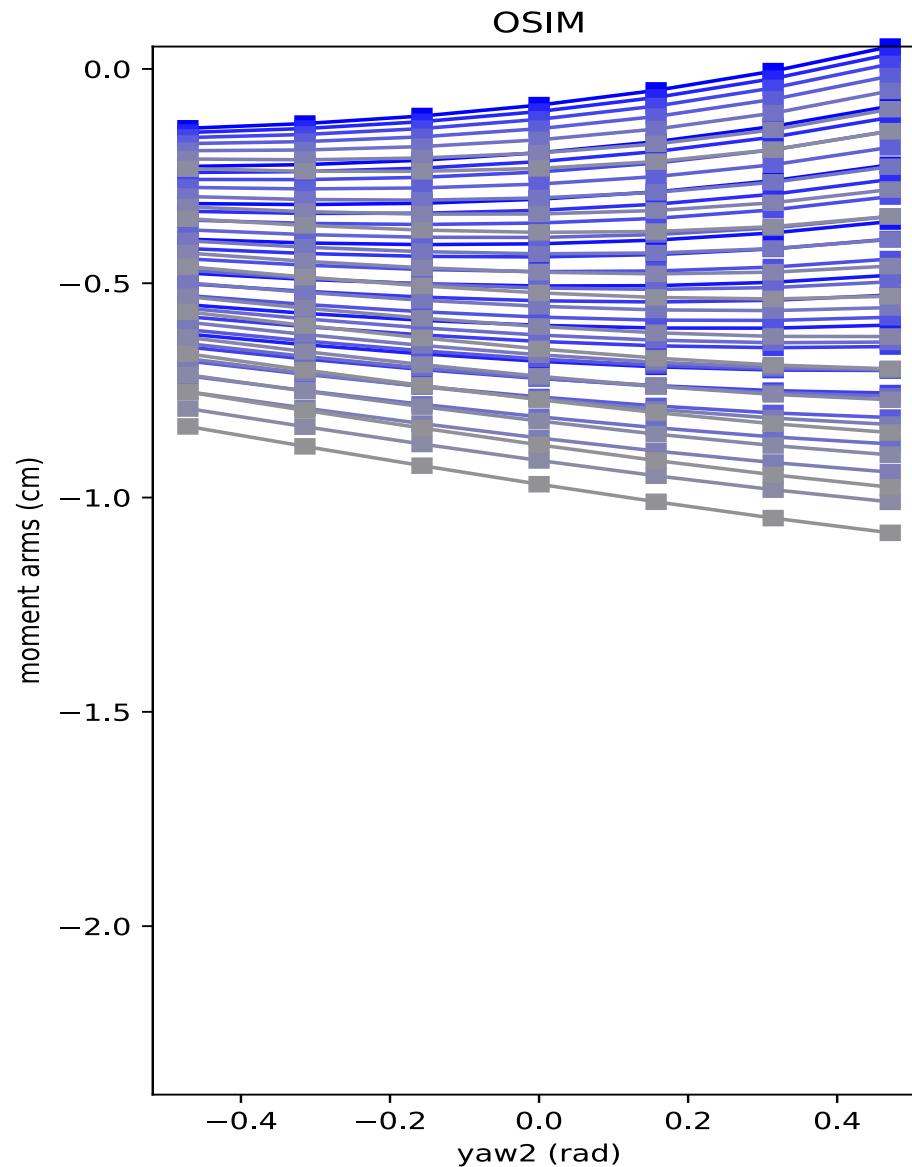
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



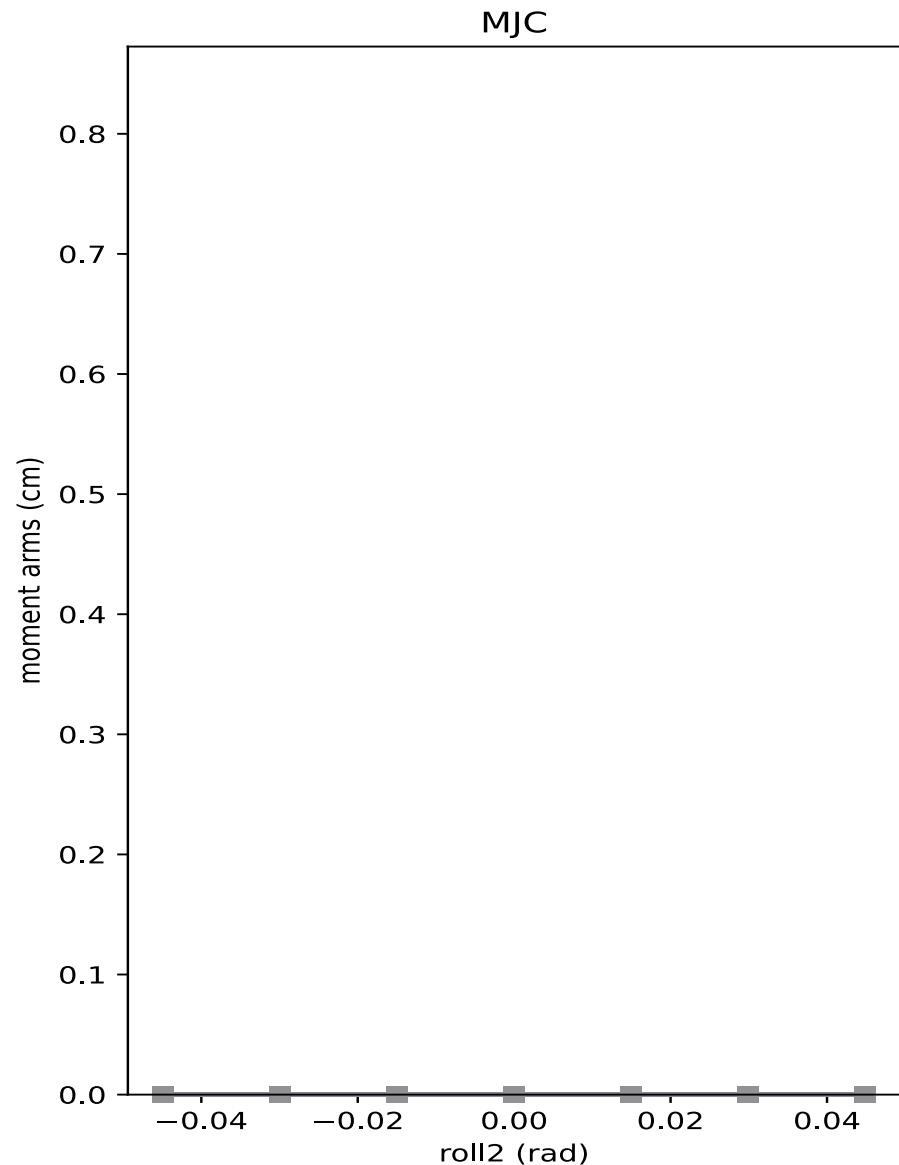
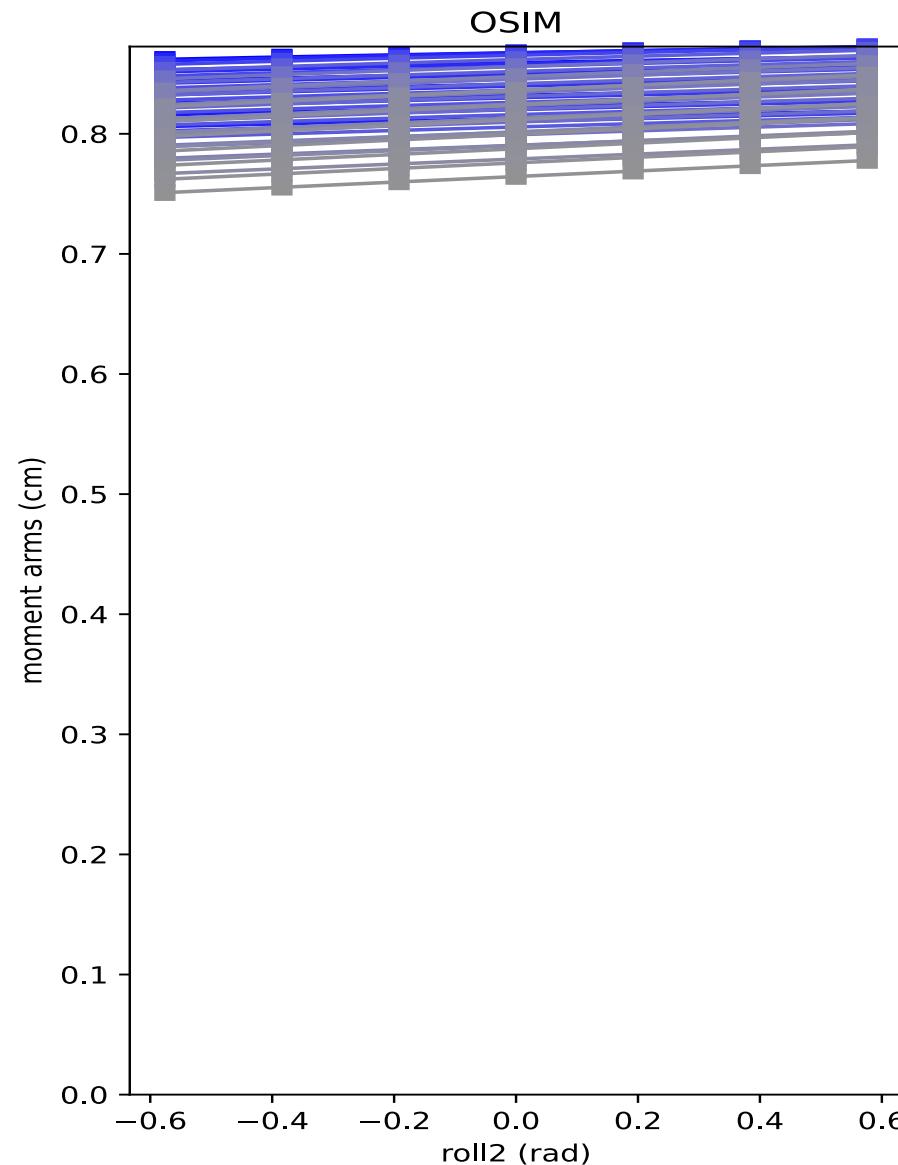
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib - pitch2 - roll2 - yaw2



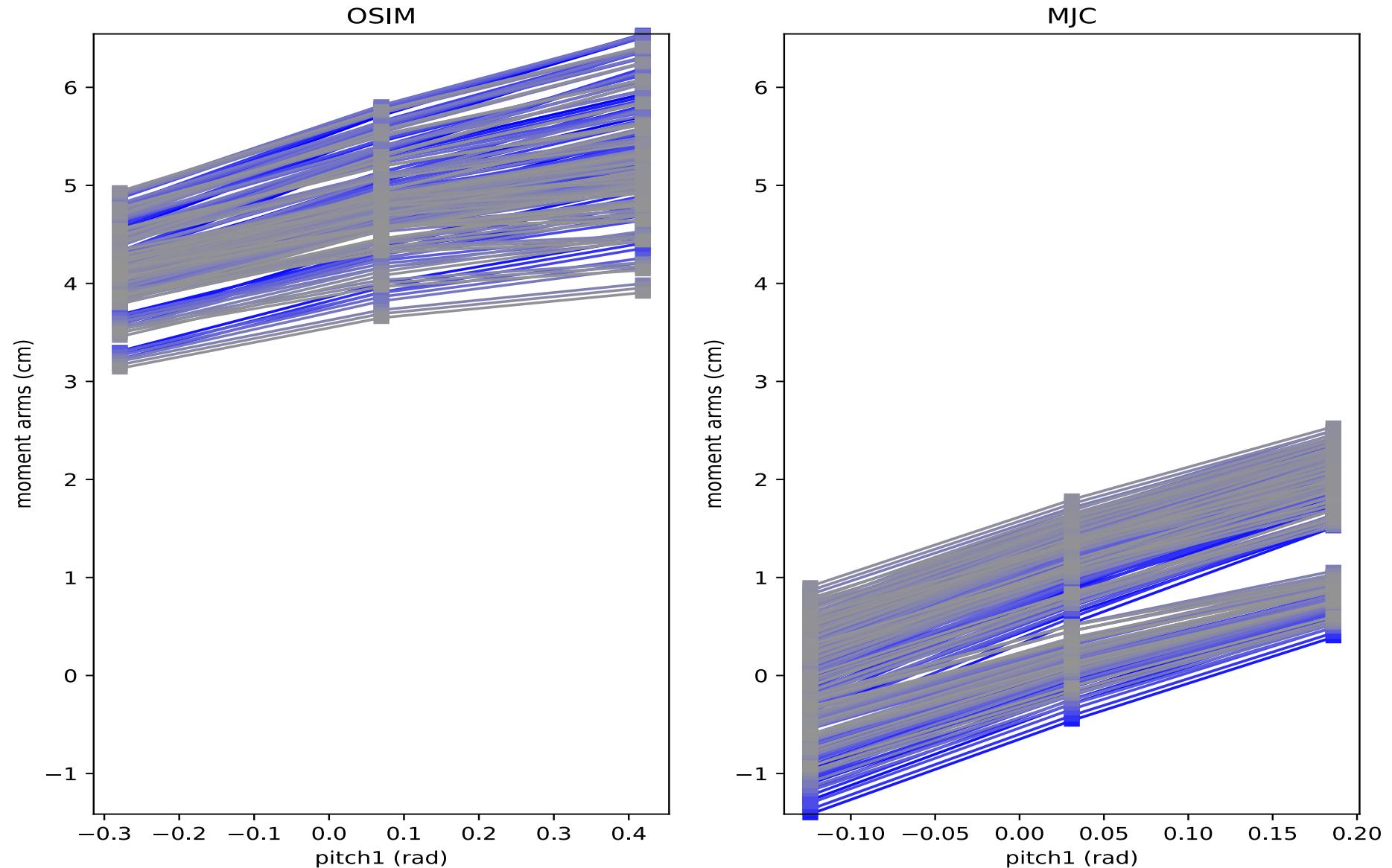
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch2 - roll2 - yaw2



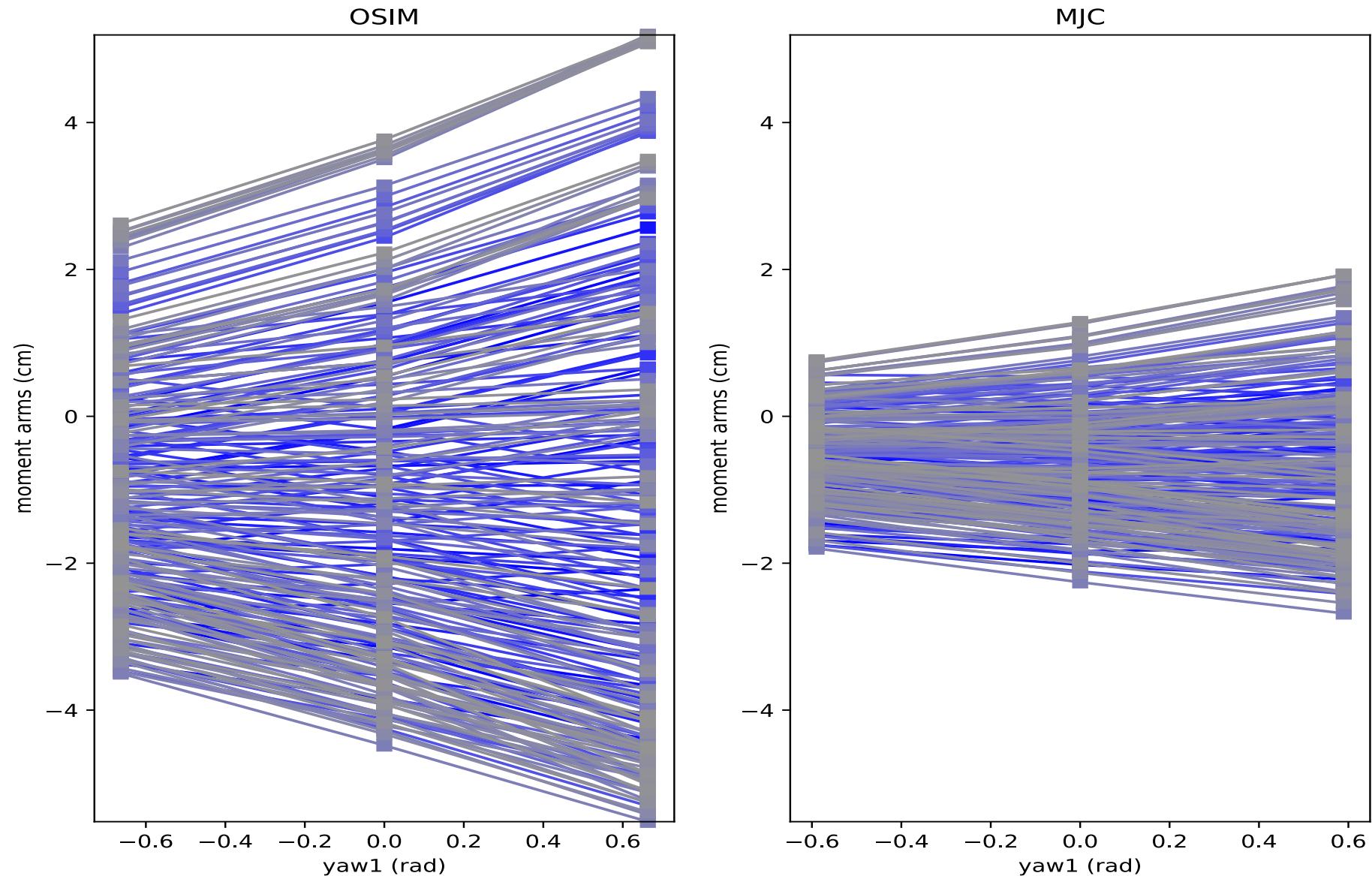
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



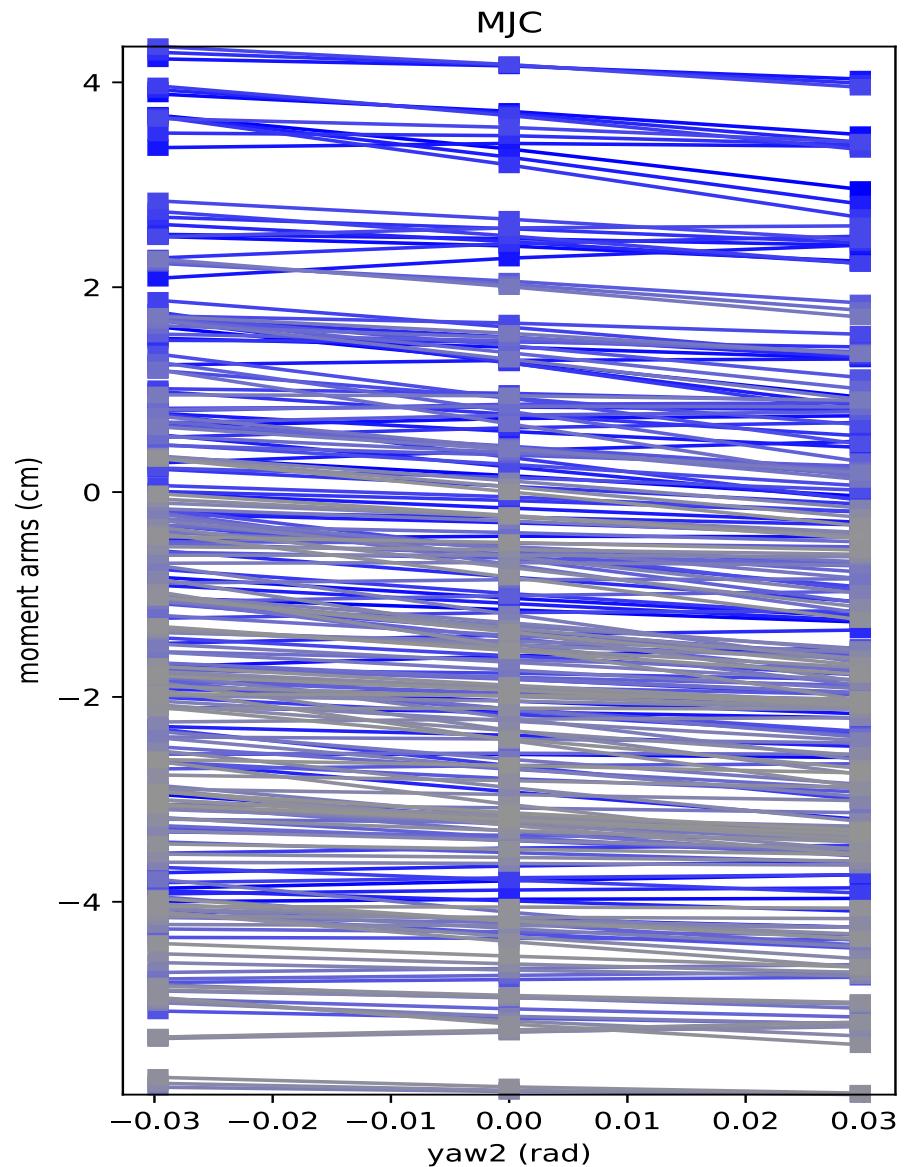
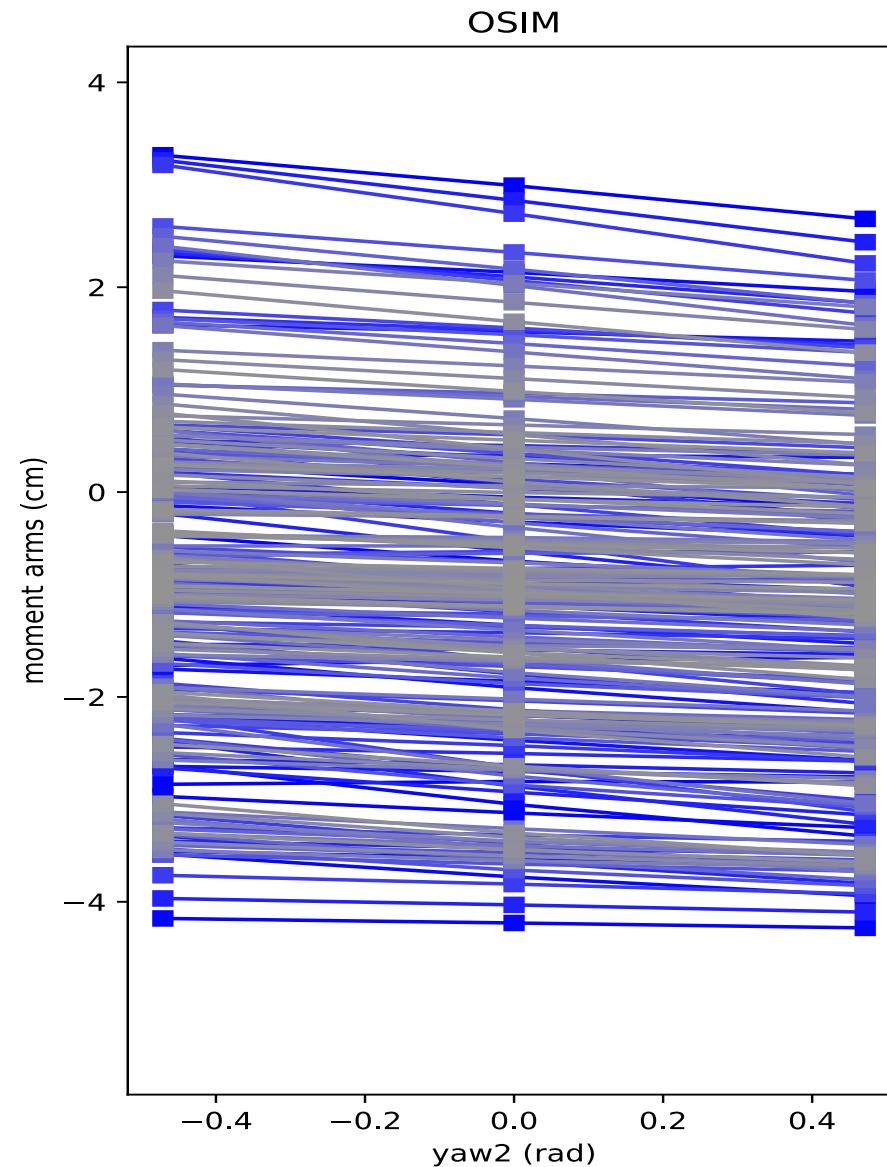
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



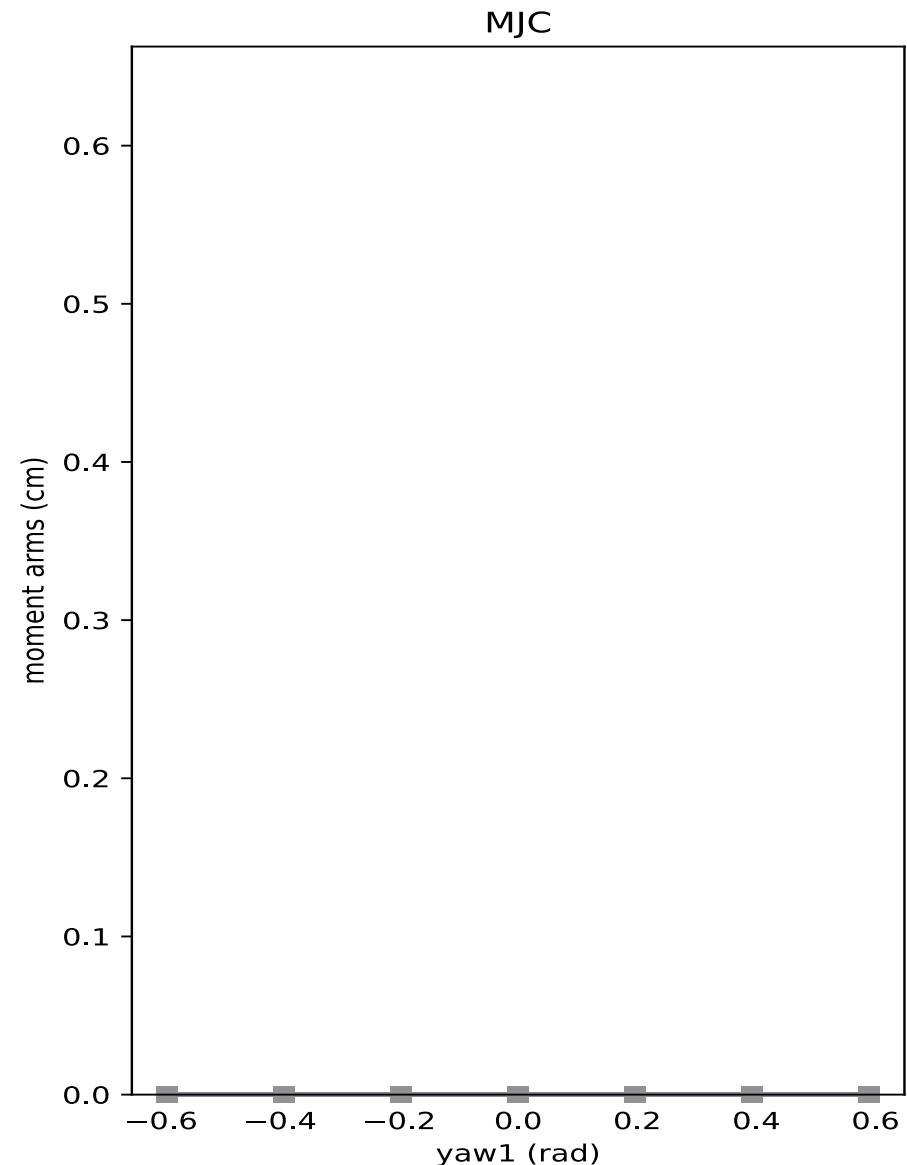
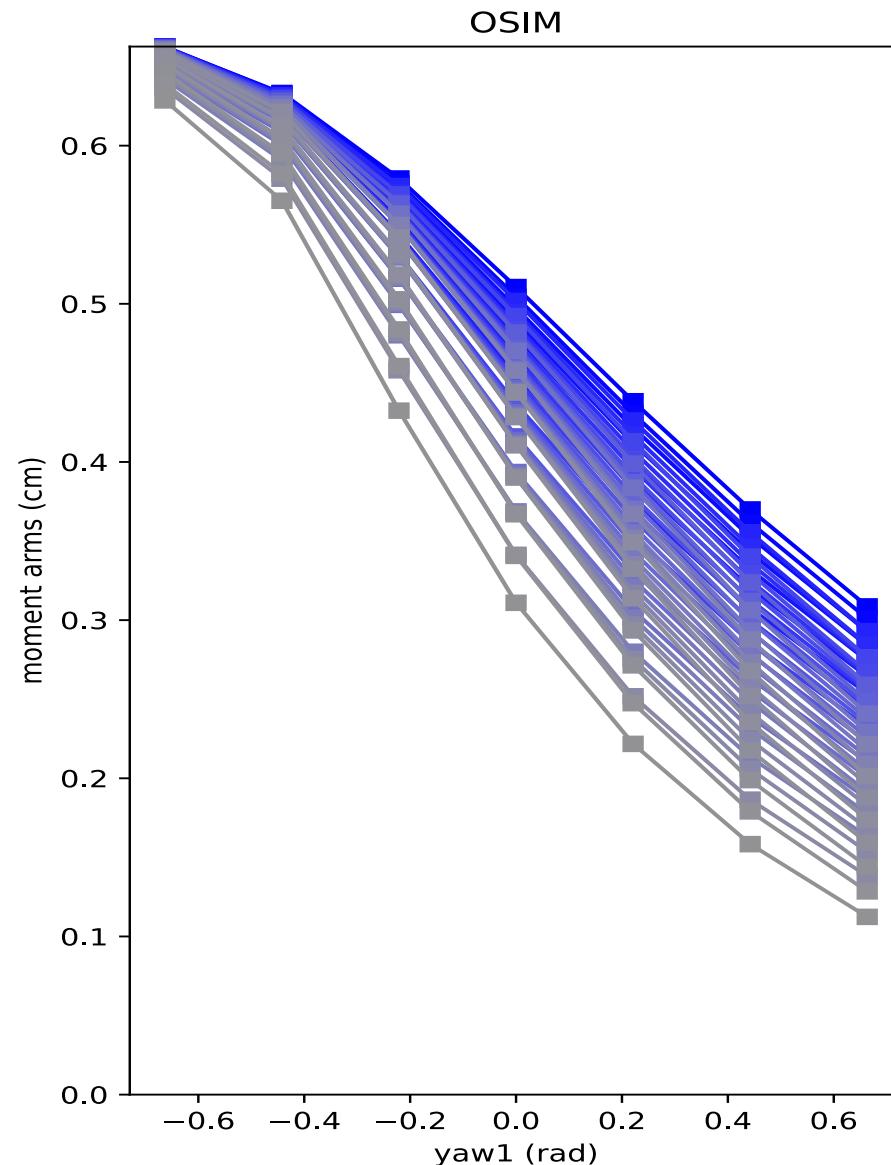
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



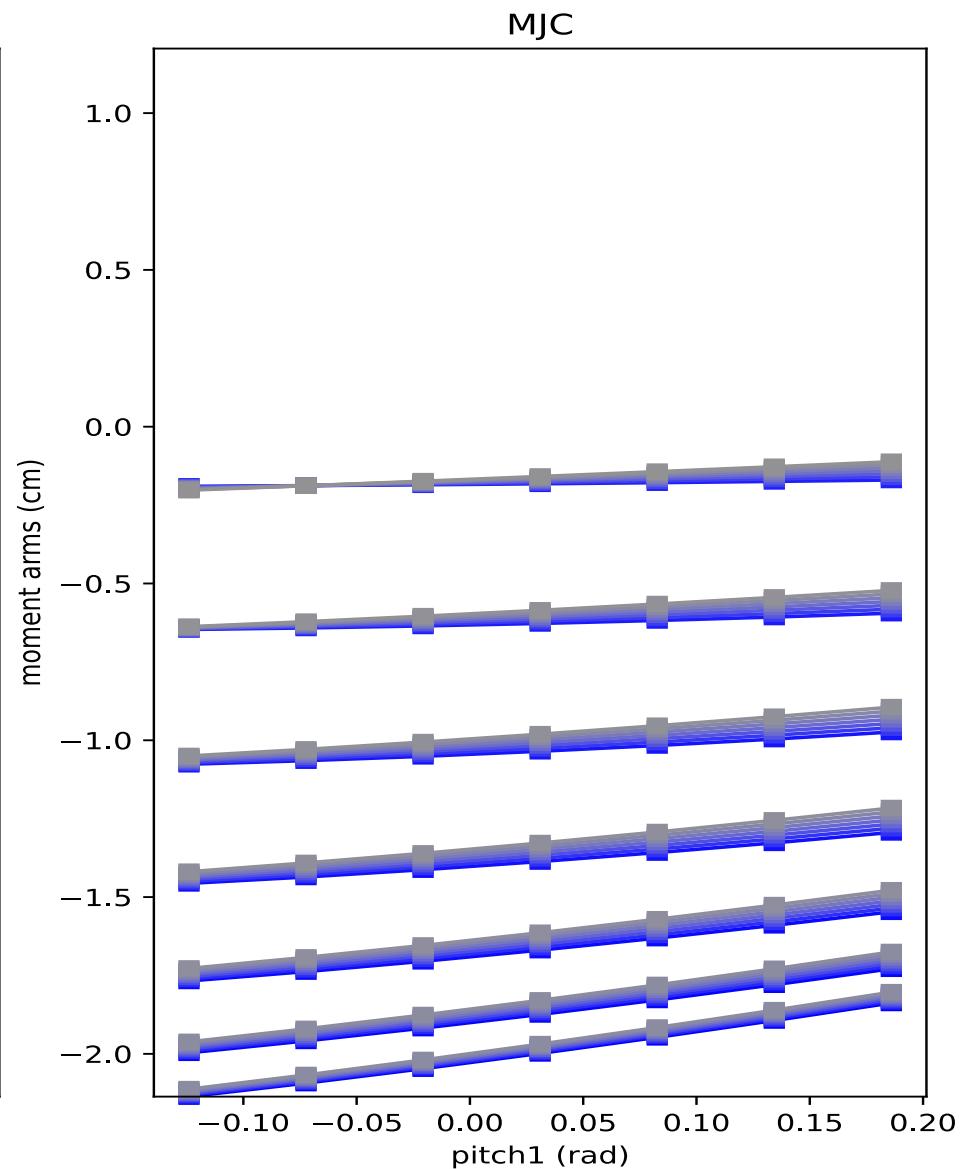
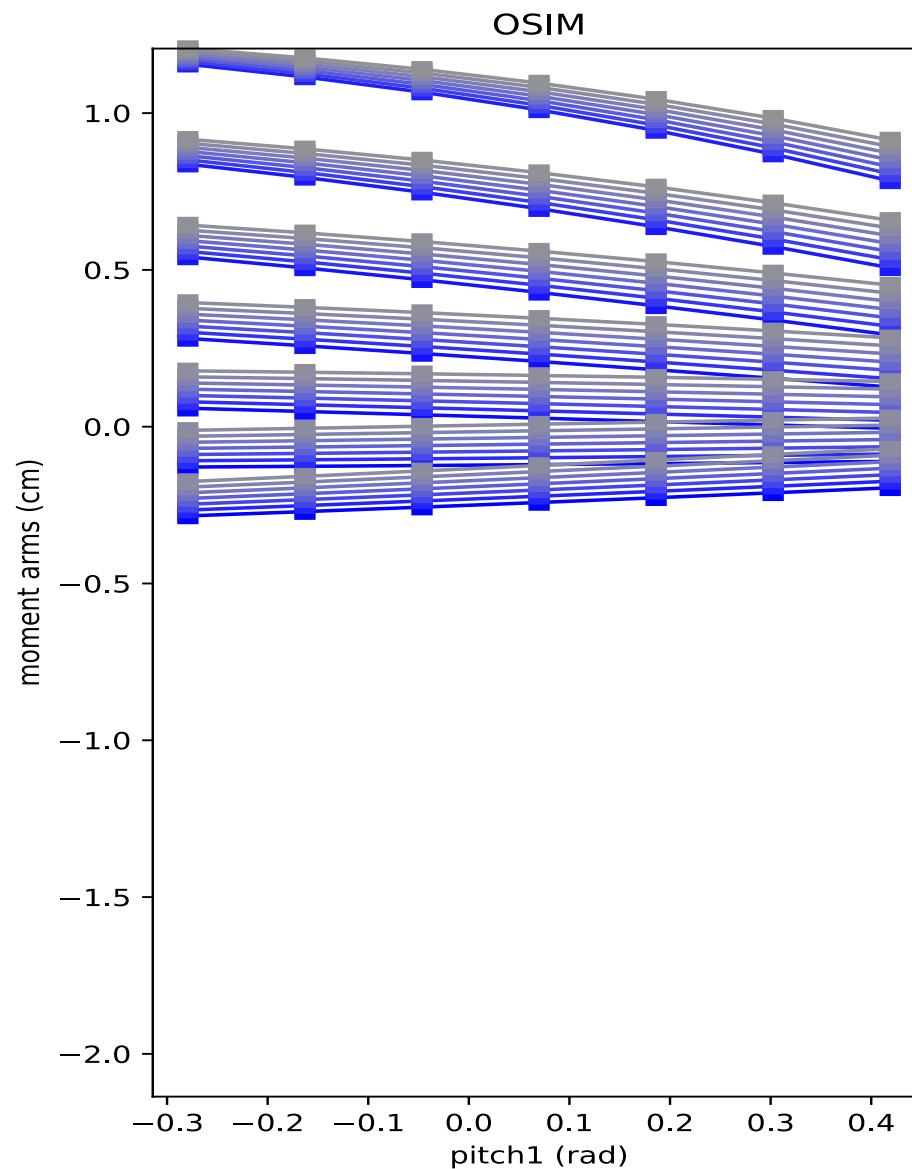
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant - pitch1 - roll1 - yaw1



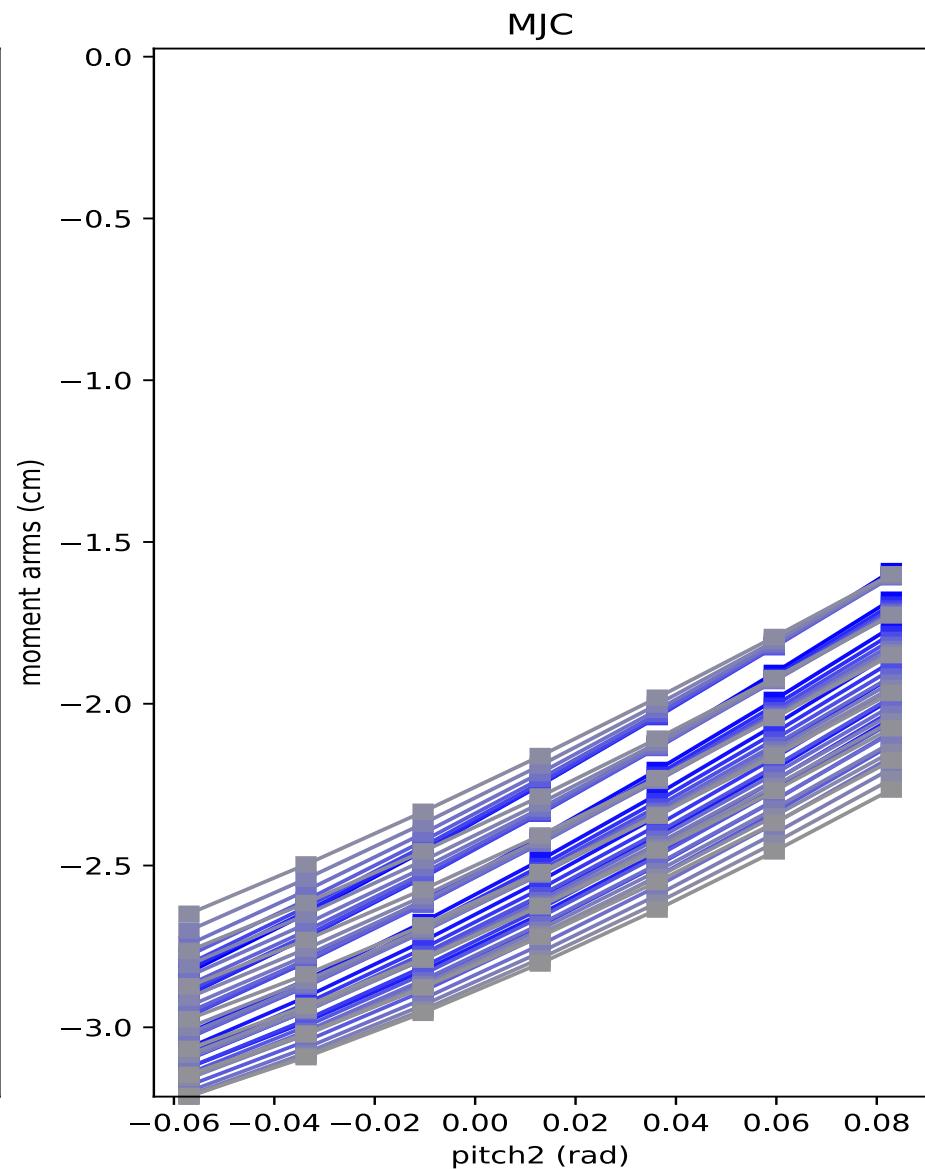
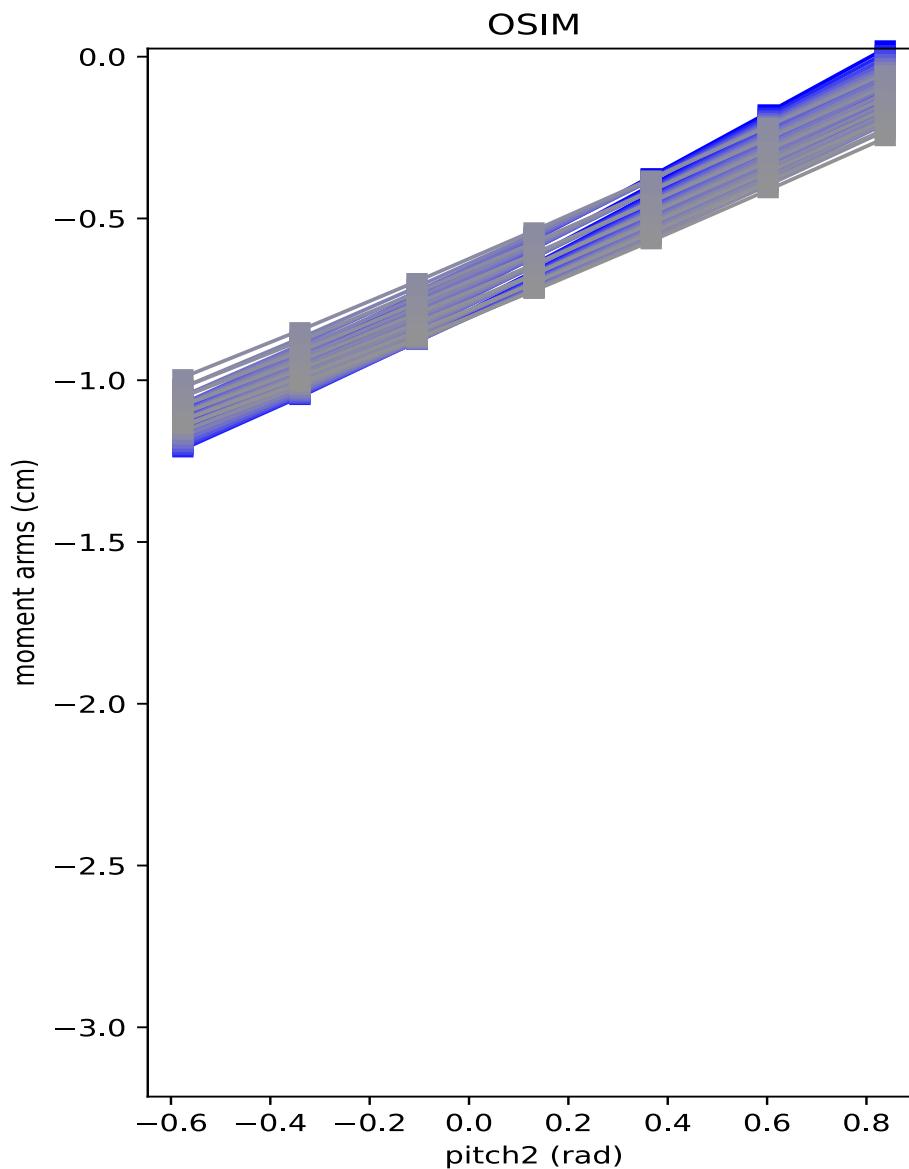
Muscle specific moment arm comparison with Osim model after optimization

obi_cap_inf_L - pitch1 - roll1 - yaw1



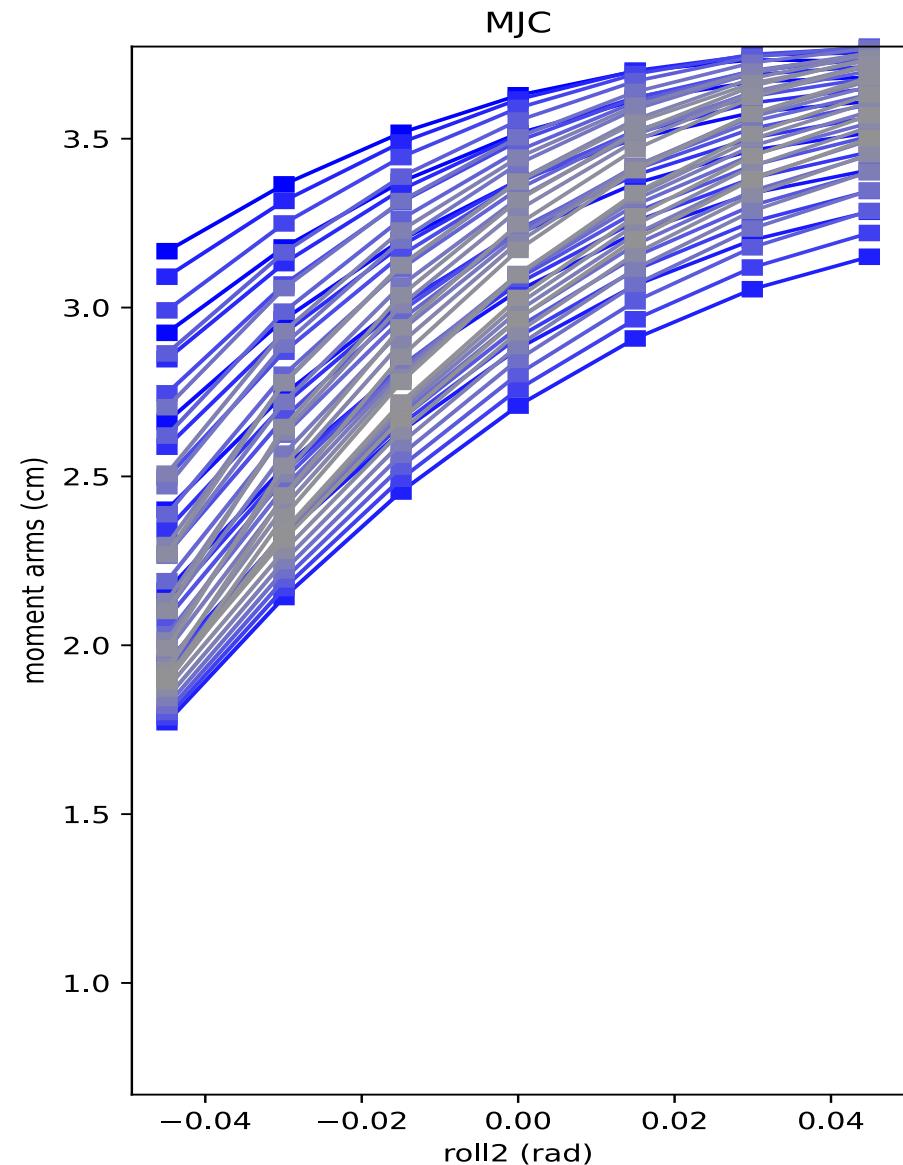
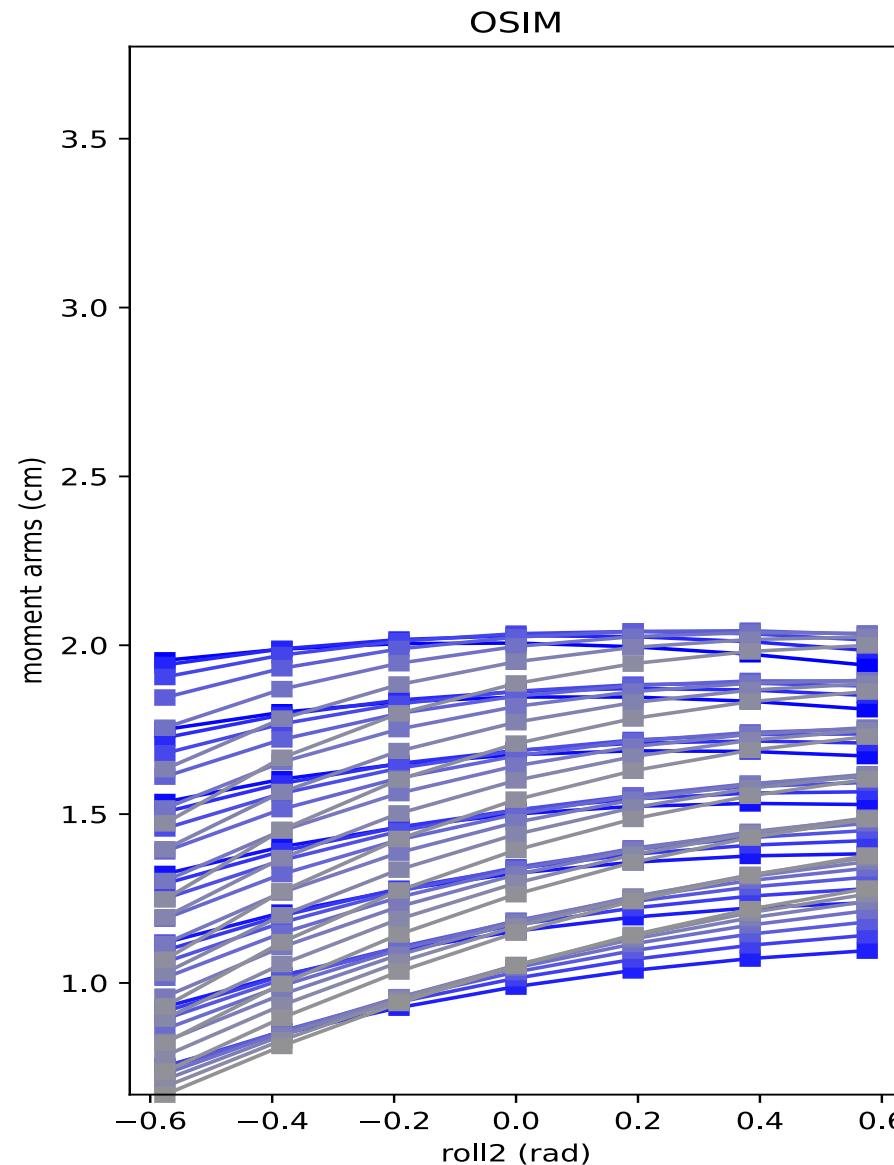
Muscle specific moment arm comparison with Osim model after optimization

scalenus_ant - pitch2 - roll2 - yaw2



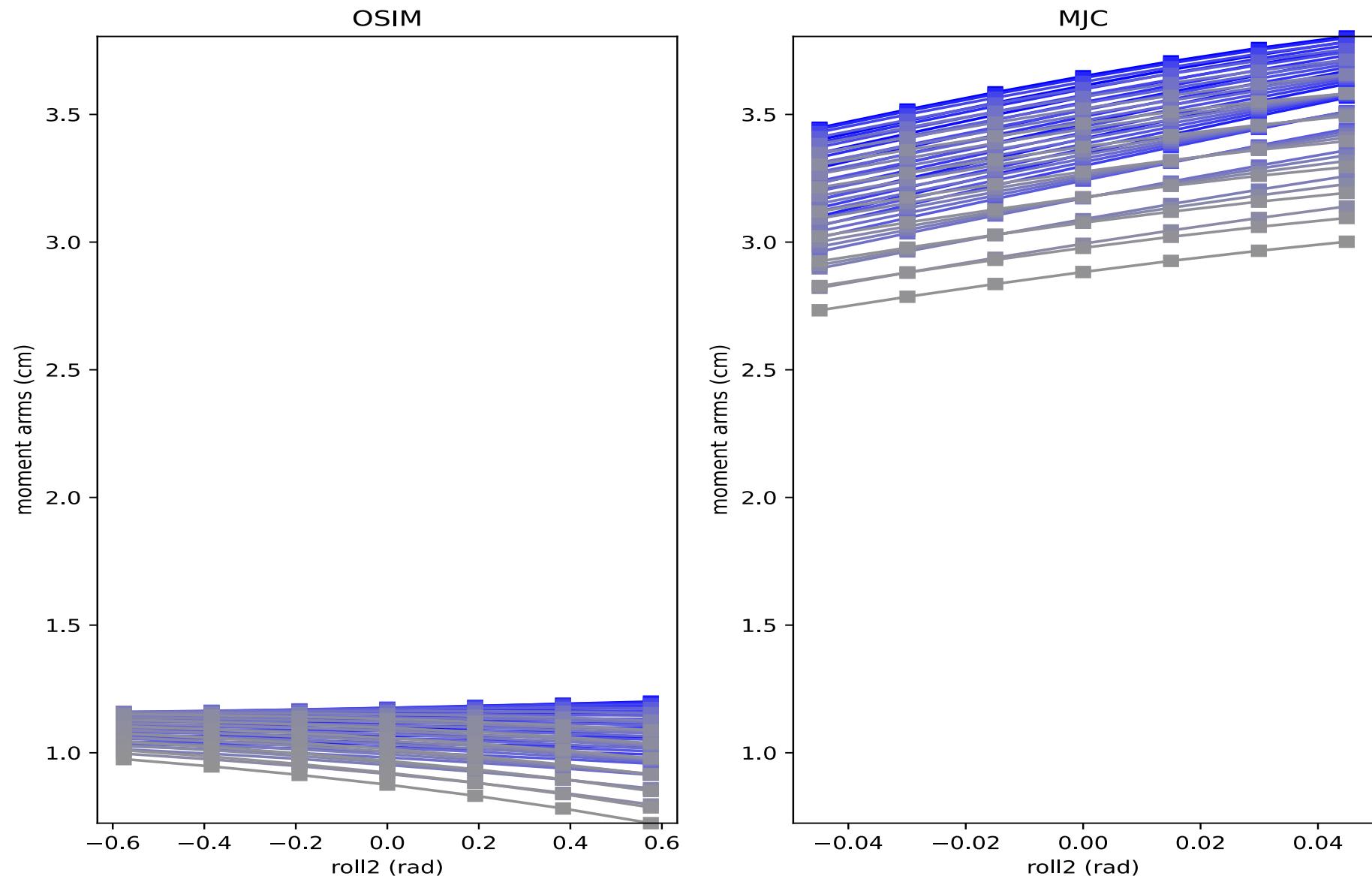
Muscle specific moment arm comparison with Osim model after optimization

Omo_hyoid - pitch2 - roll2 - yaw2



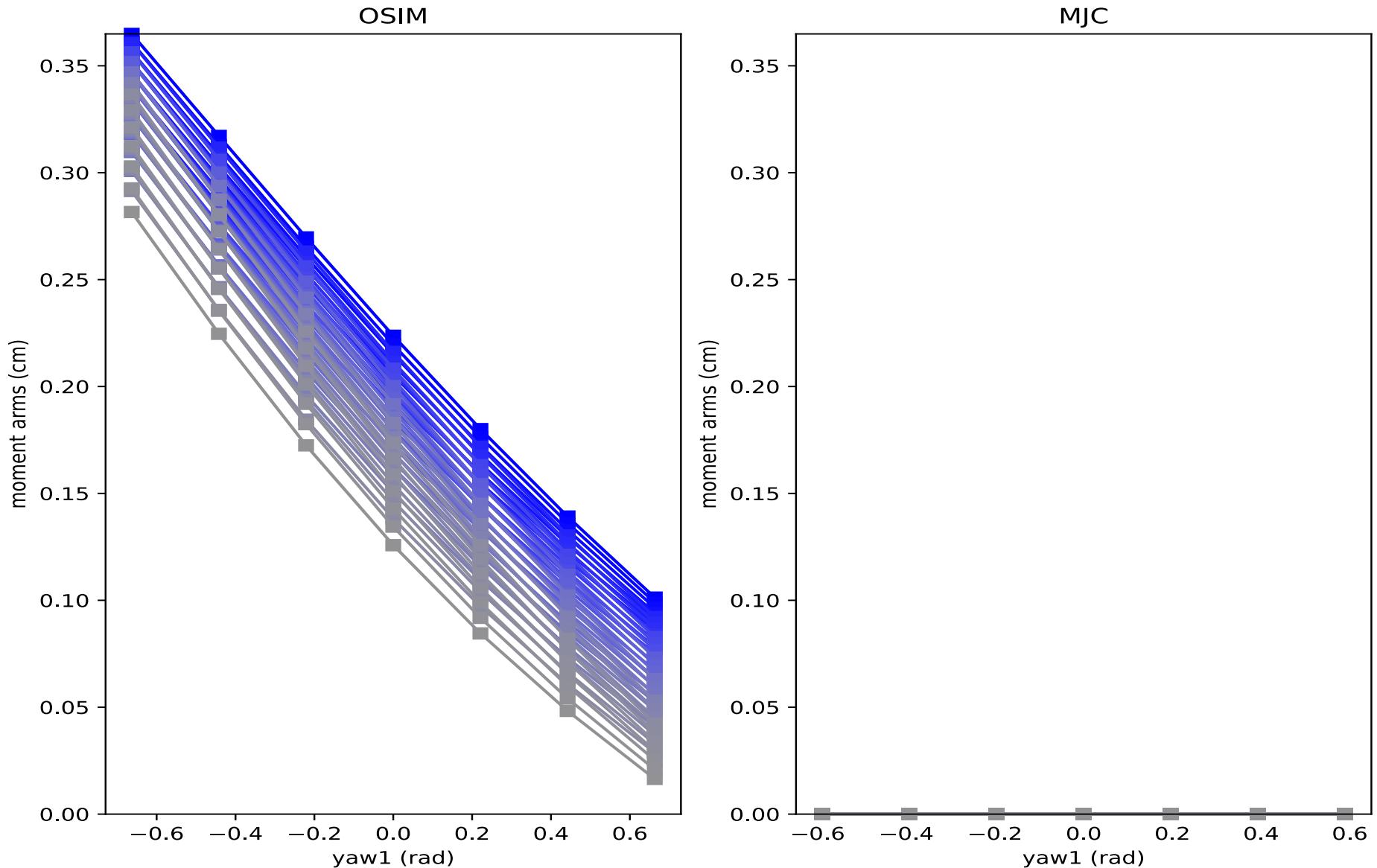
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib - pitch2 - roll2 - yaw2



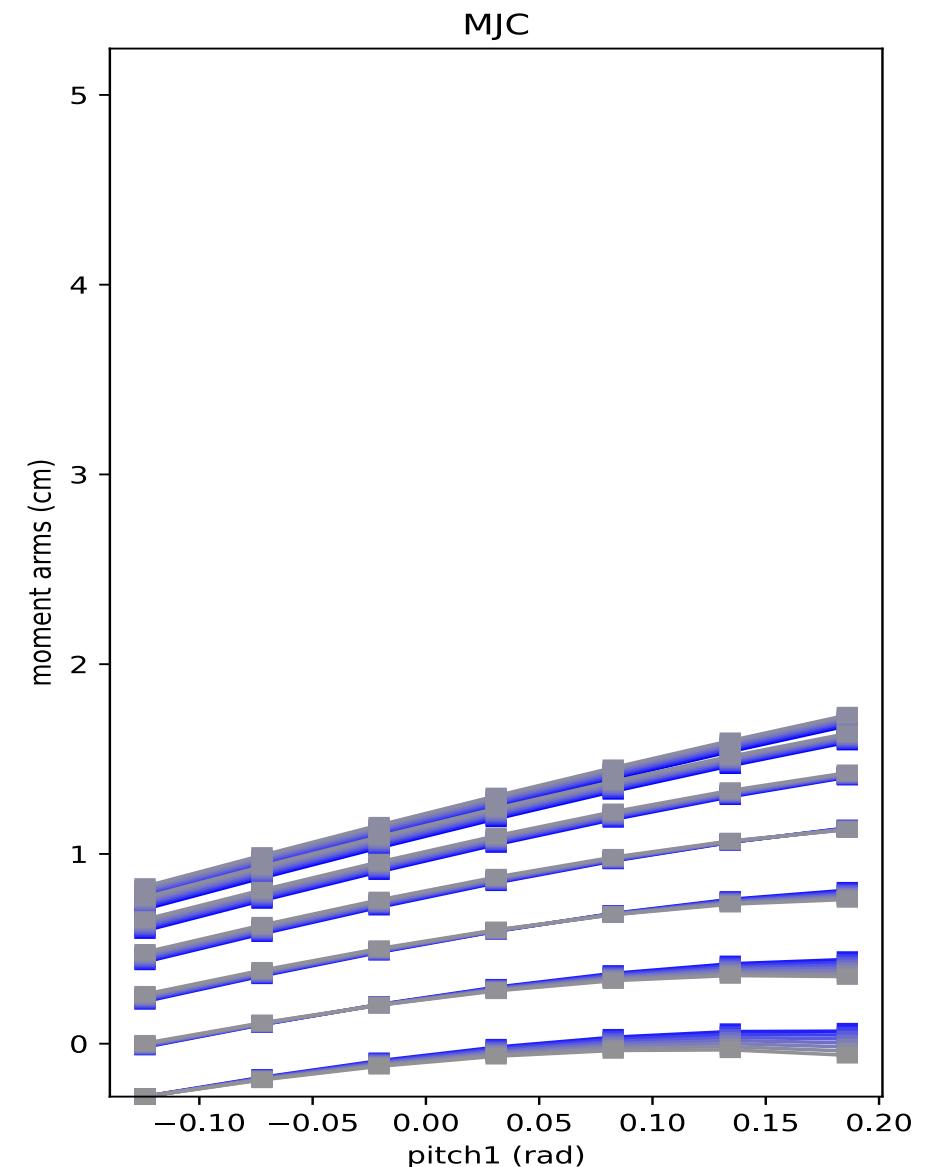
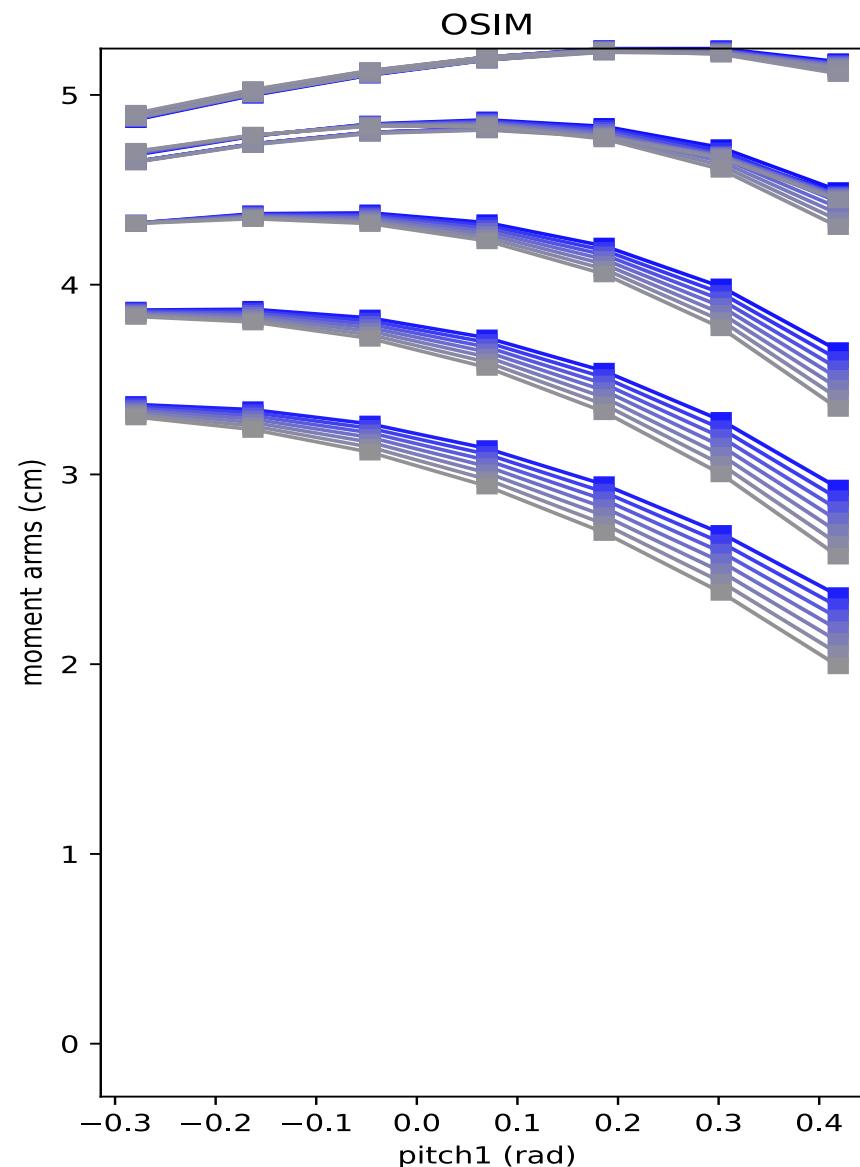
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Post - pitch1 - roll1 - yaw1



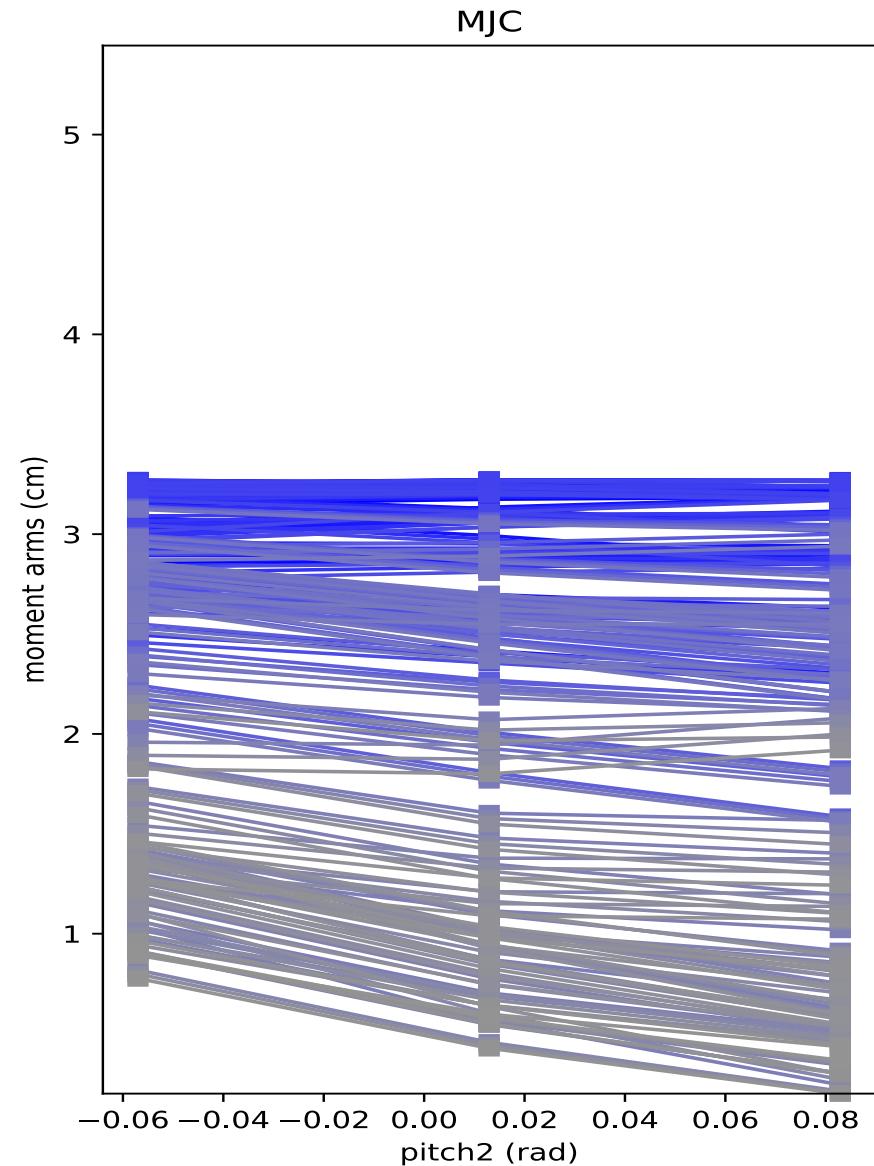
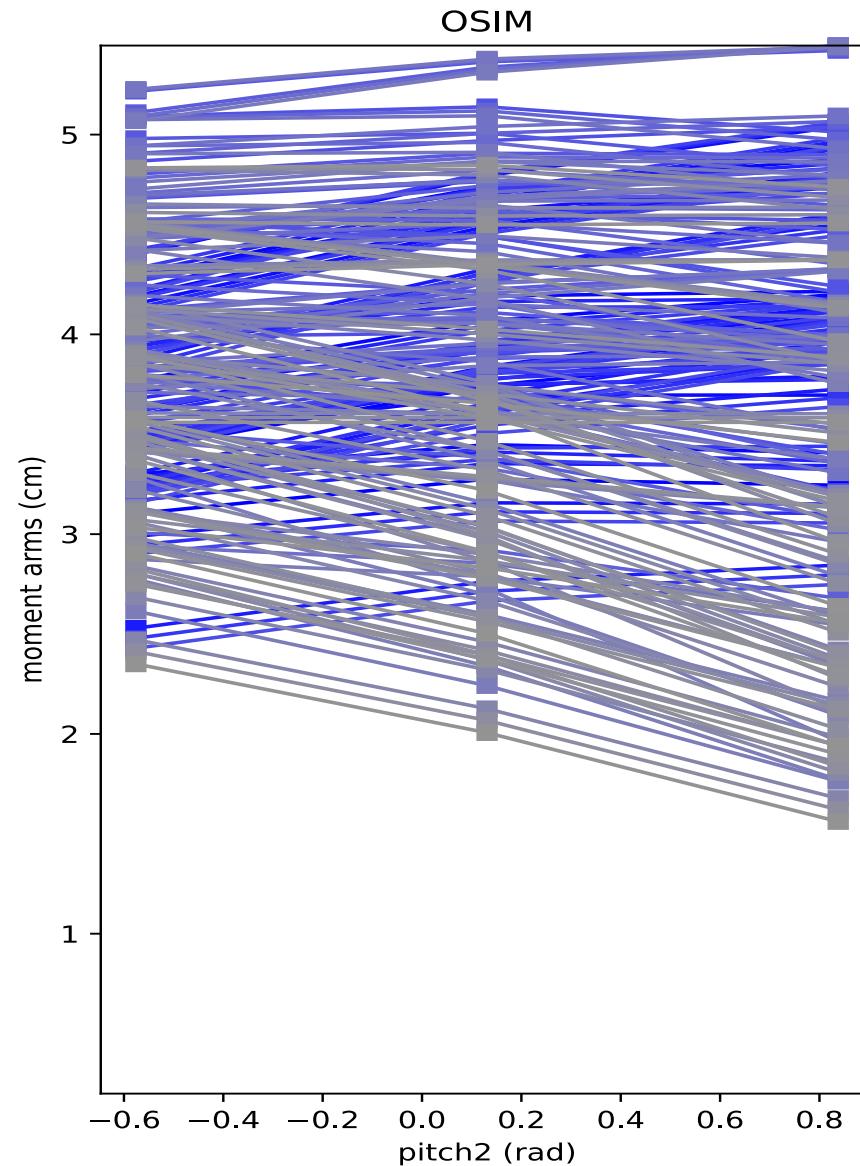
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj - pitch1 - roll1 - yaw1



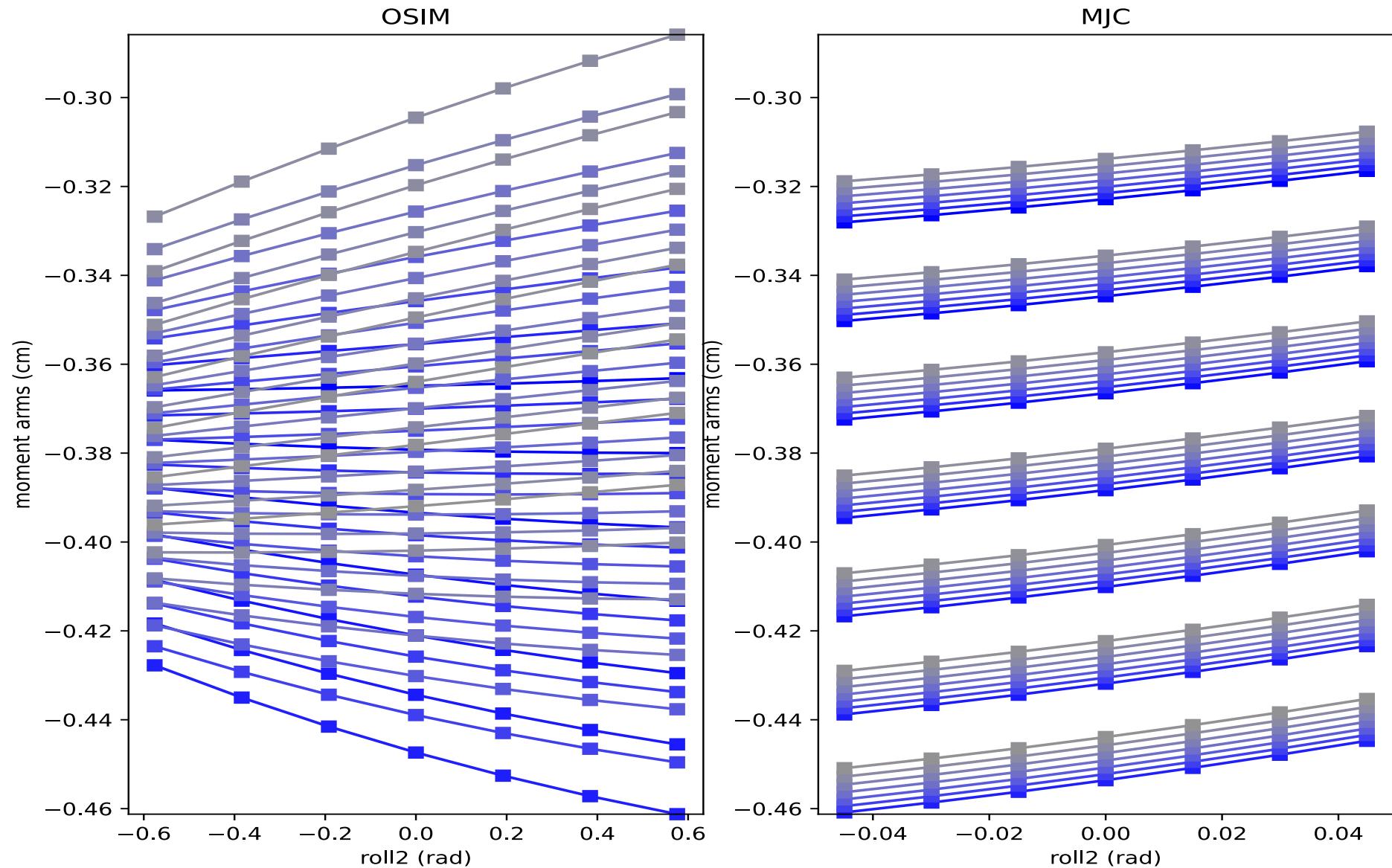
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



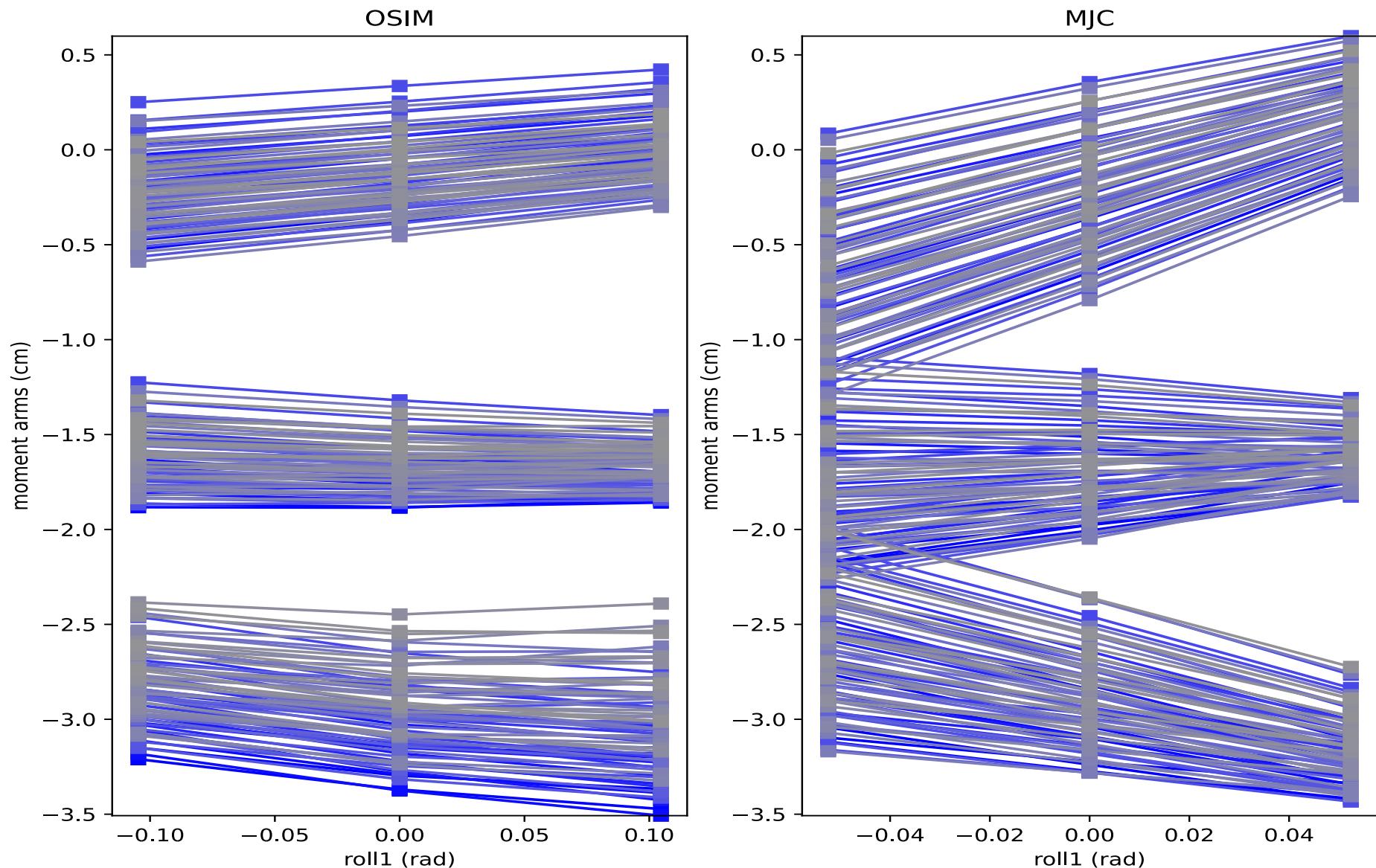
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch2 - roll2 - yaw2



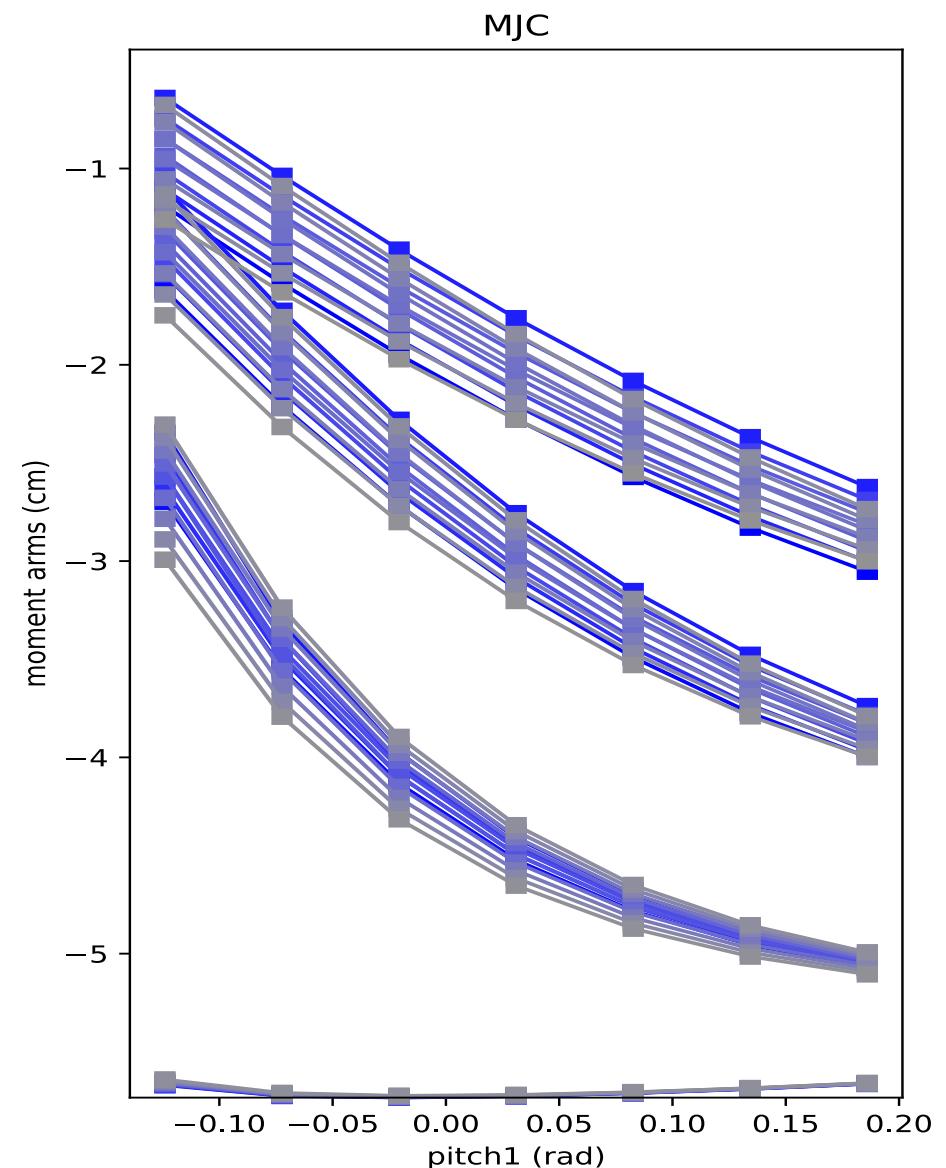
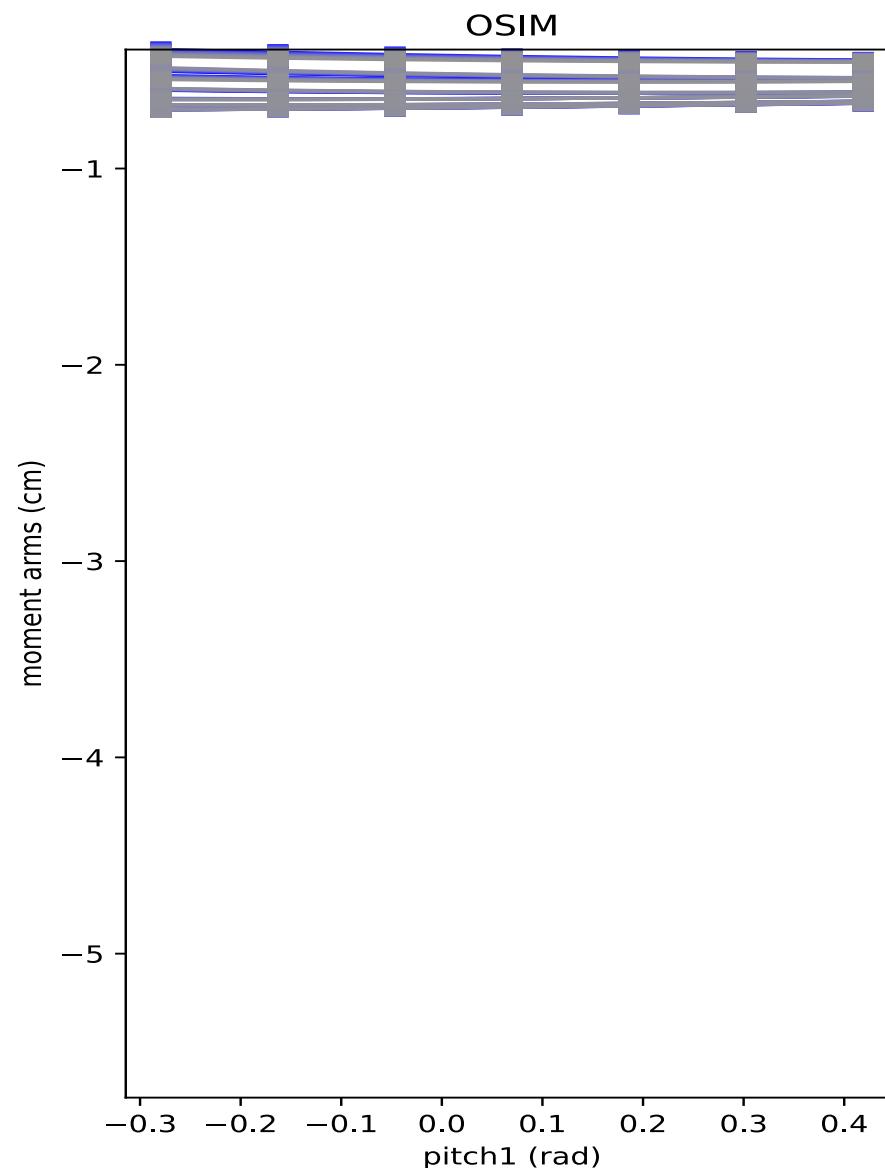
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



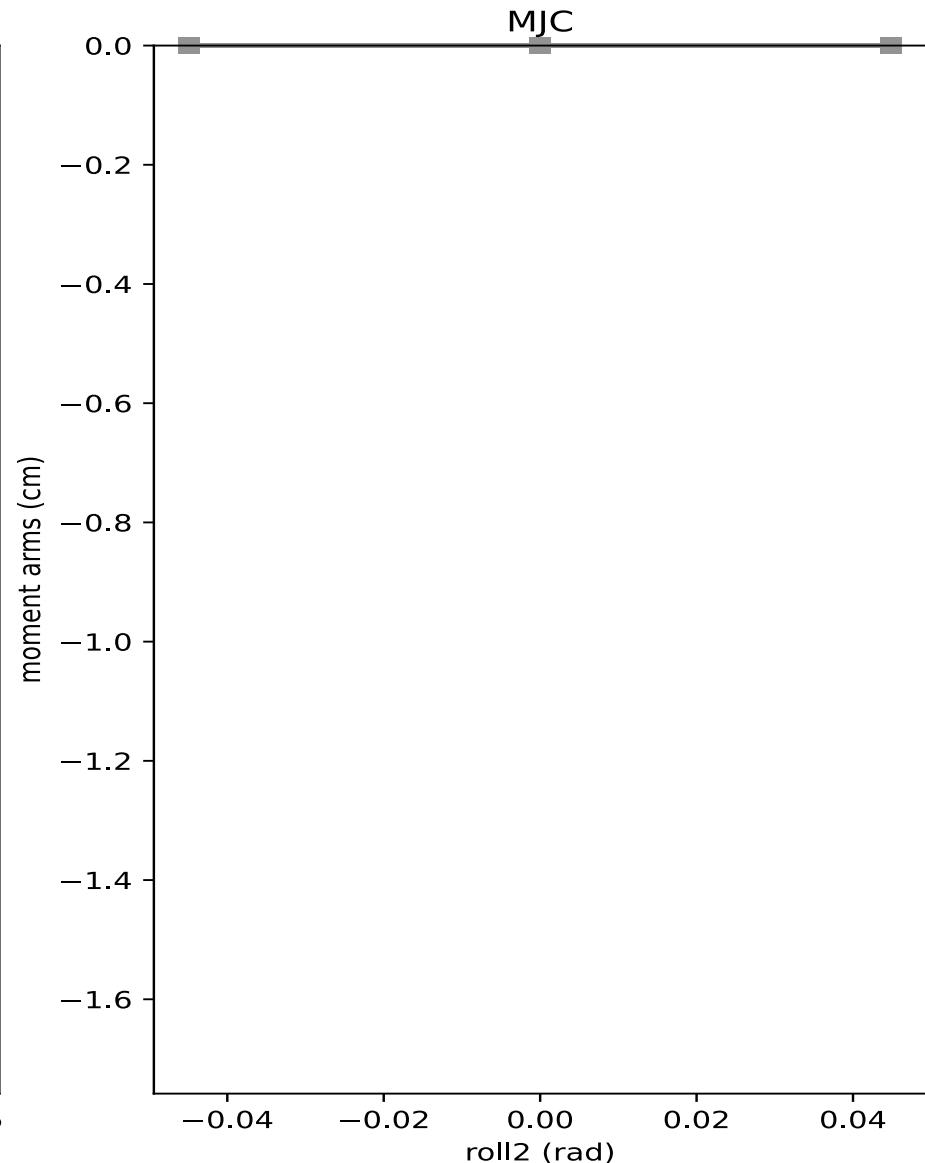
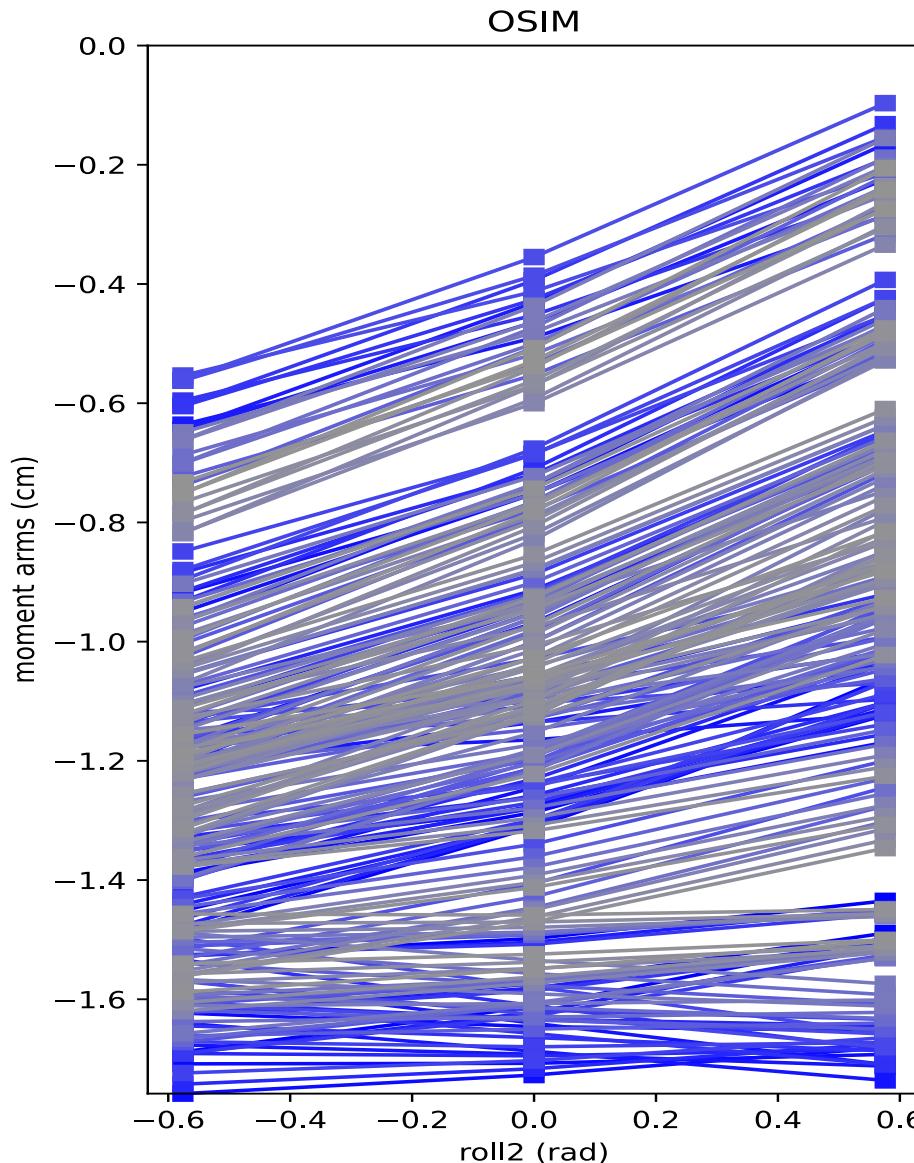
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch1 - roll1 - yaw1



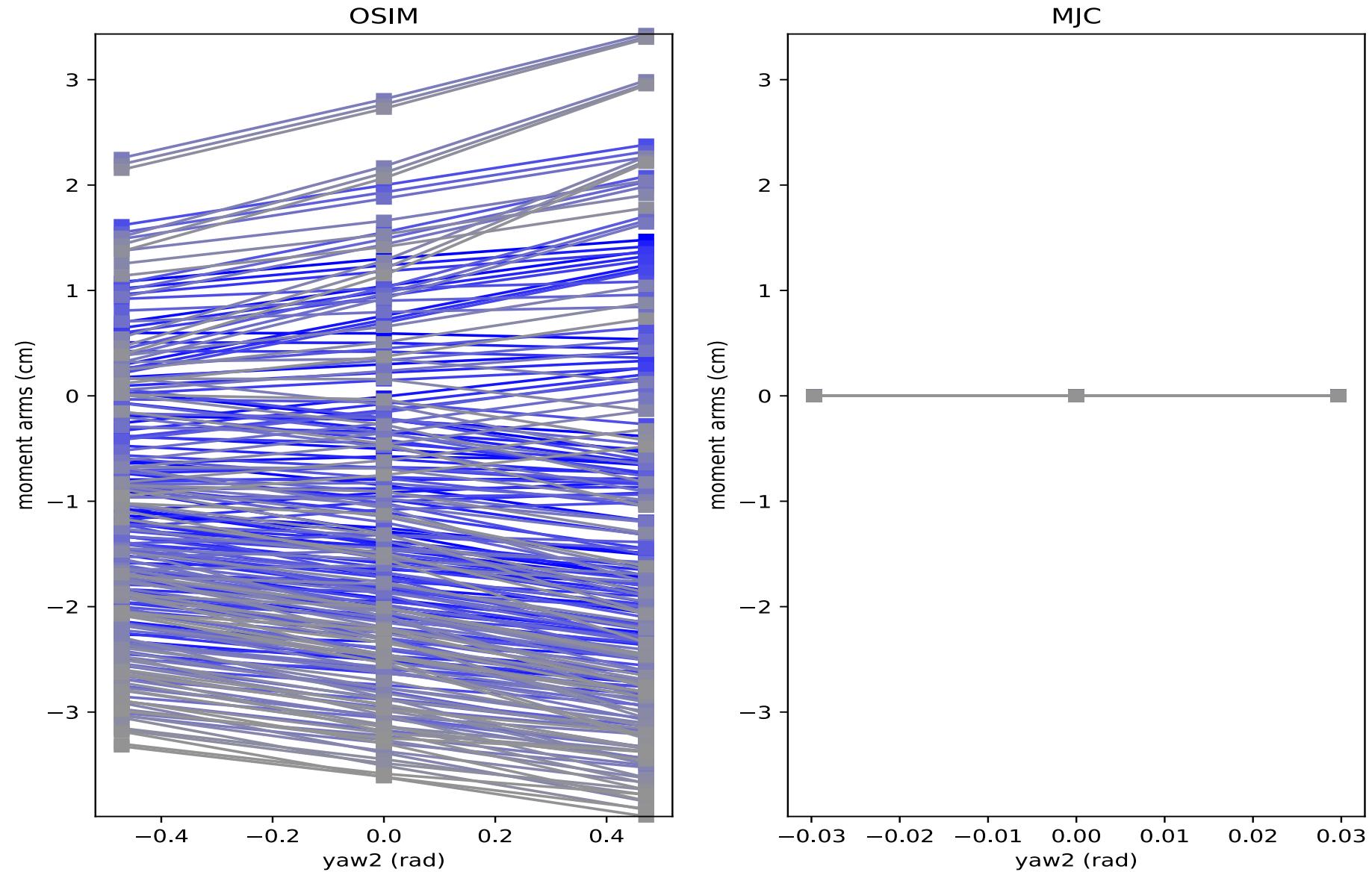
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



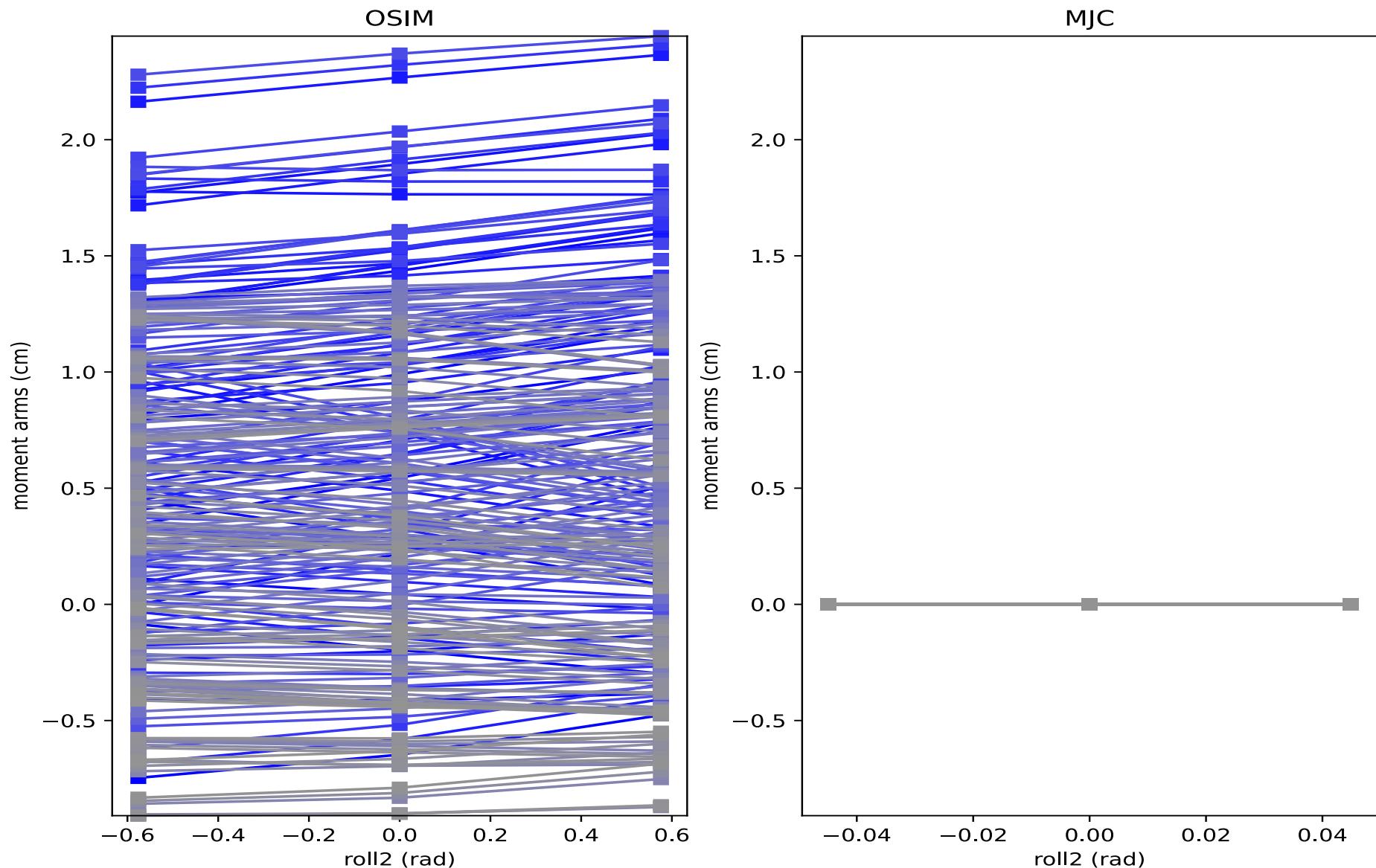
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



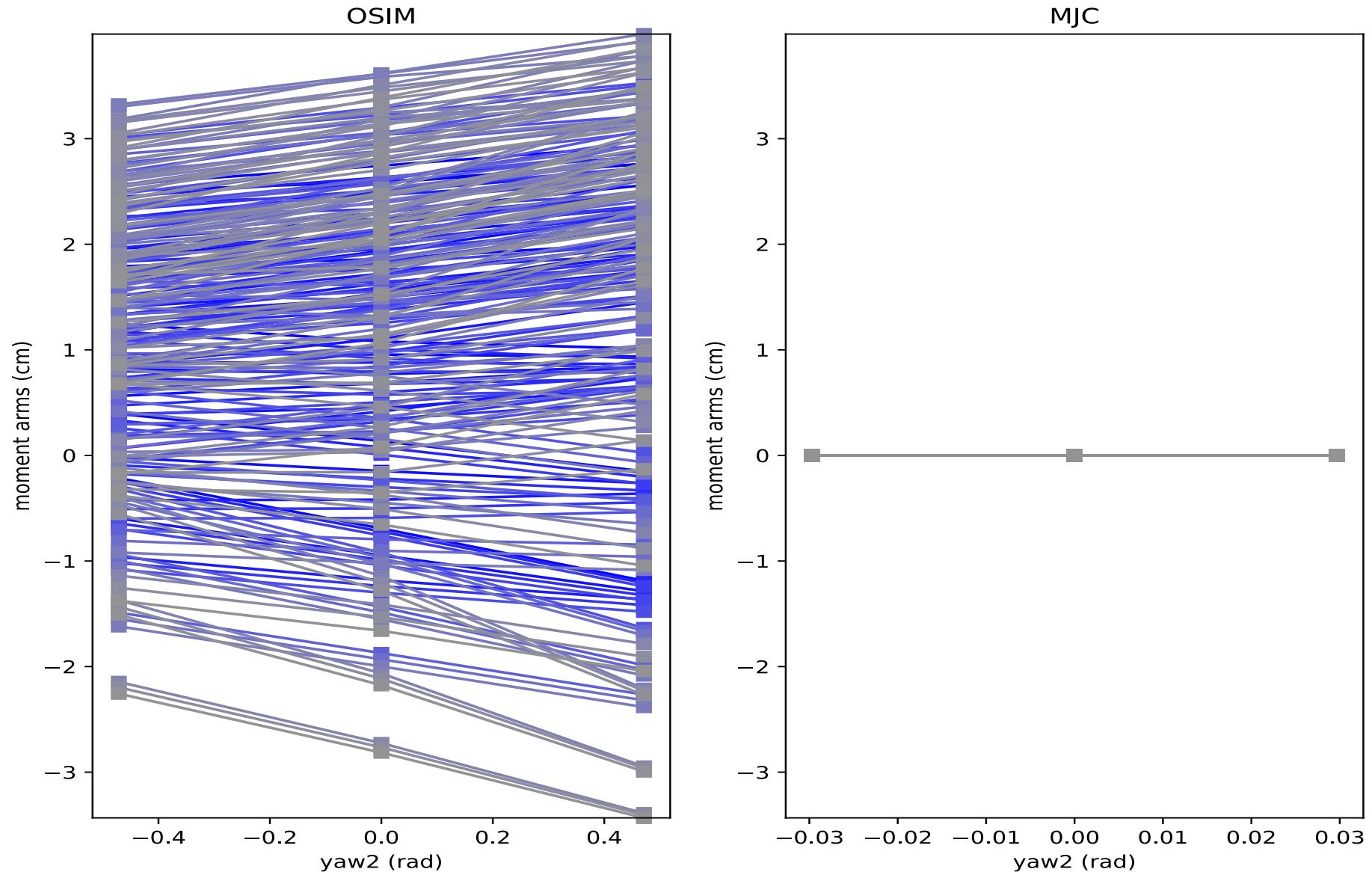
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



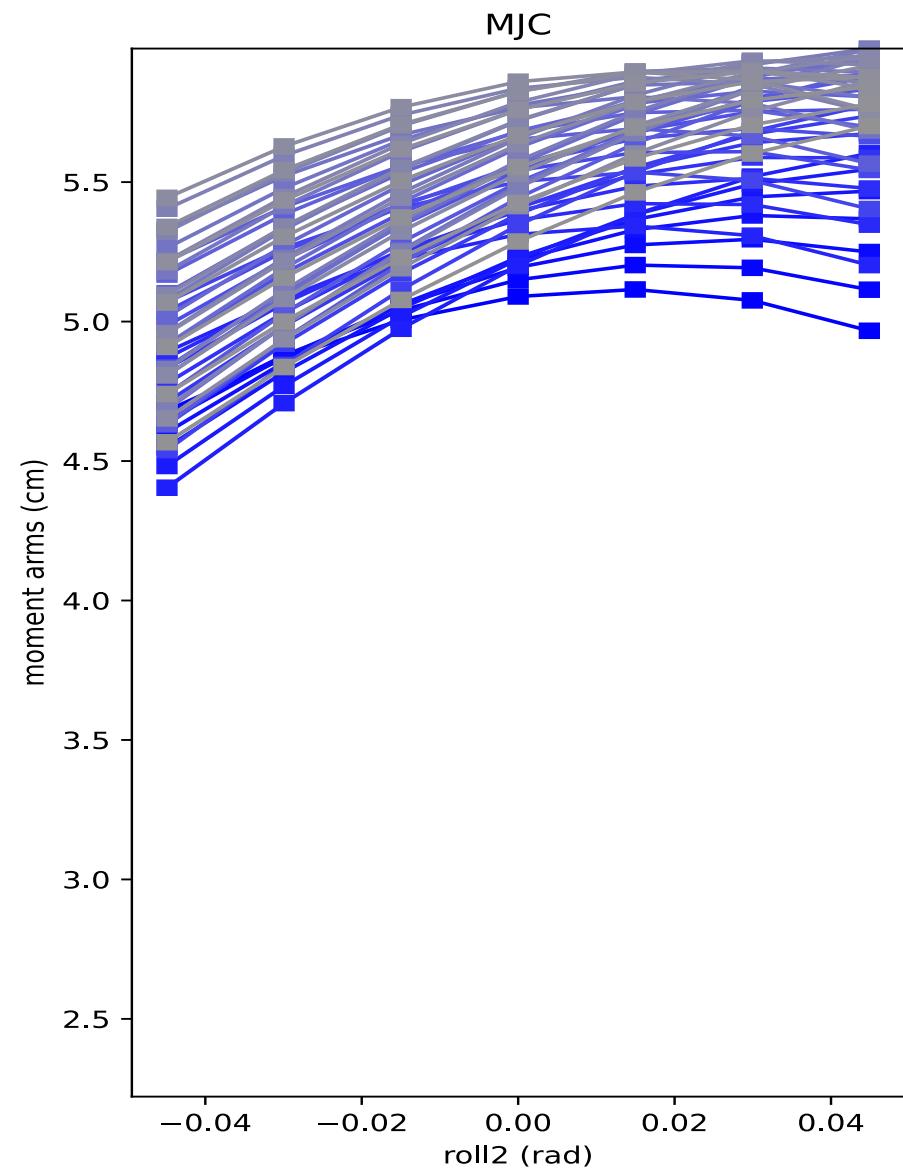
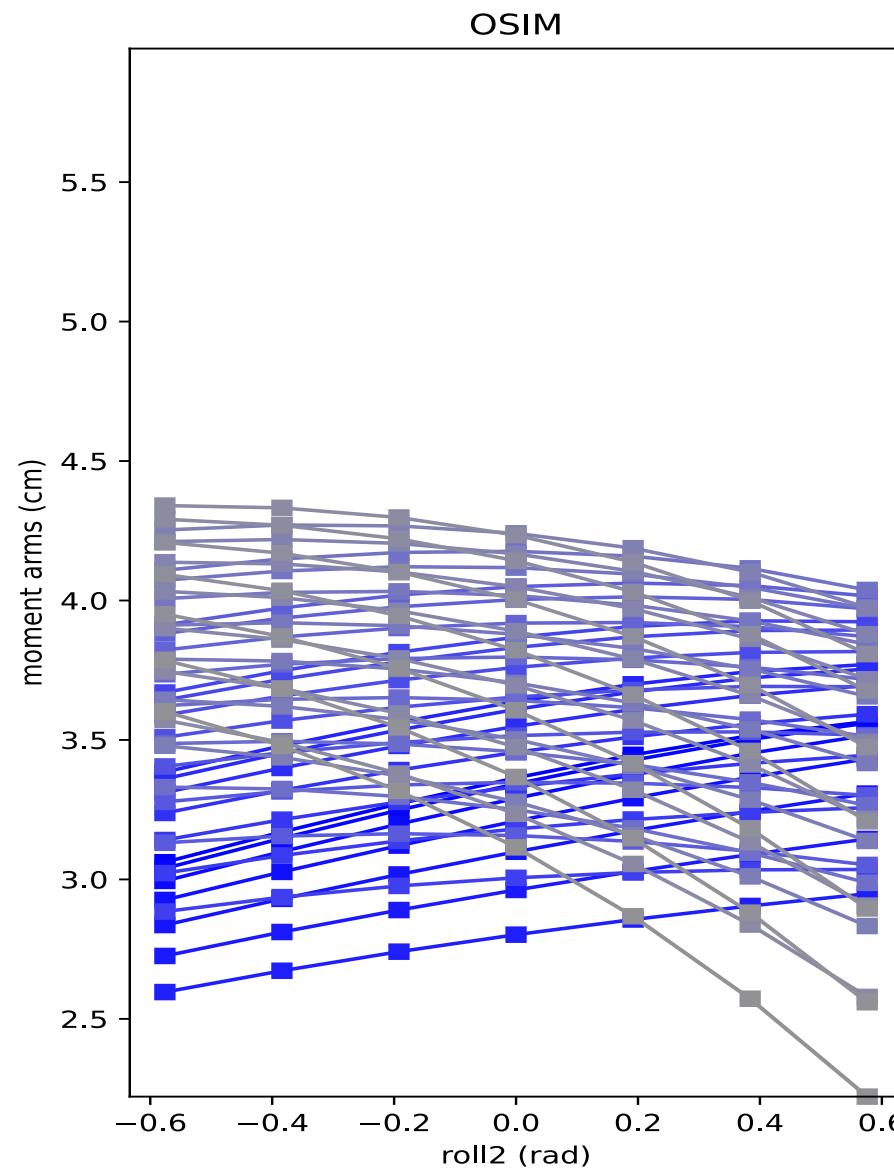
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



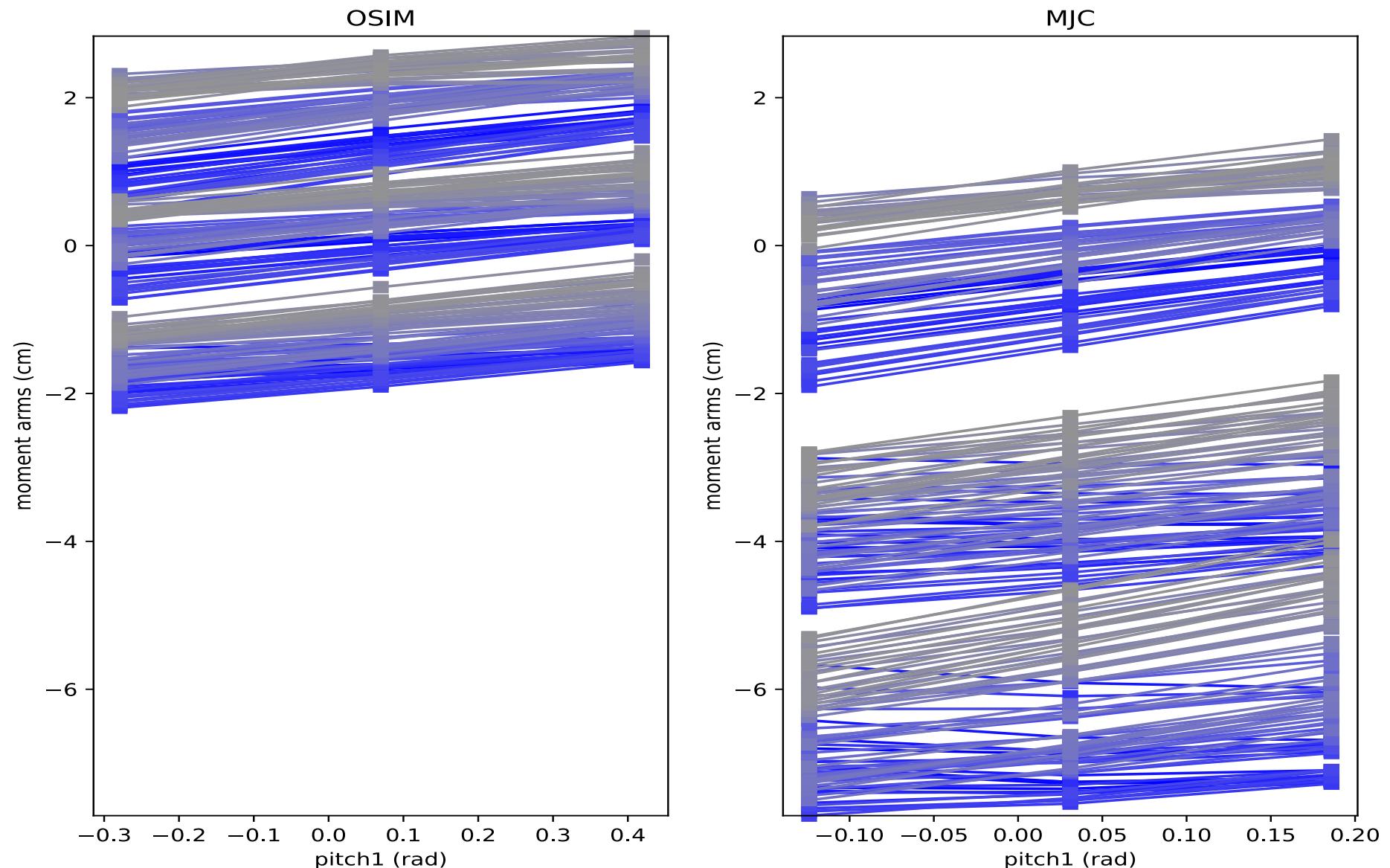
Muscle specific moment arm comparison with Osim model after optimization

levator_scap - pitch2 - roll2 - yaw2



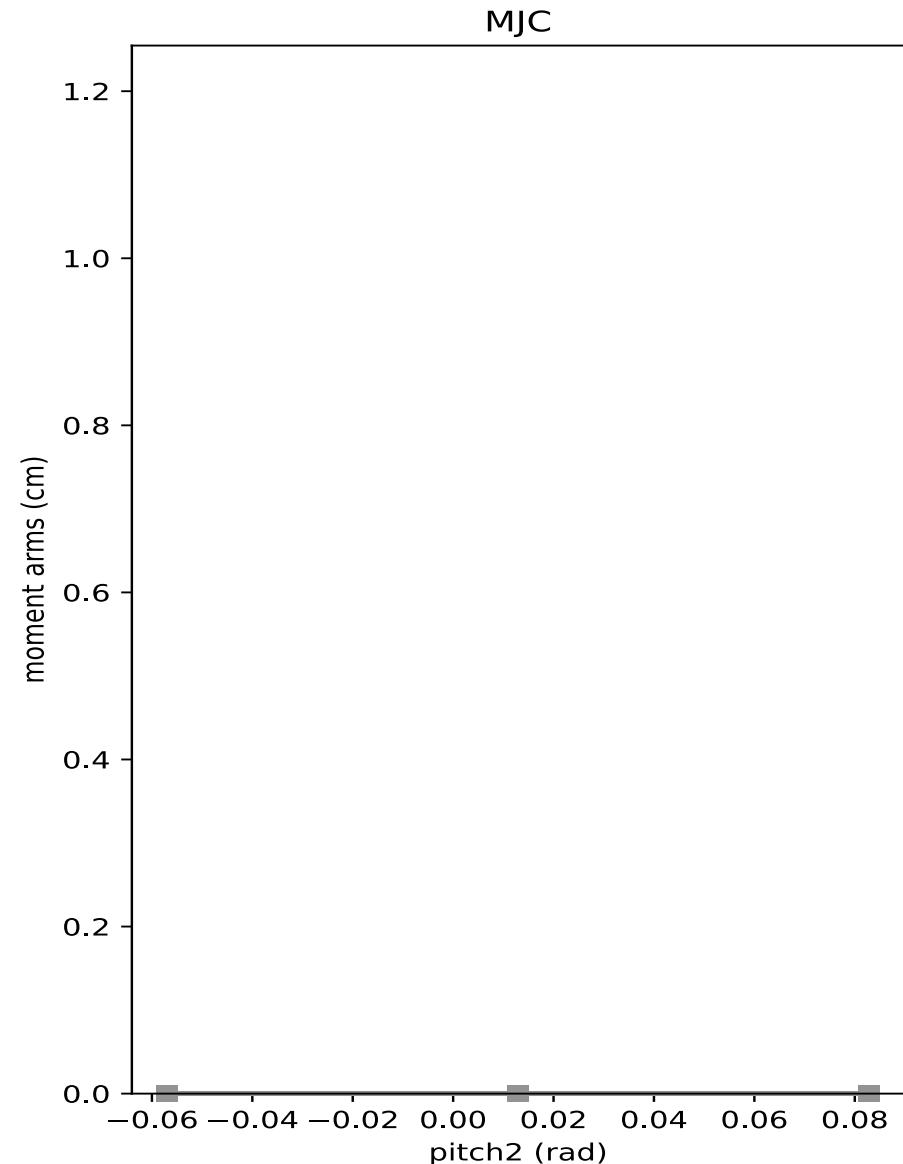
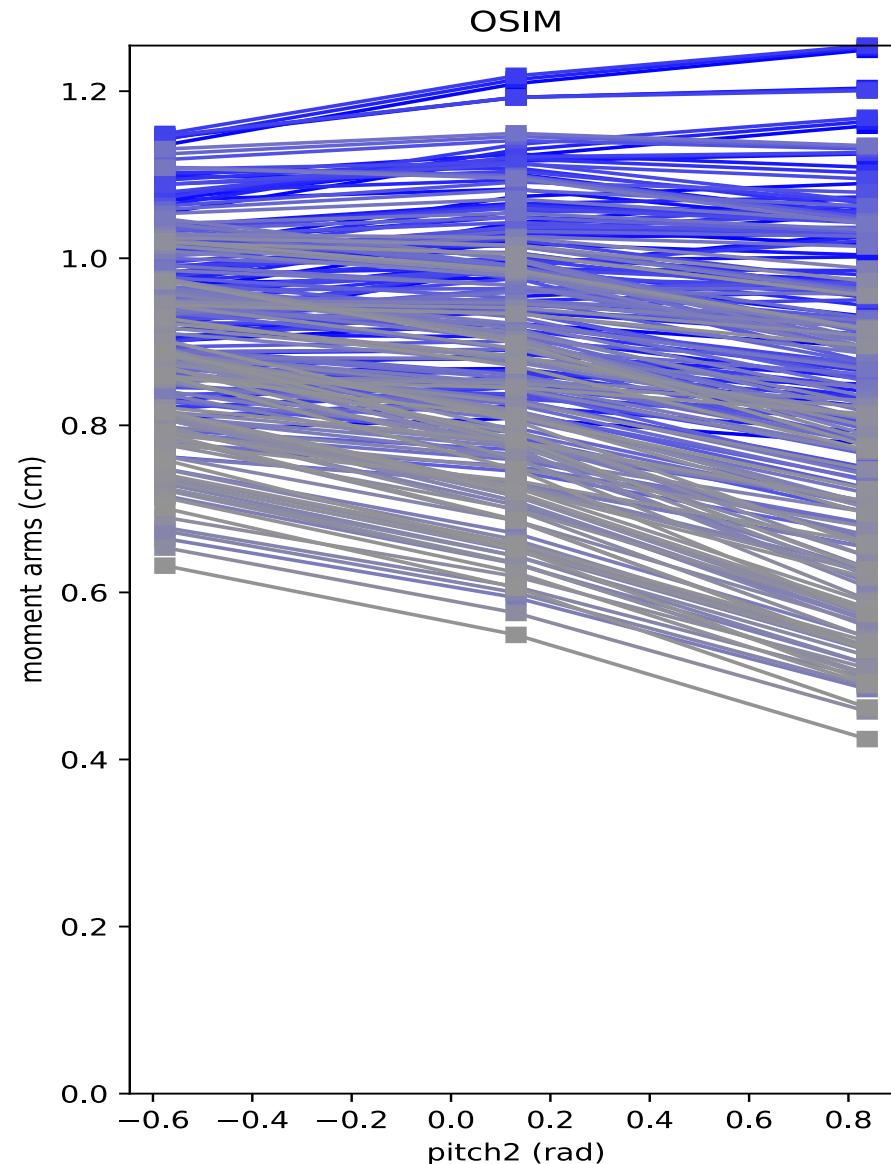
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



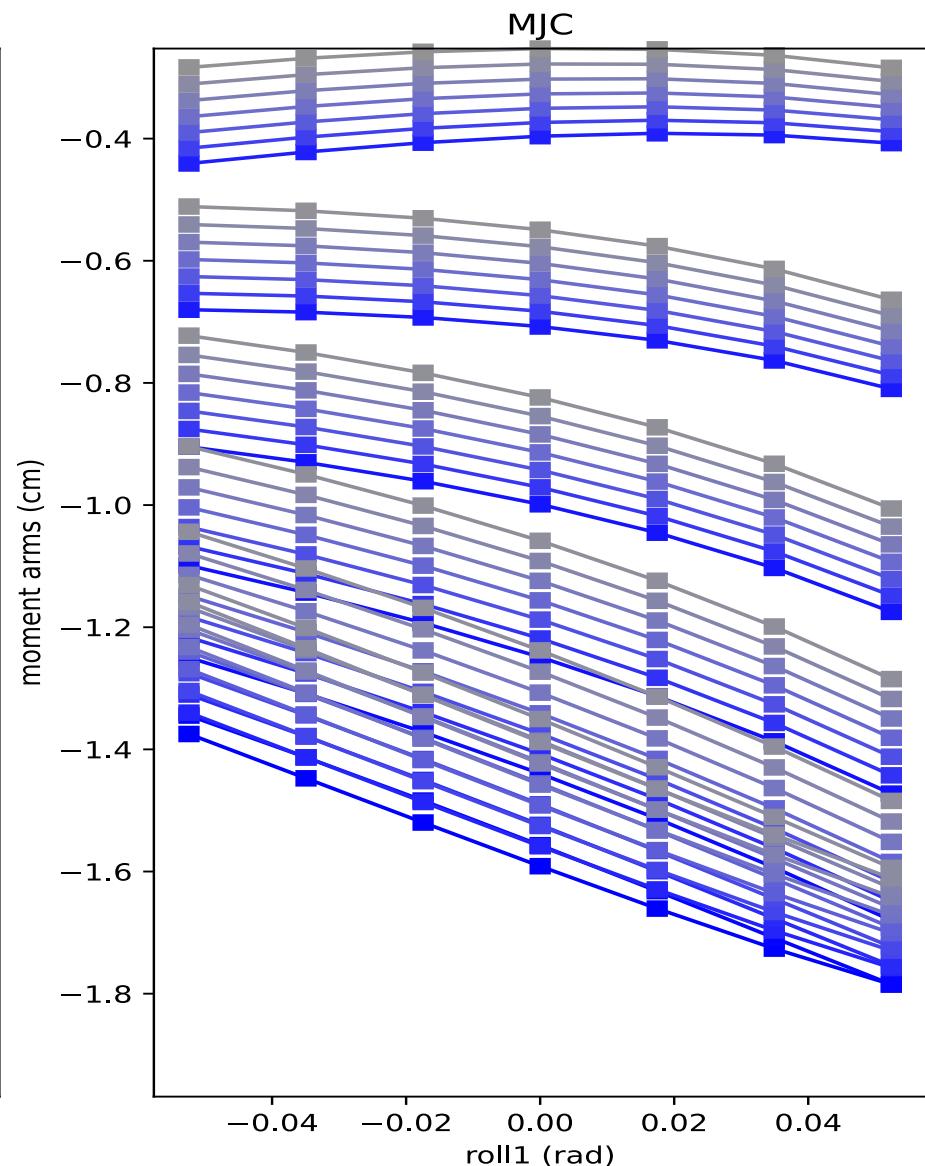
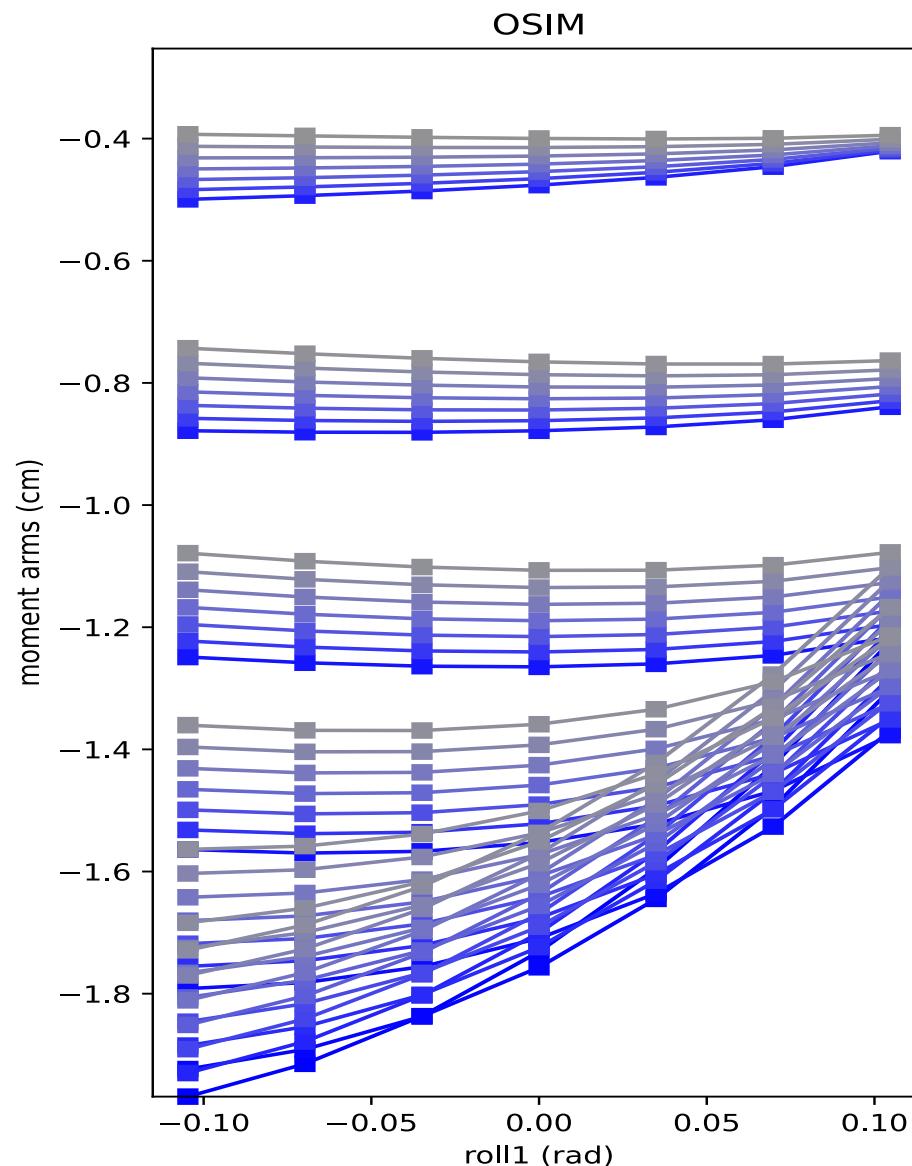
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



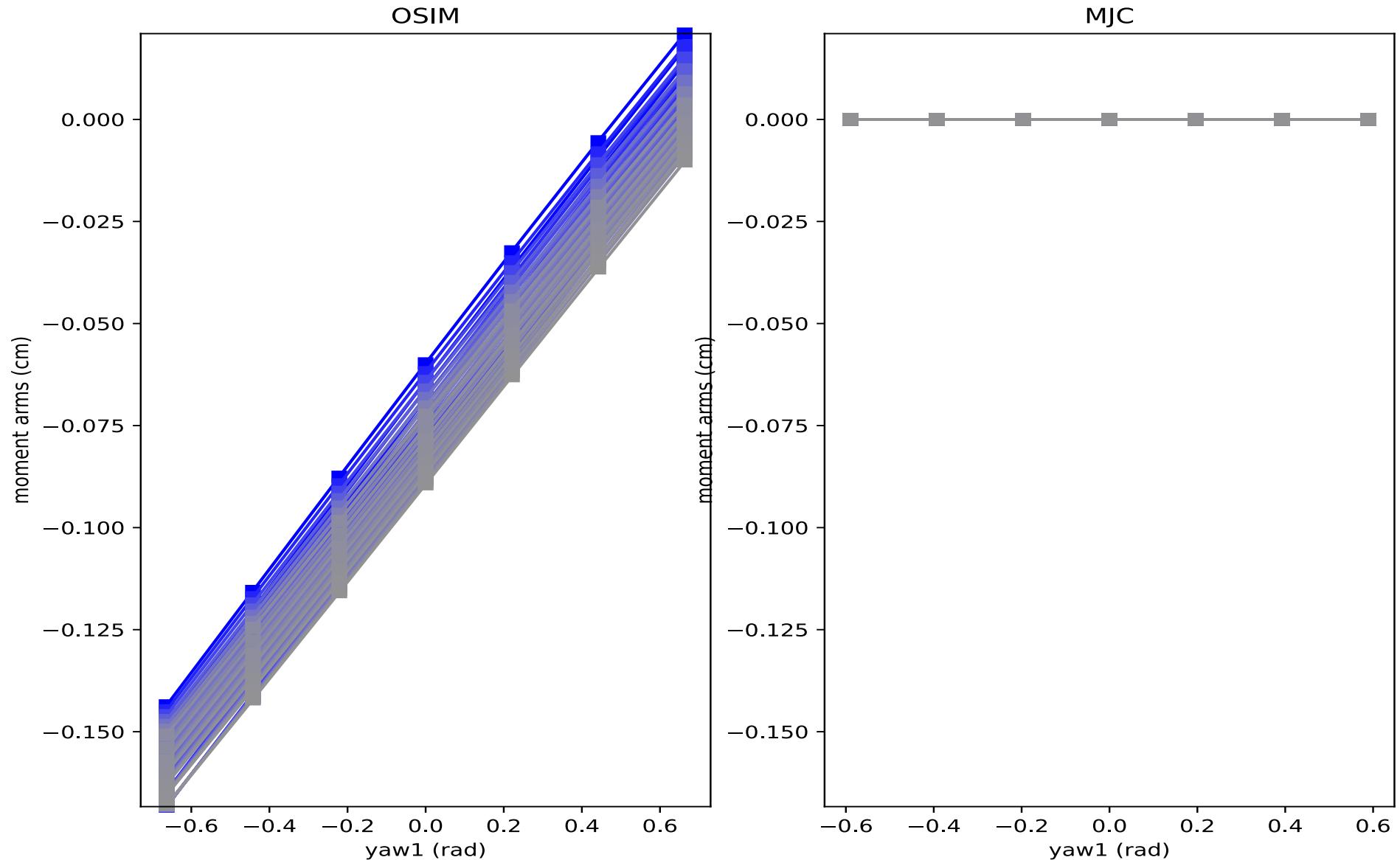
Muscle specific moment arm comparison with Osim model after optimization

rectcap_post_maj_L - pitch1 - roll1 - yaw1



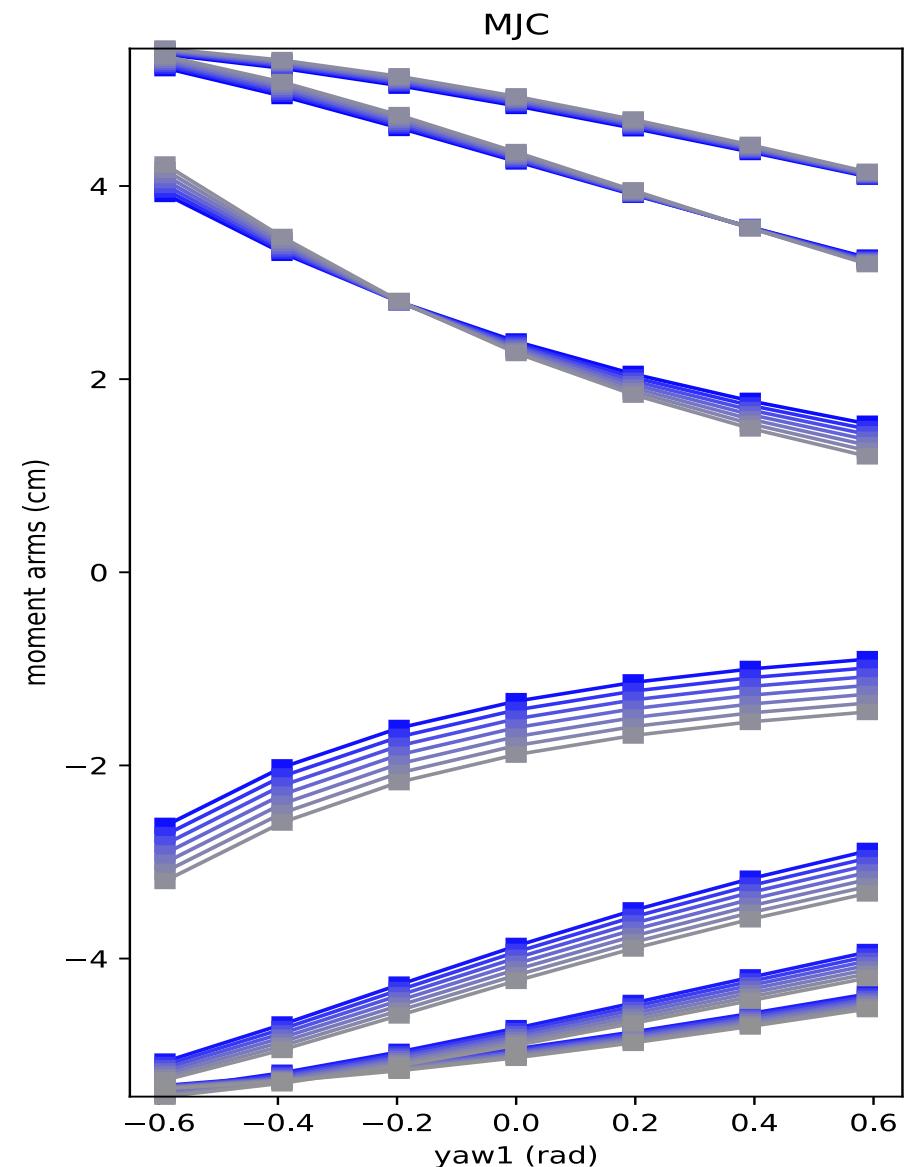
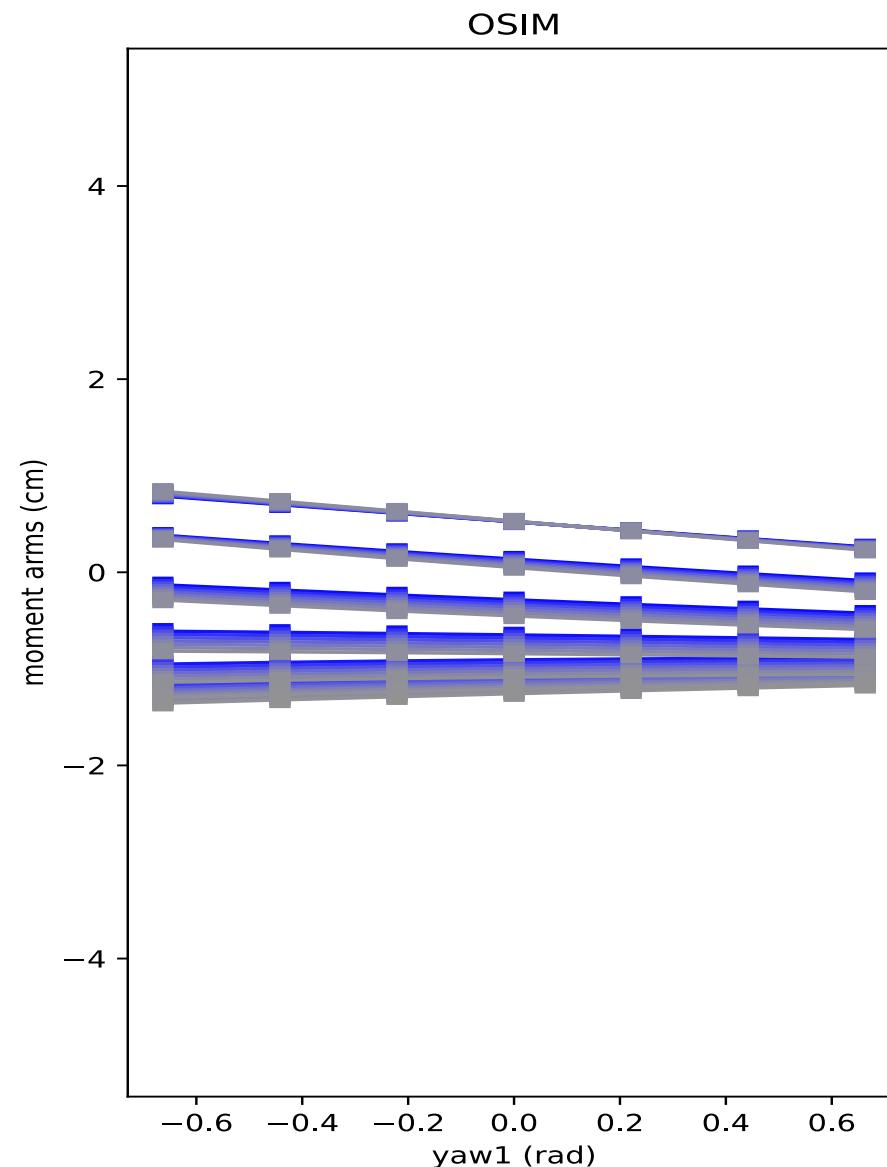
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med_L - pitch1 - roll1 - yaw1



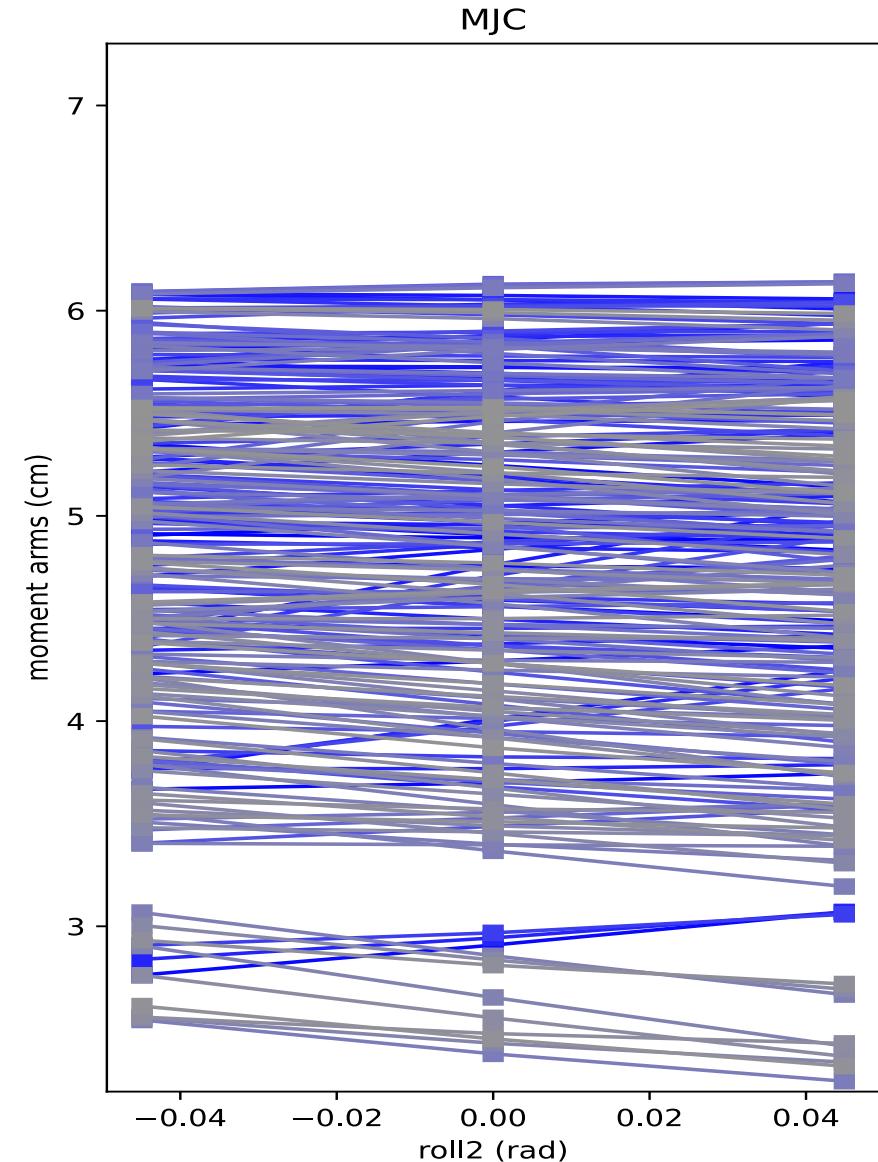
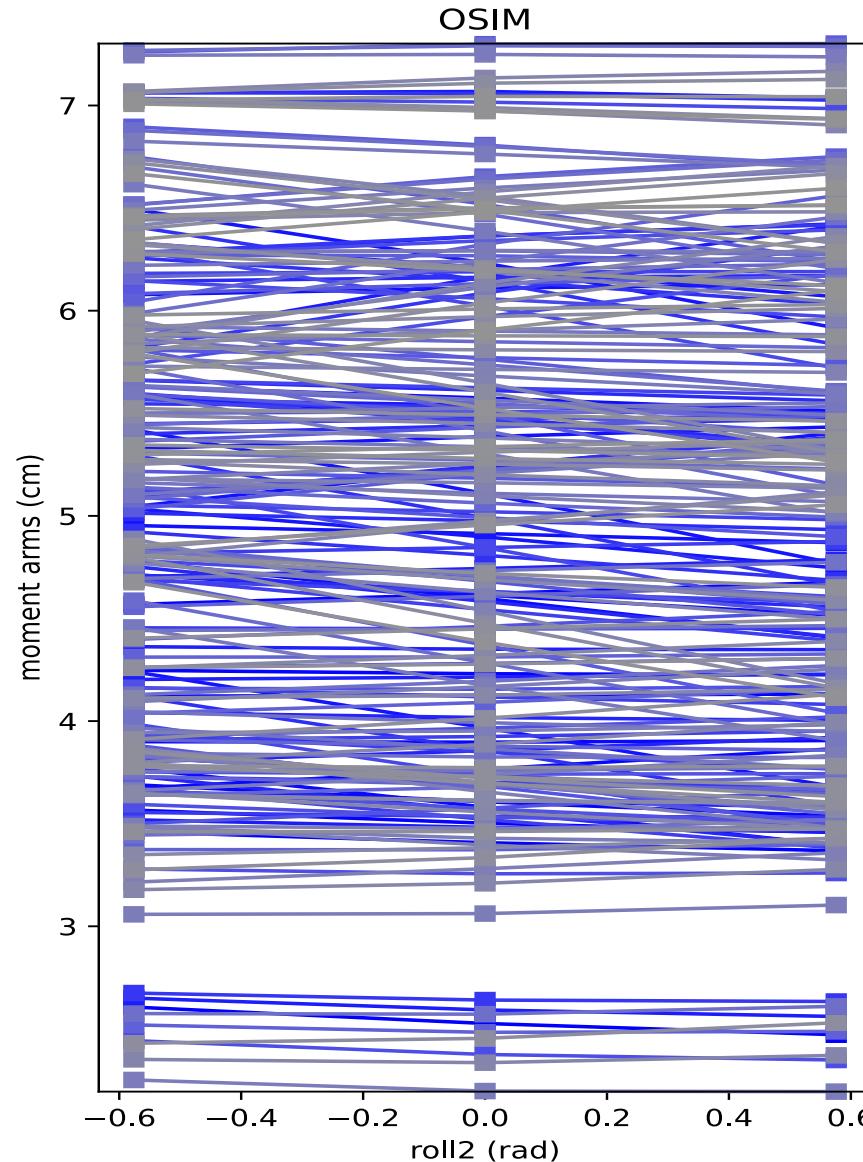
Muscle specific moment arm comparison with Osim model after optimization

long_cap_sklc4 - pitch1 - roll1 - yaw1



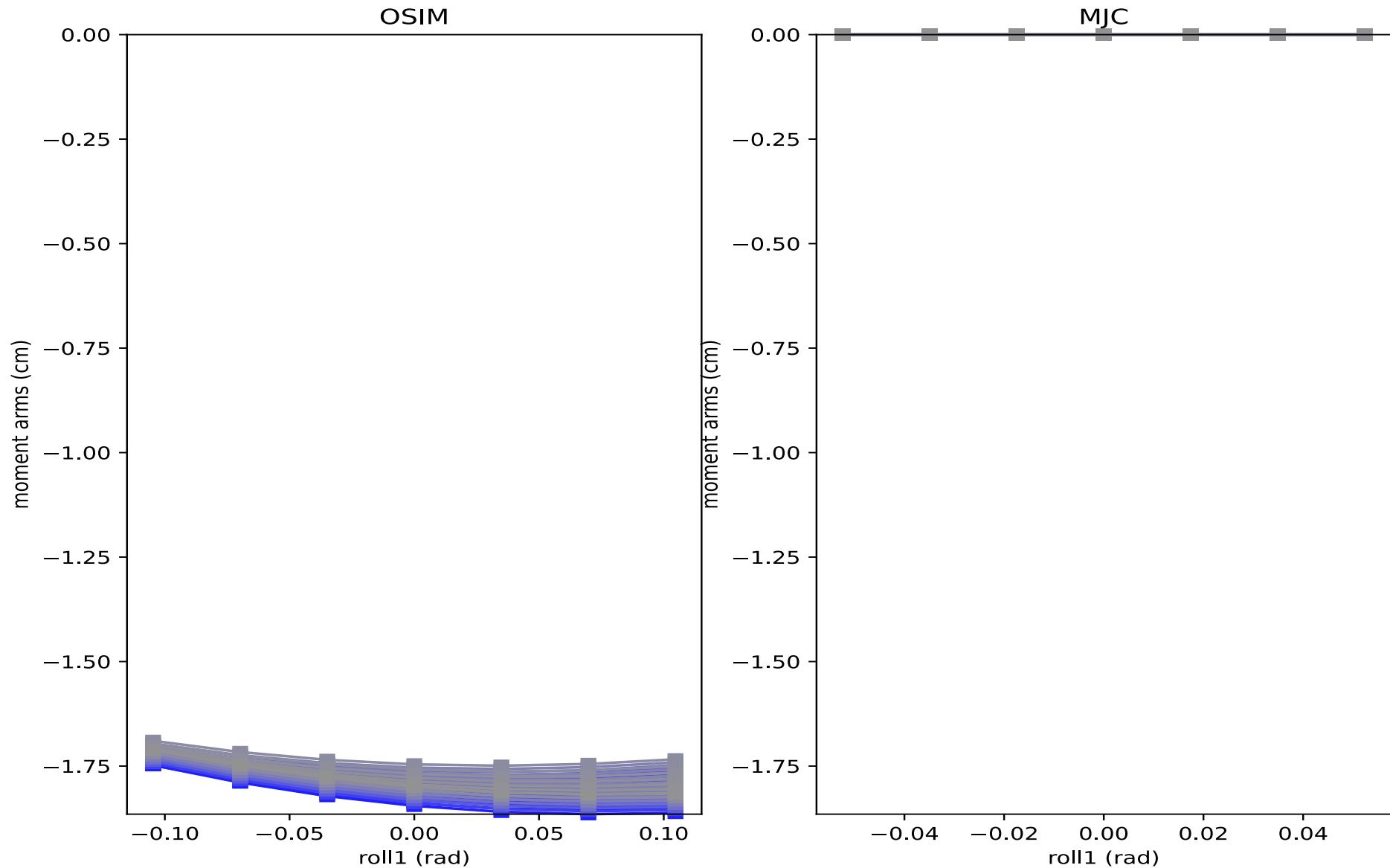
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



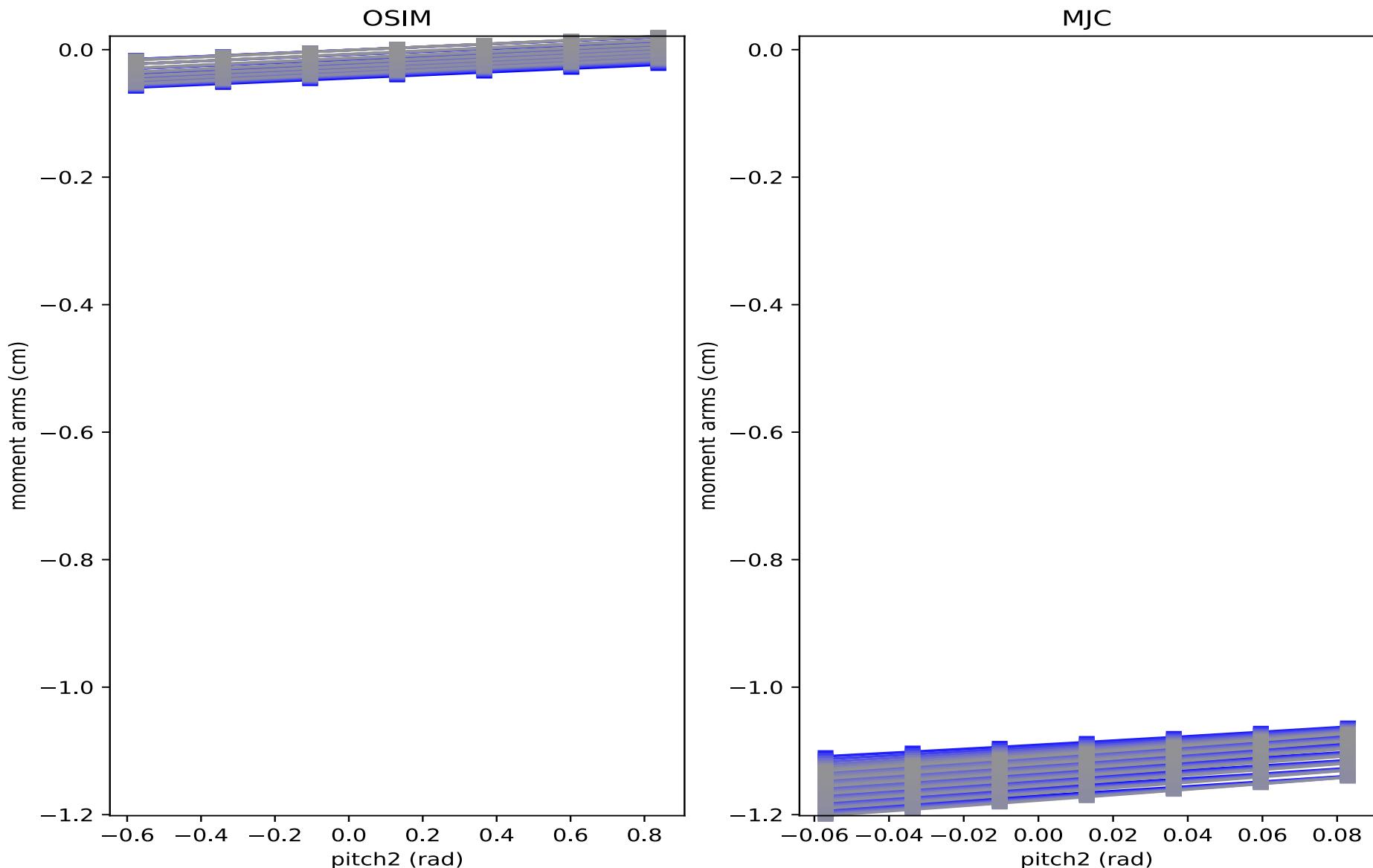
Muscle specific moment arm comparison with Osim model after optimization

Stylohyoid_Med_L - pitch1 - roll1 - yaw1



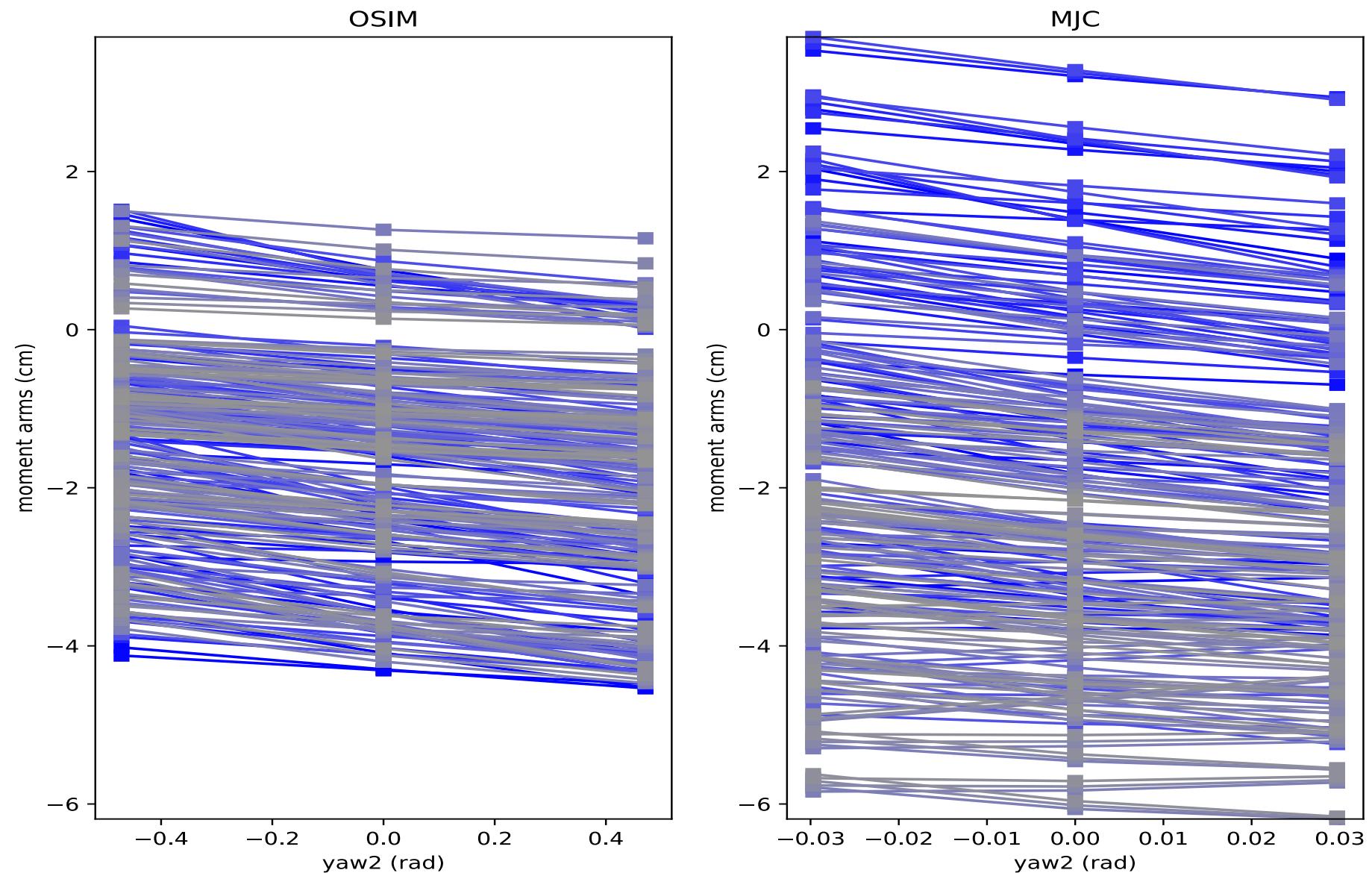
Muscle specific moment arm comparison with Osim model after optimization

long_col_c5thx_L - pitch2 - roll2 - yaw2



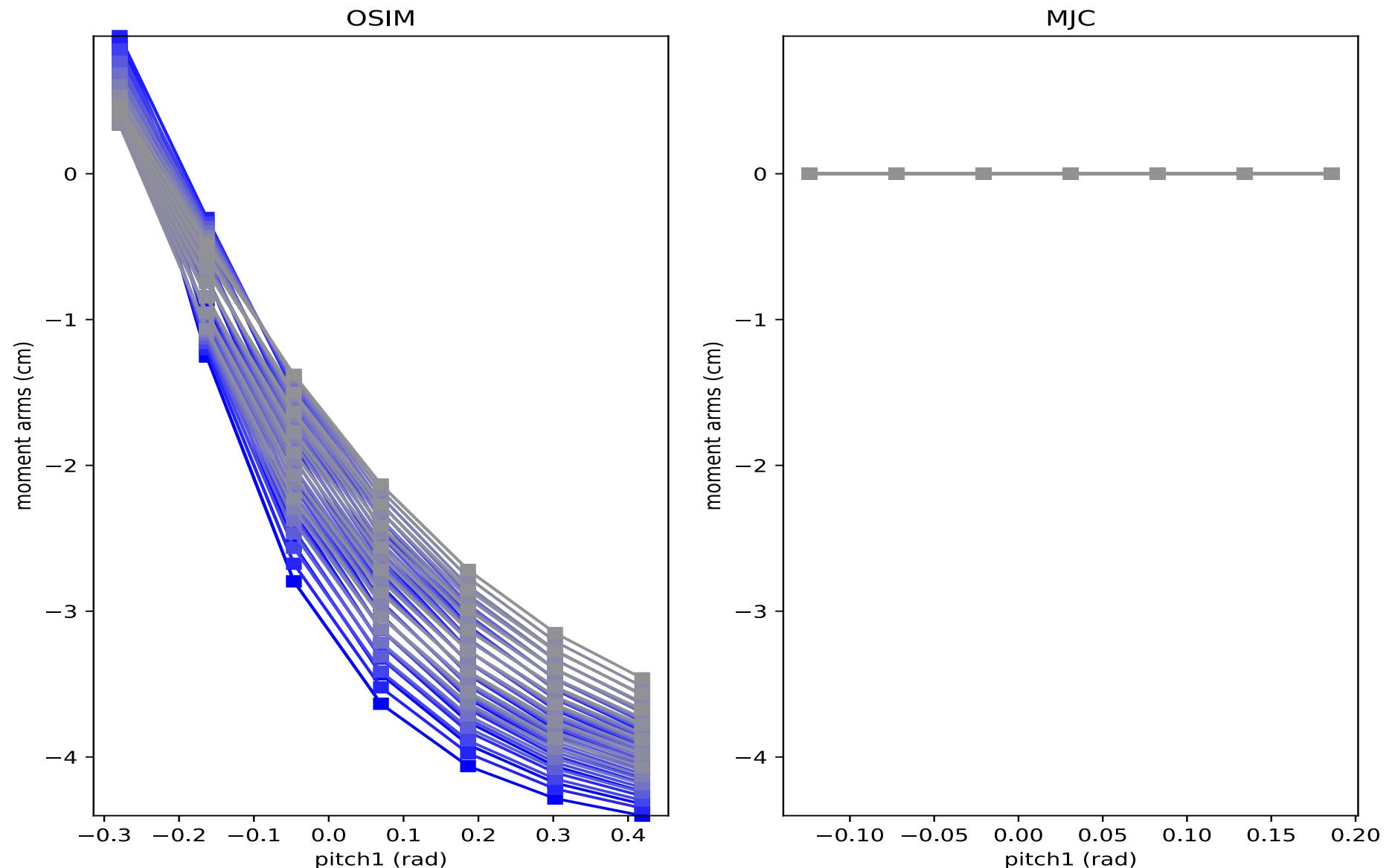
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



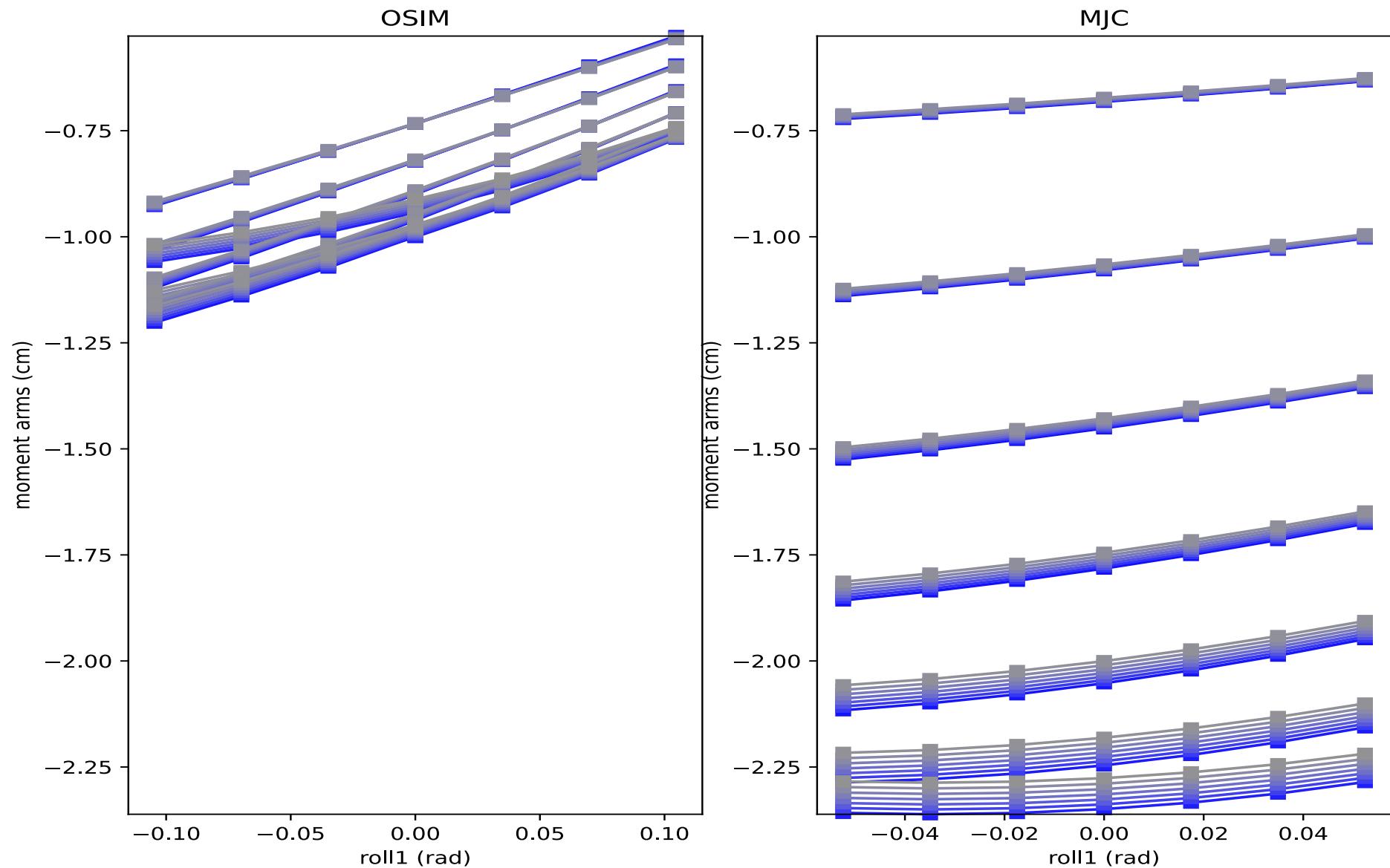
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant_L - pitch1 - roll1 - yaw1



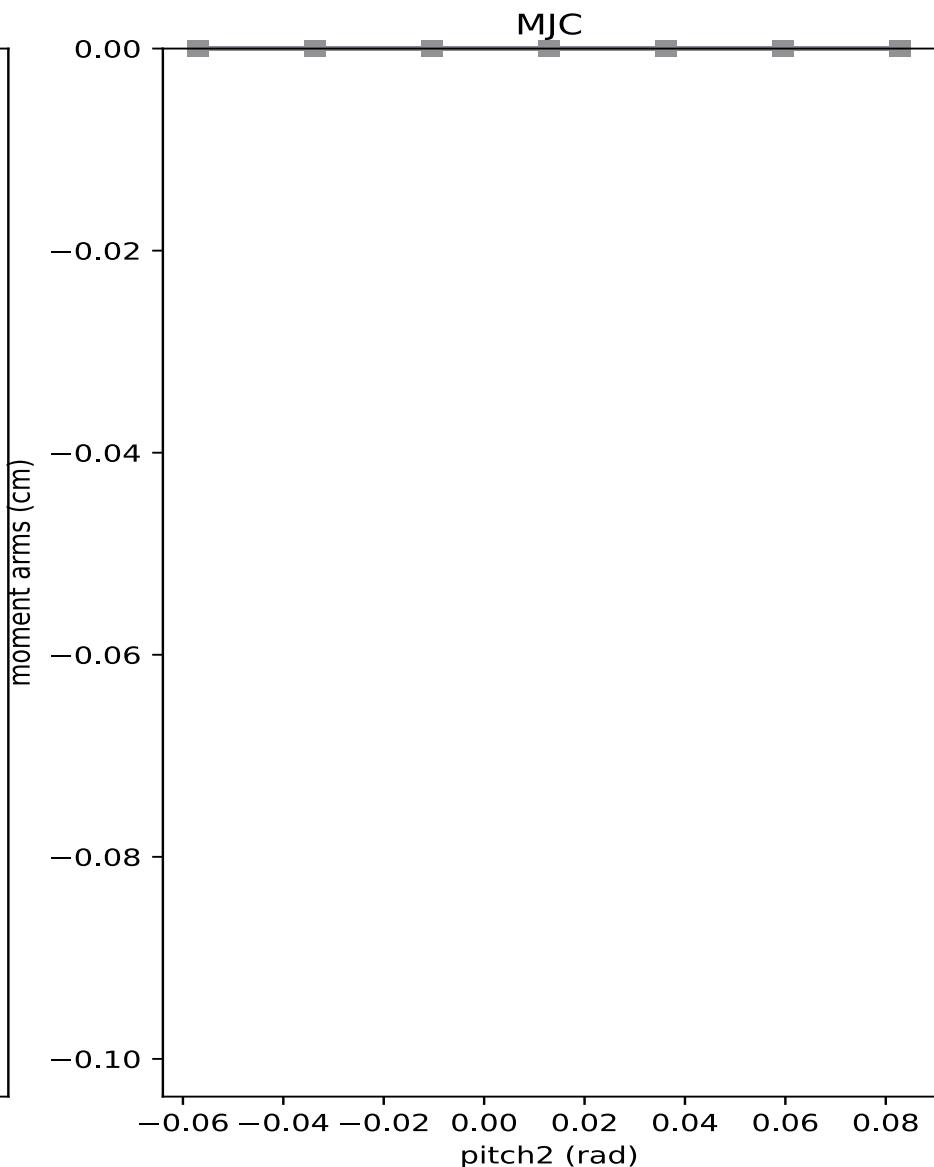
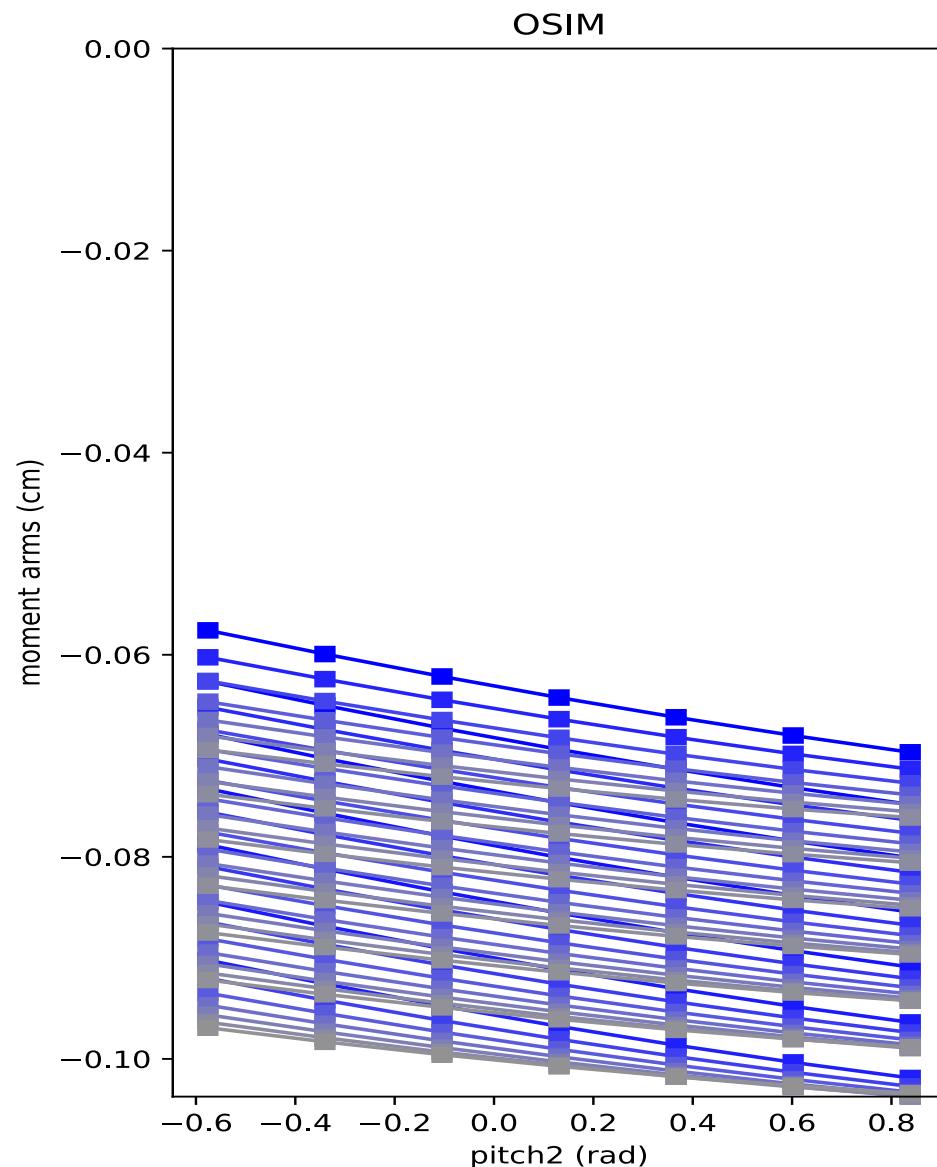
Muscle specific moment arm comparison with Osim model after optimization

obi_cap_inf_L - pitch1 - roll1 - yaw1



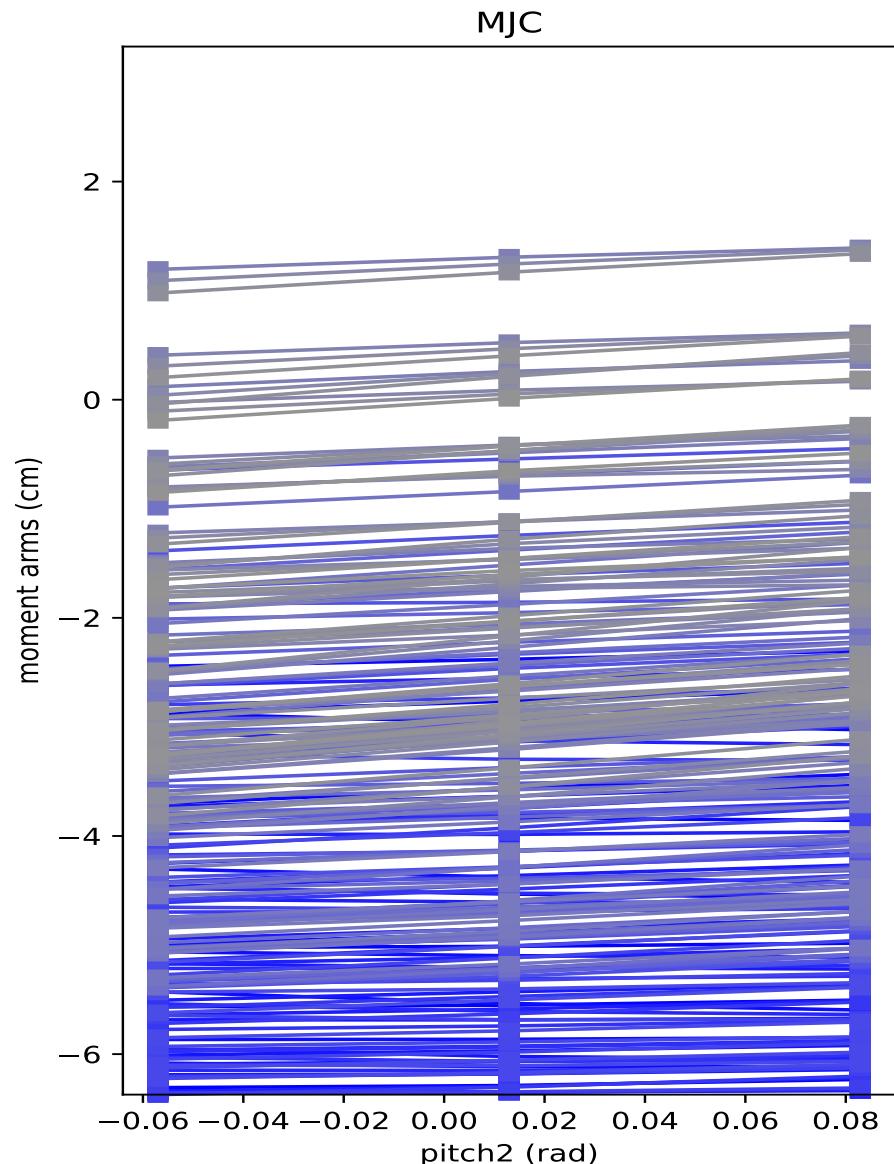
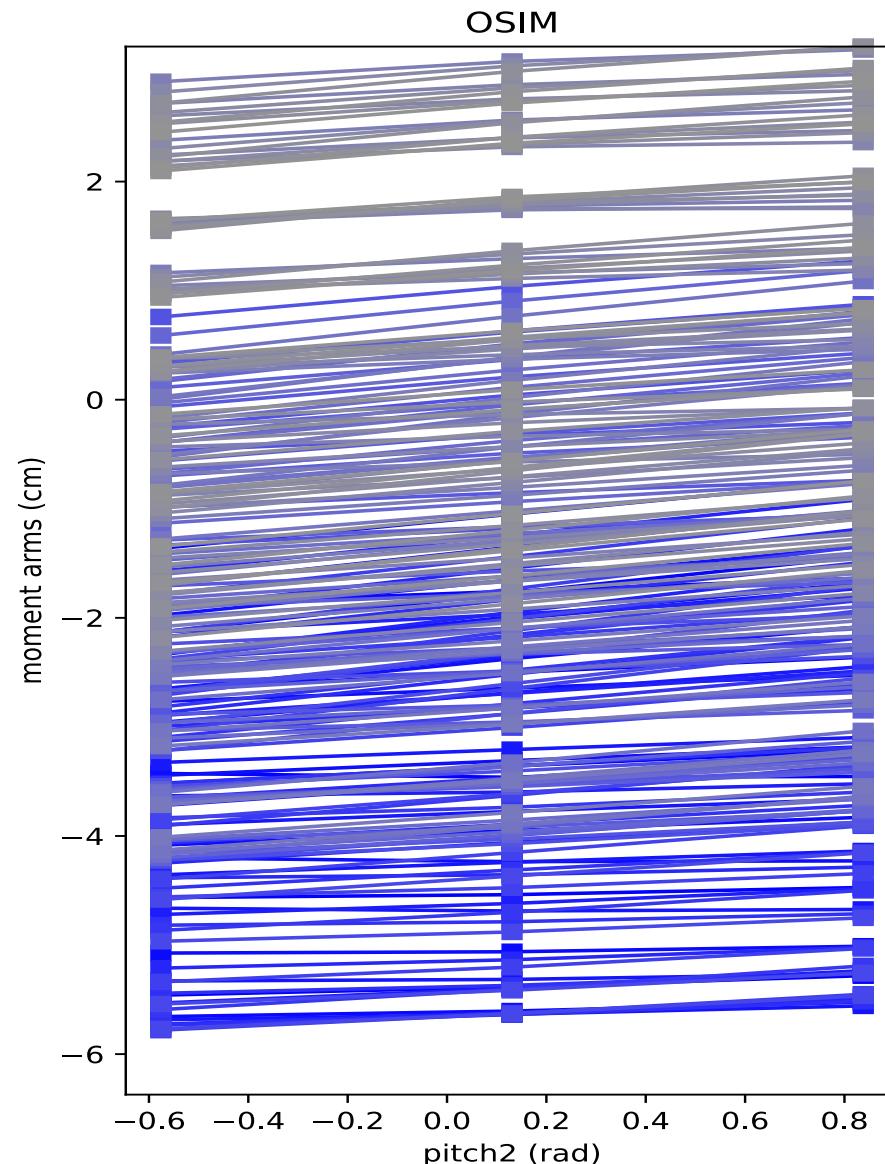
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1c5_L - pitch2 - roll2 - yaw2



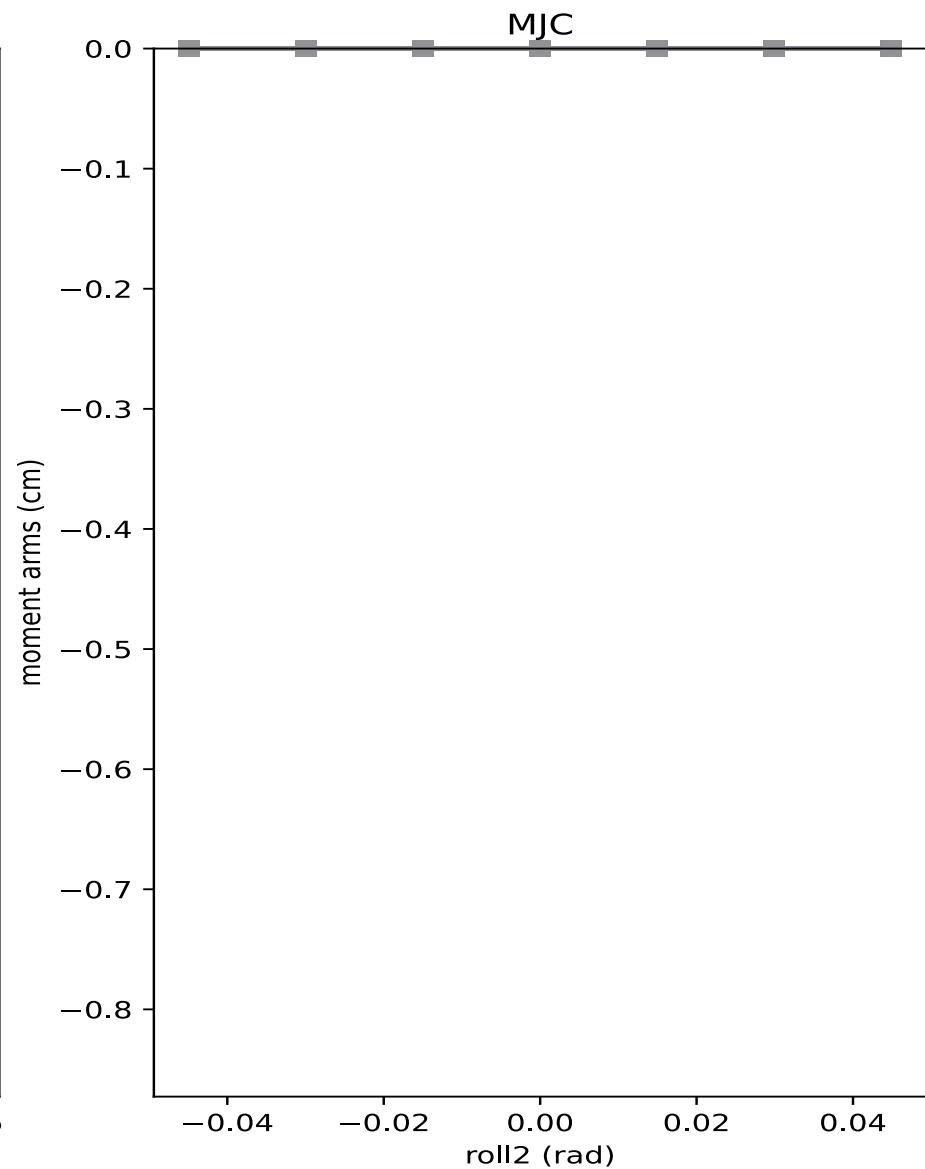
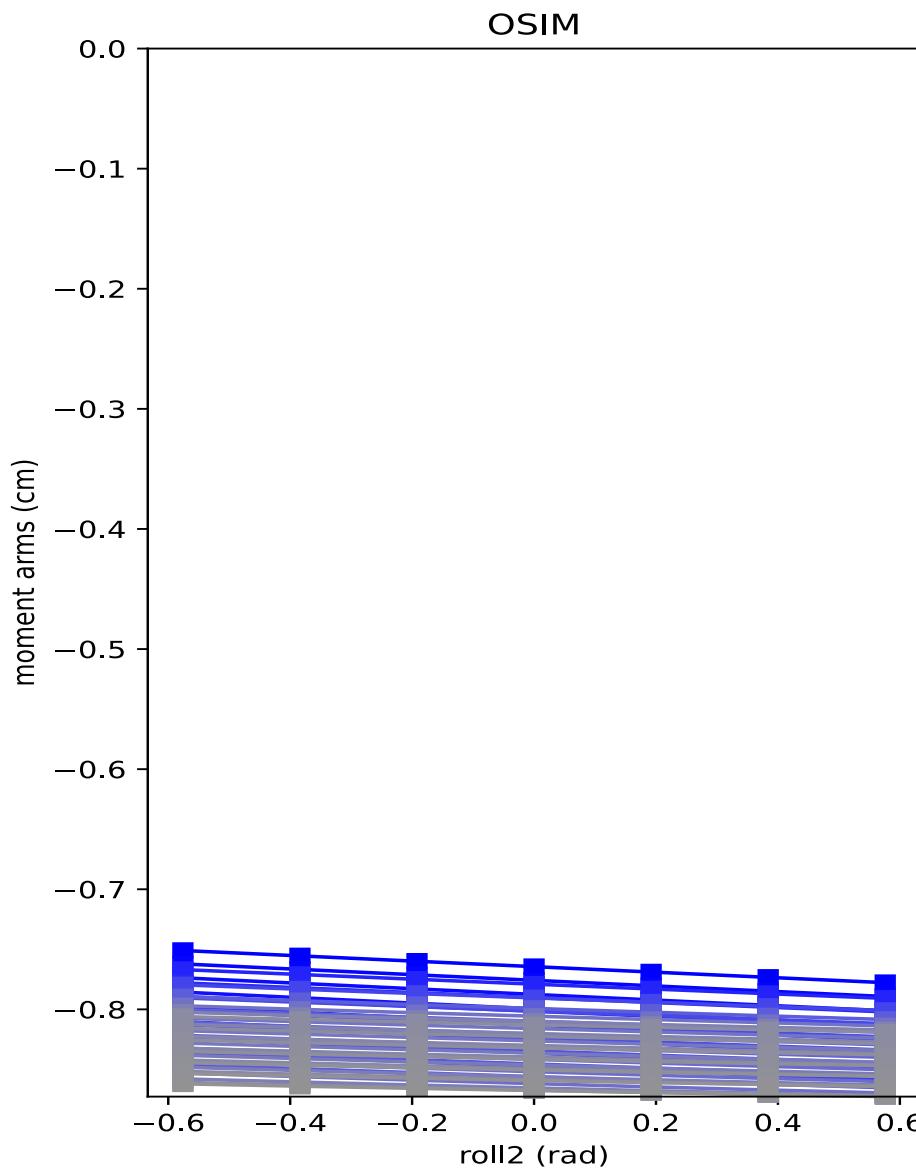
Muscle specific moment arm comparison with Osim model after optimization

stern_mast_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



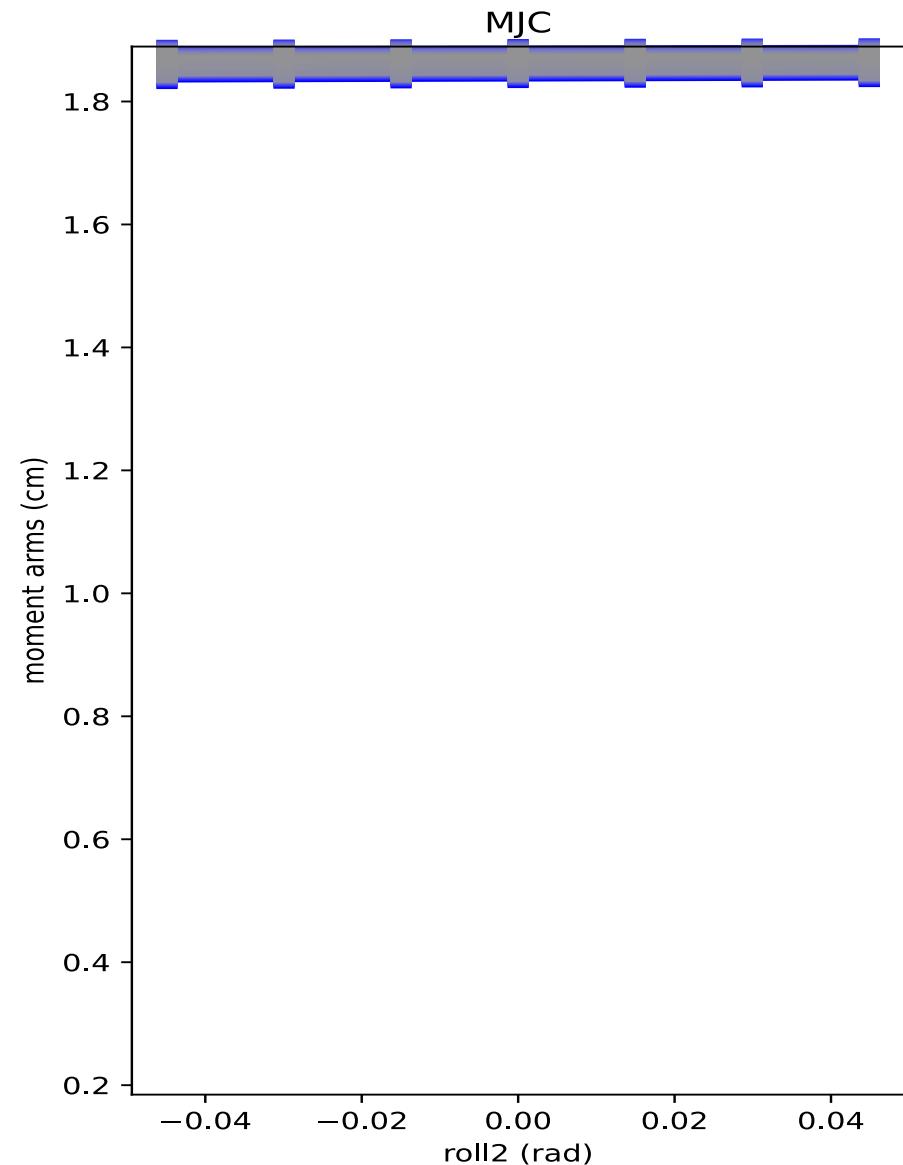
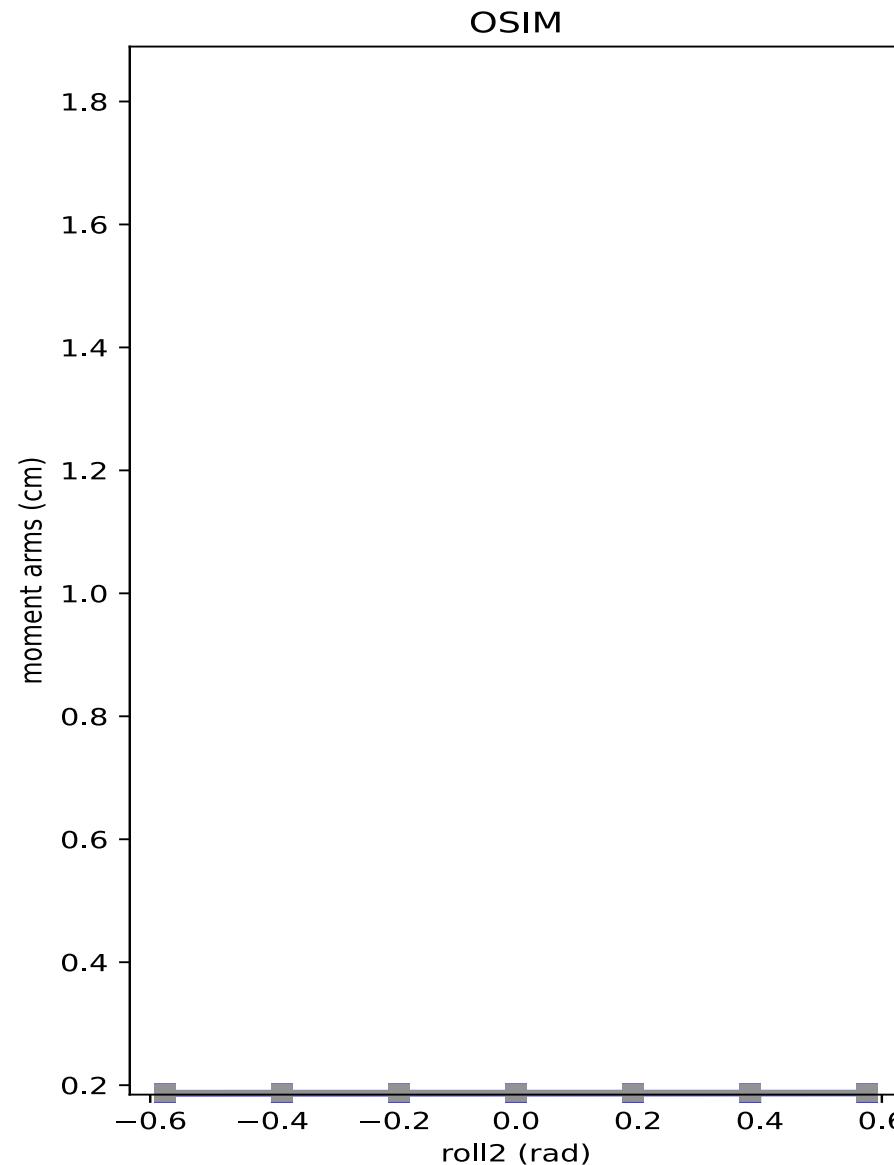
Muscle specific moment arm comparison with Osim model after optimization

long_cap_skIc4_L - pitch2 - roll2 - yaw2



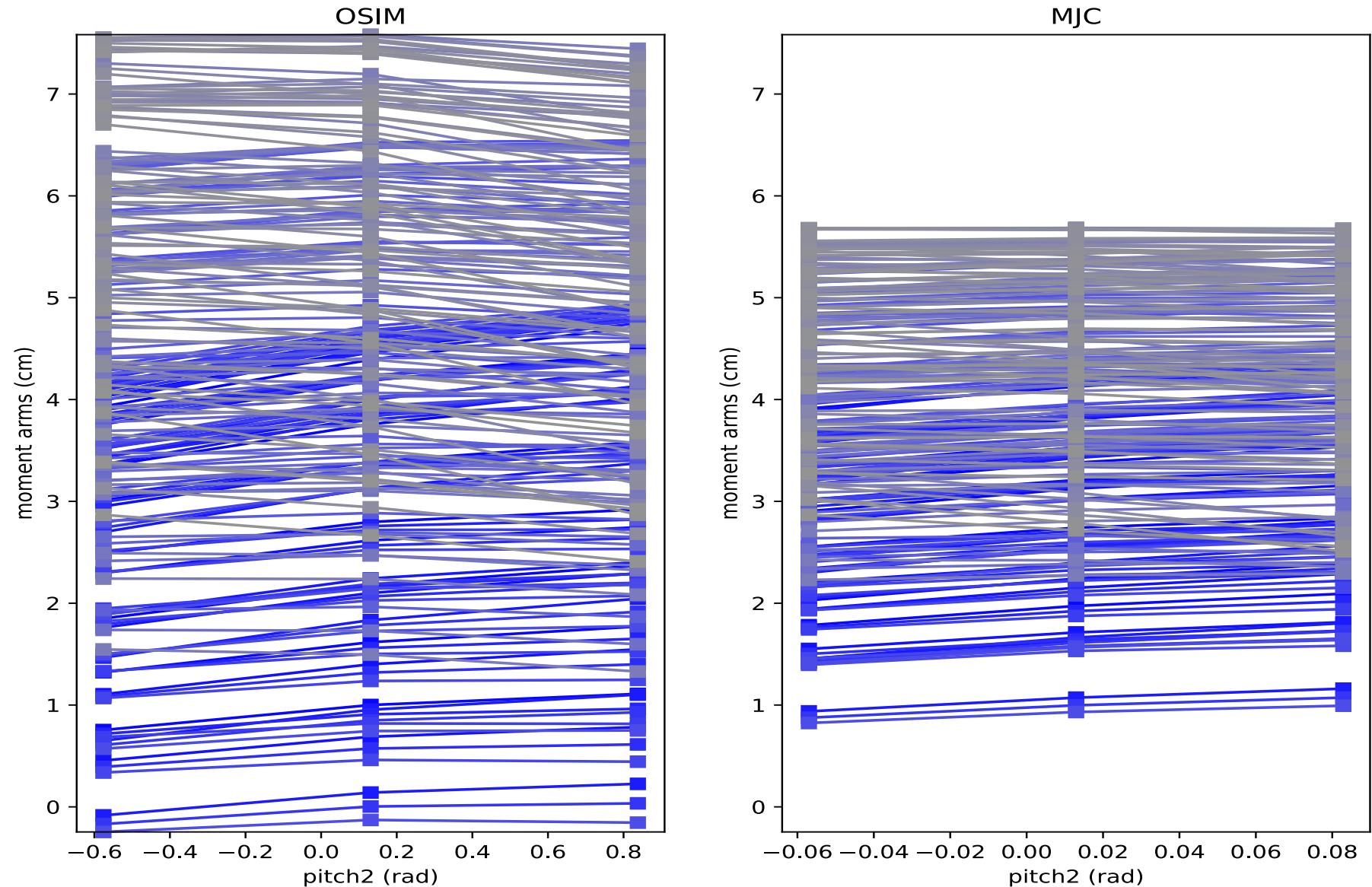
Muscle specific moment arm comparison with Osim model after optimization

trap_acr - pitch2 - roll2 - yaw2



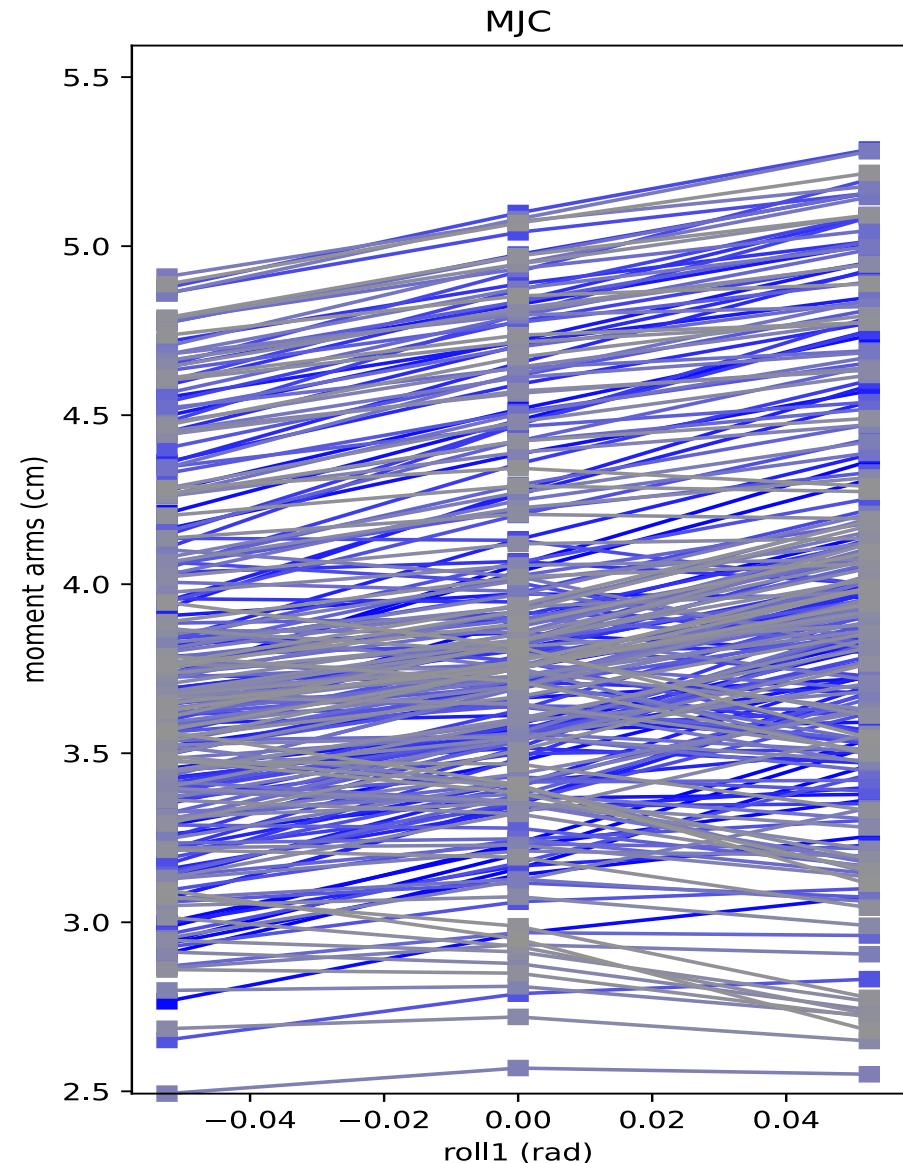
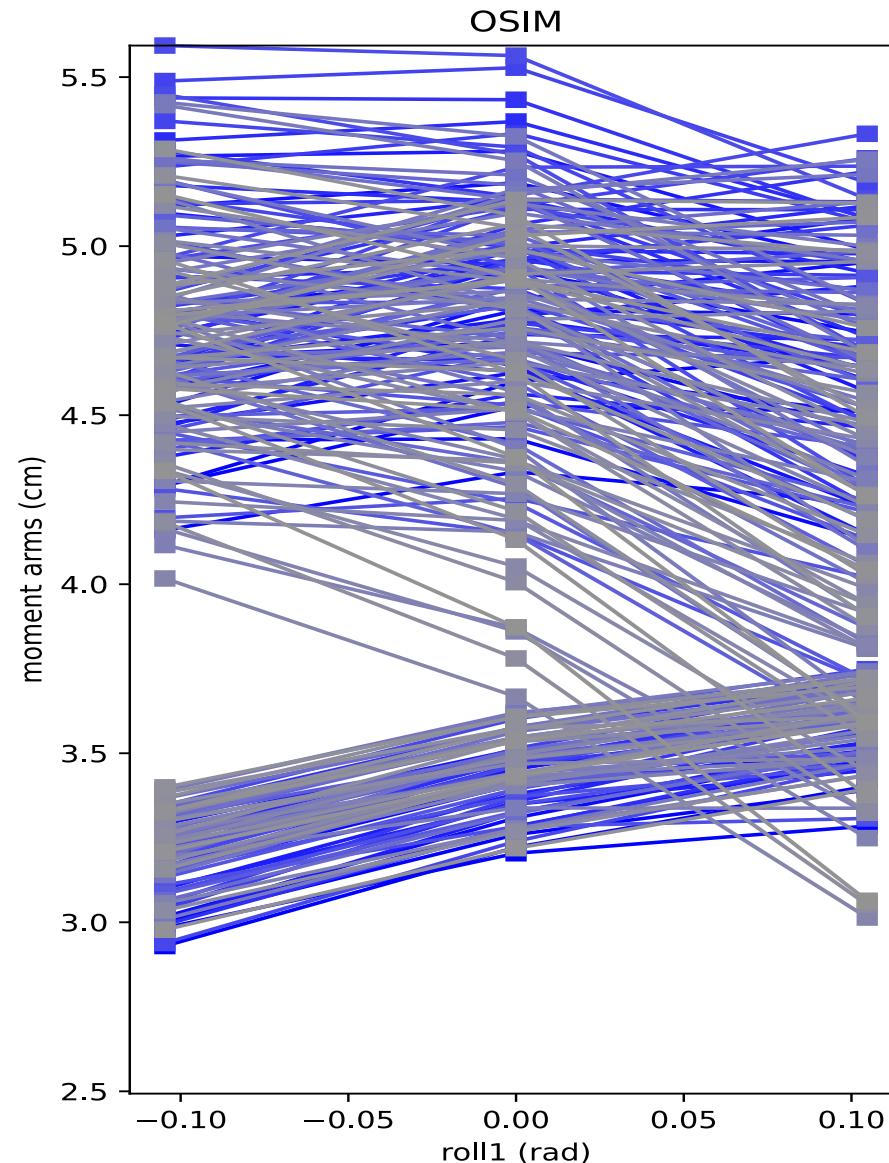
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



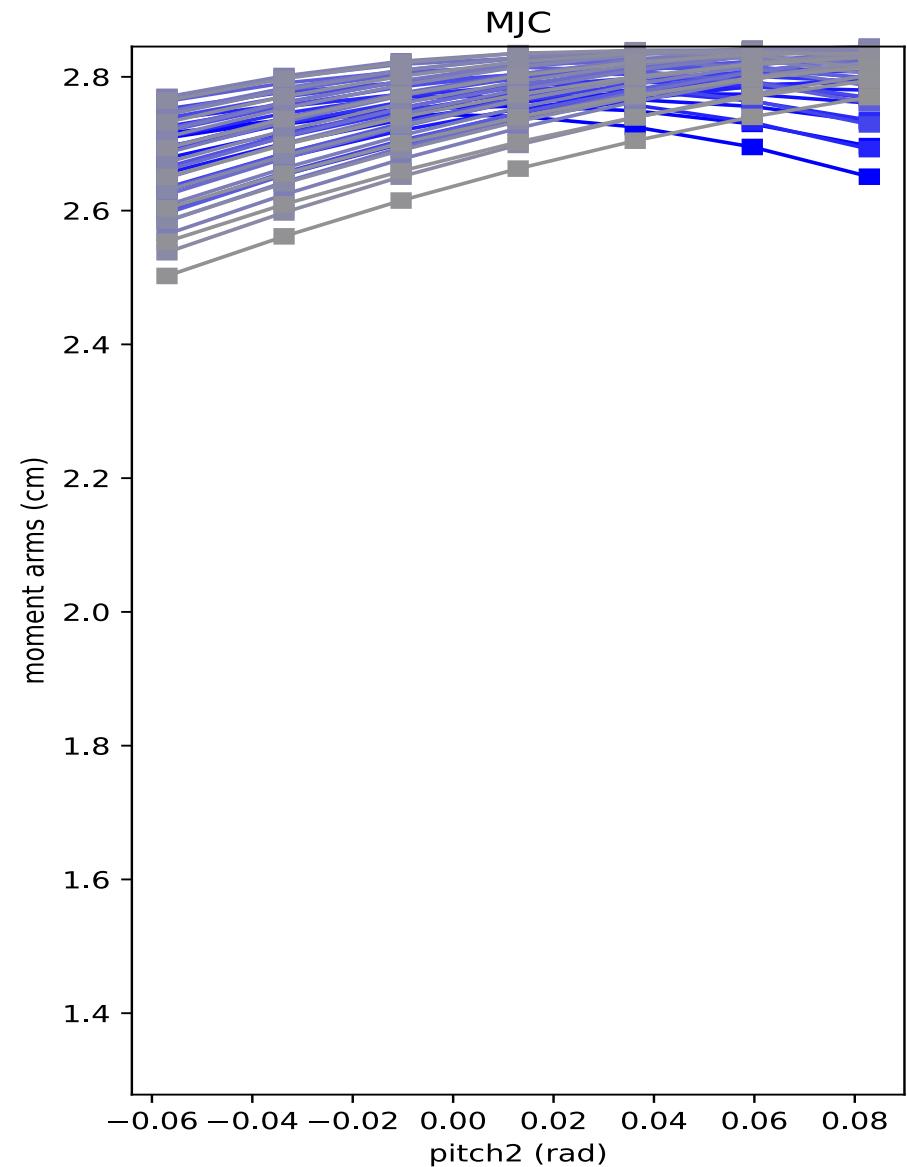
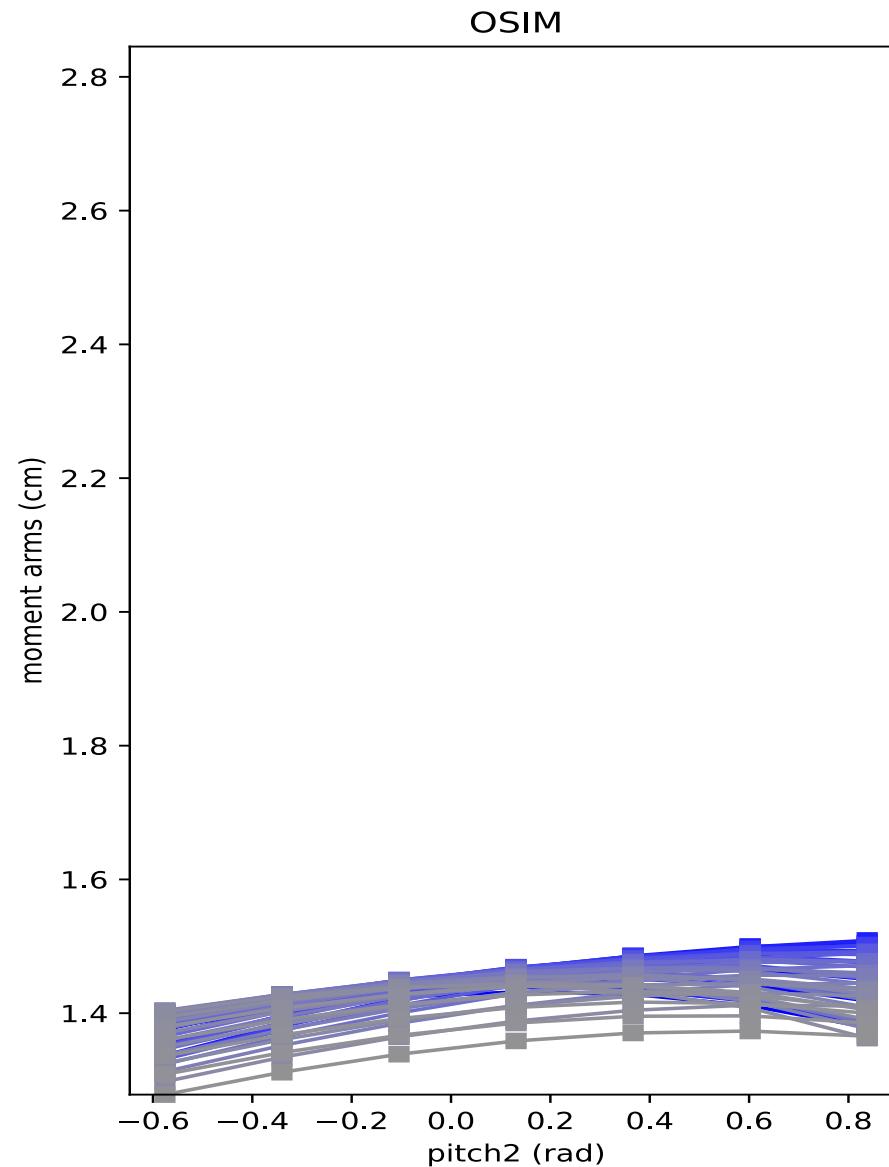
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



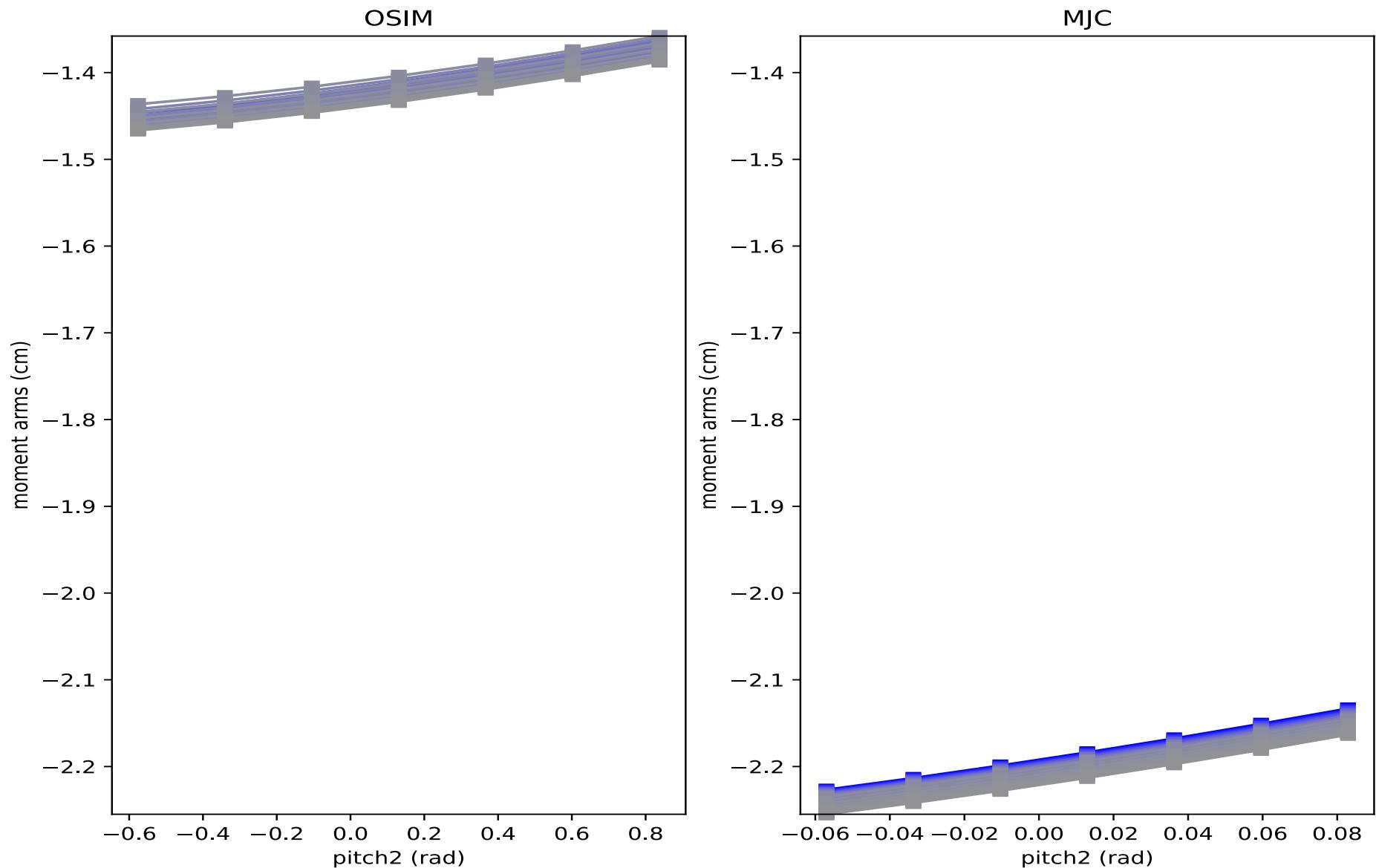
Muscle specific moment arm comparison with Osim model after optimization

iliocost_cerv_c5rib - pitch2 - roll2 - yaw2



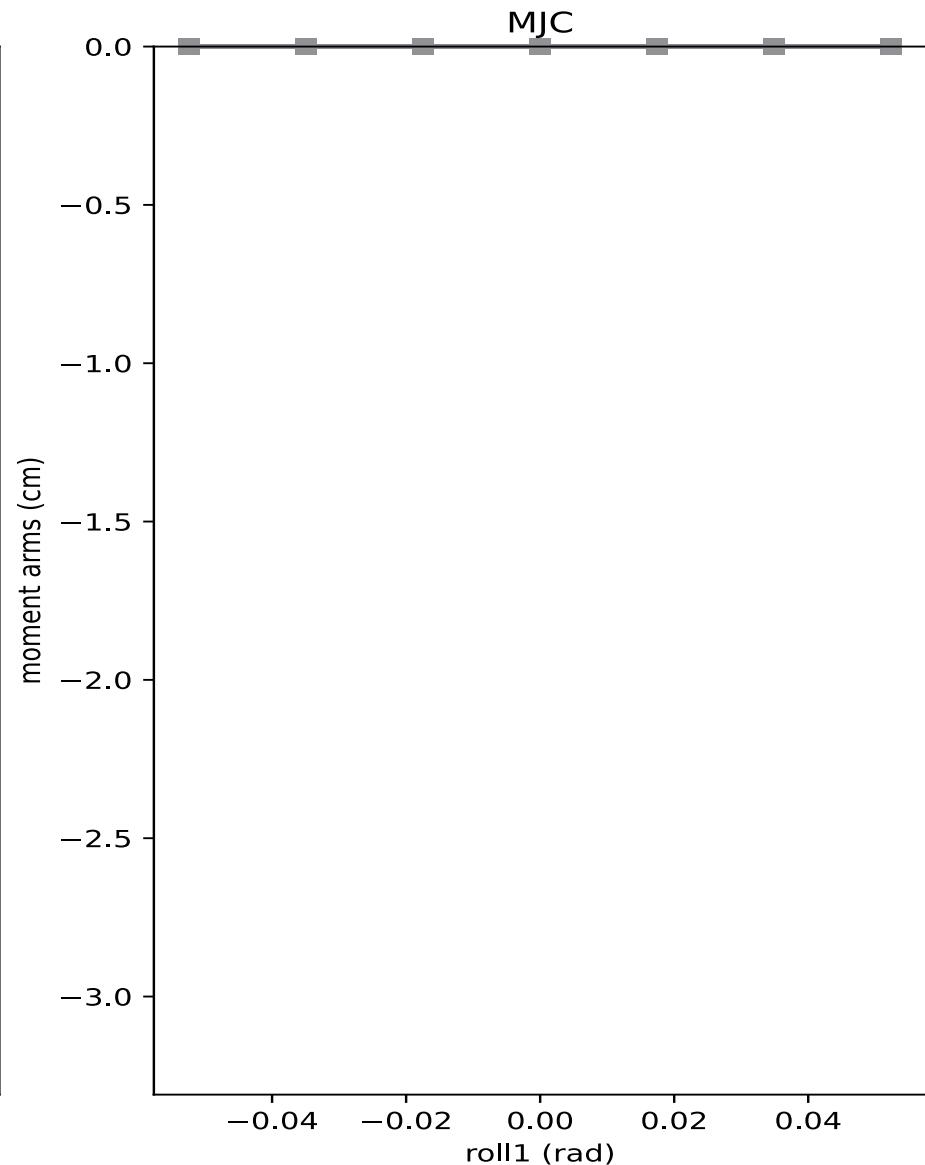
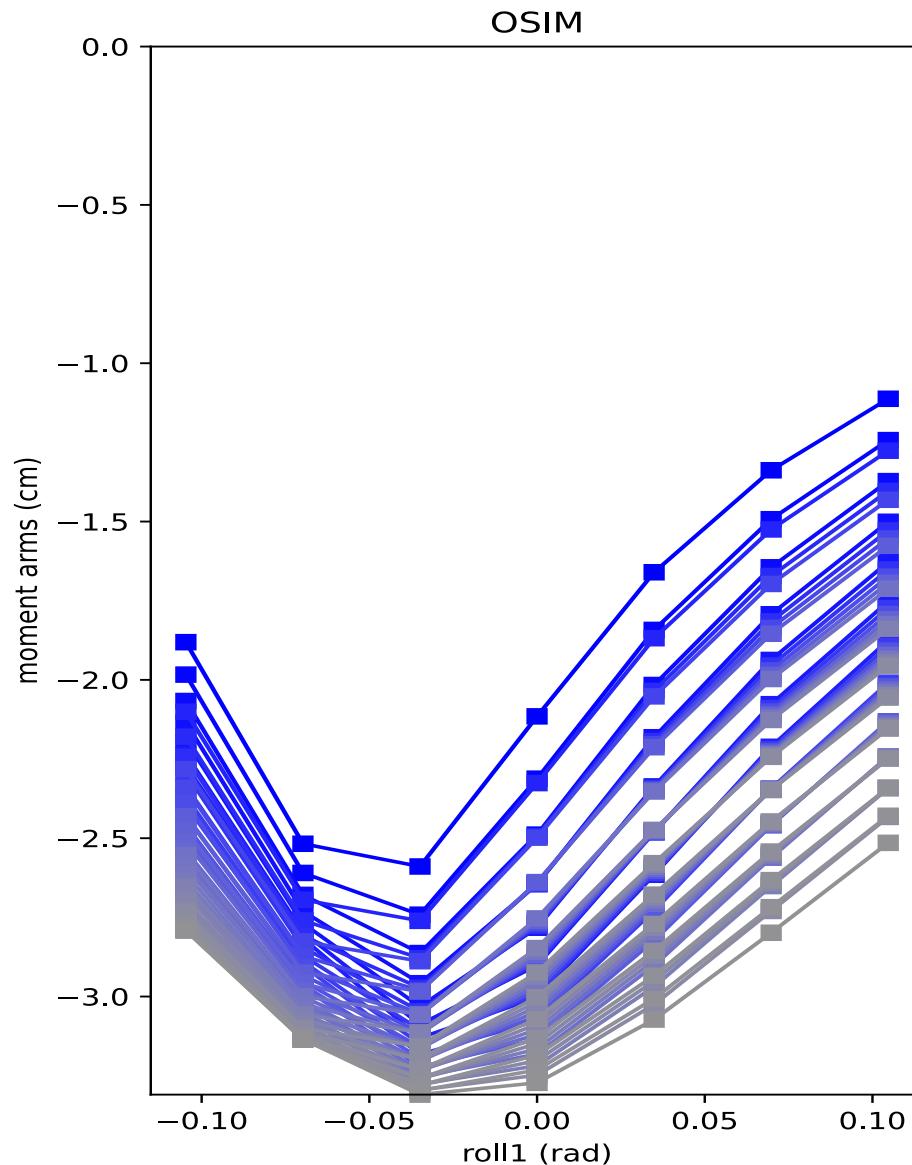
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx - pitch2 - roll2 - yaw2



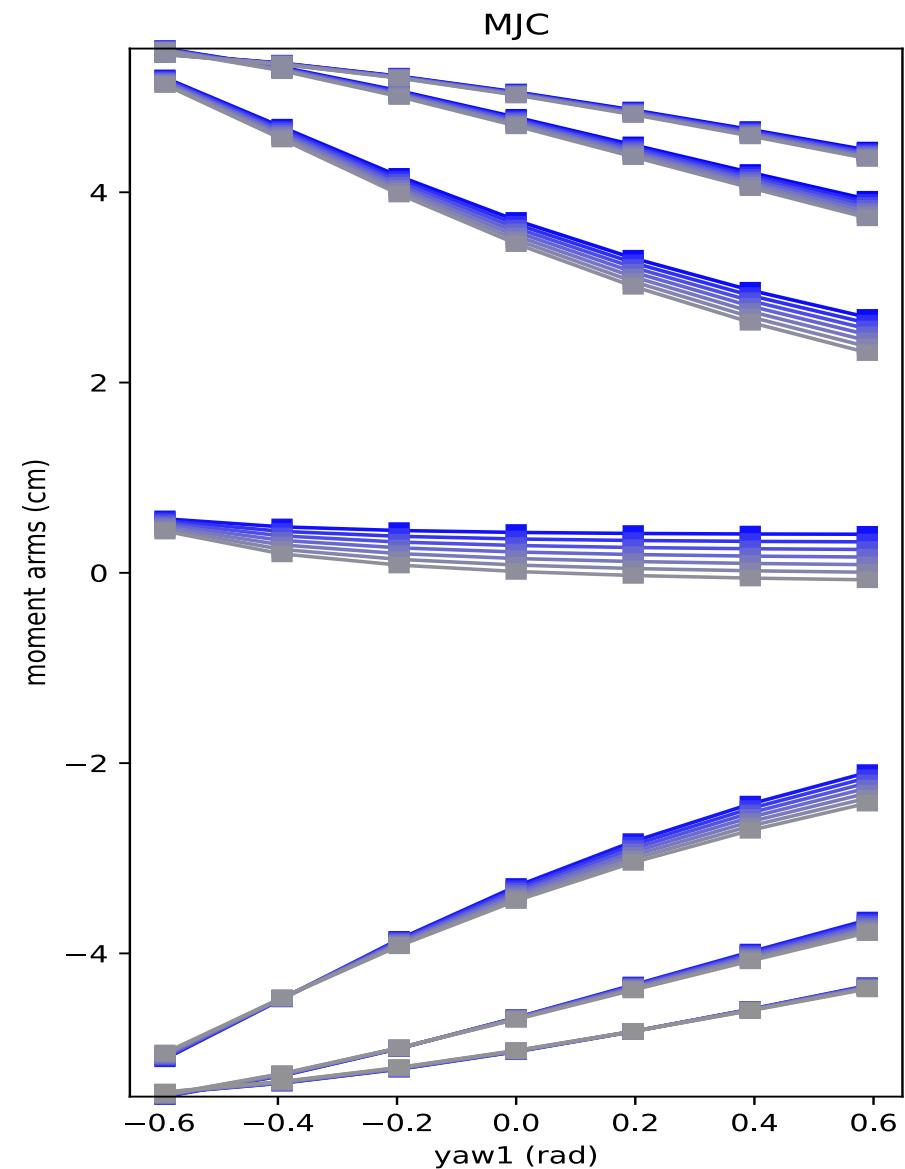
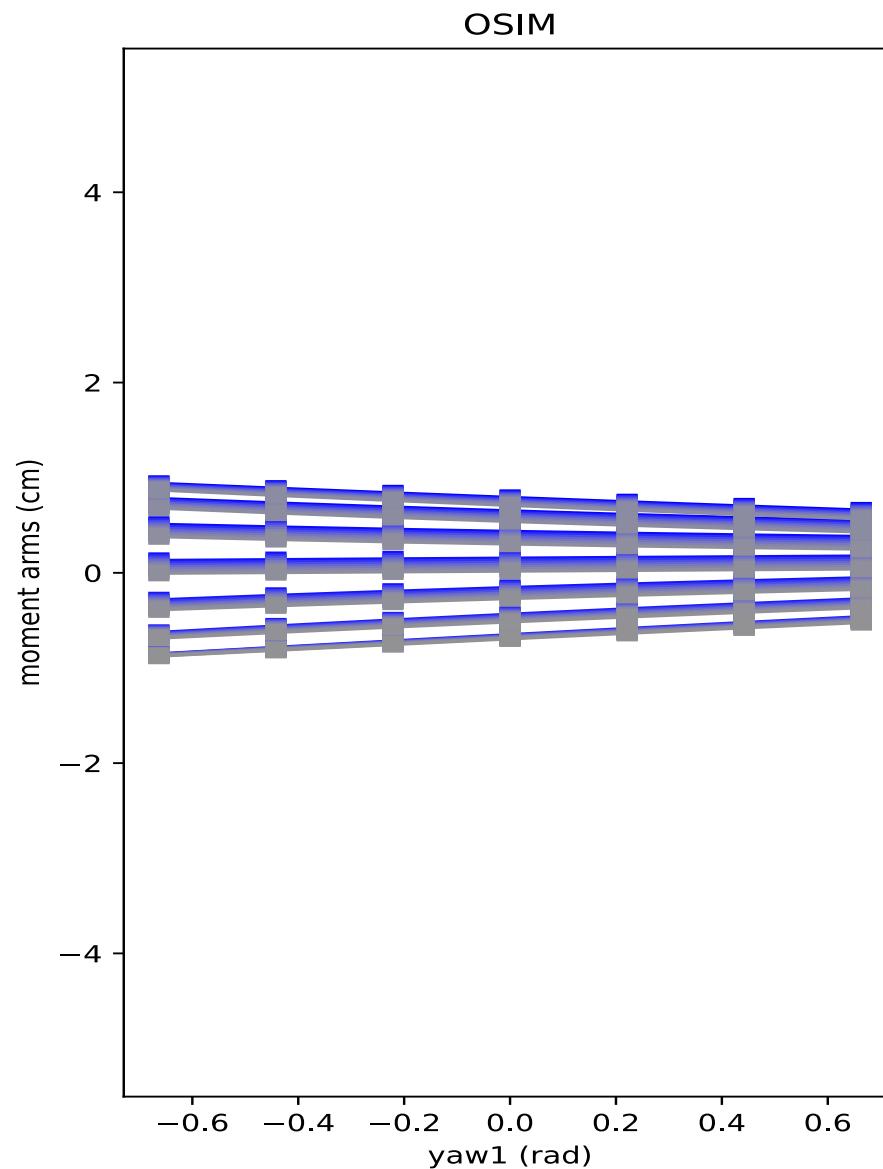
Muscle specific moment arm comparison with Osim model after optimization

digastric_ant_L - pitch1 - roll1 - yaw1



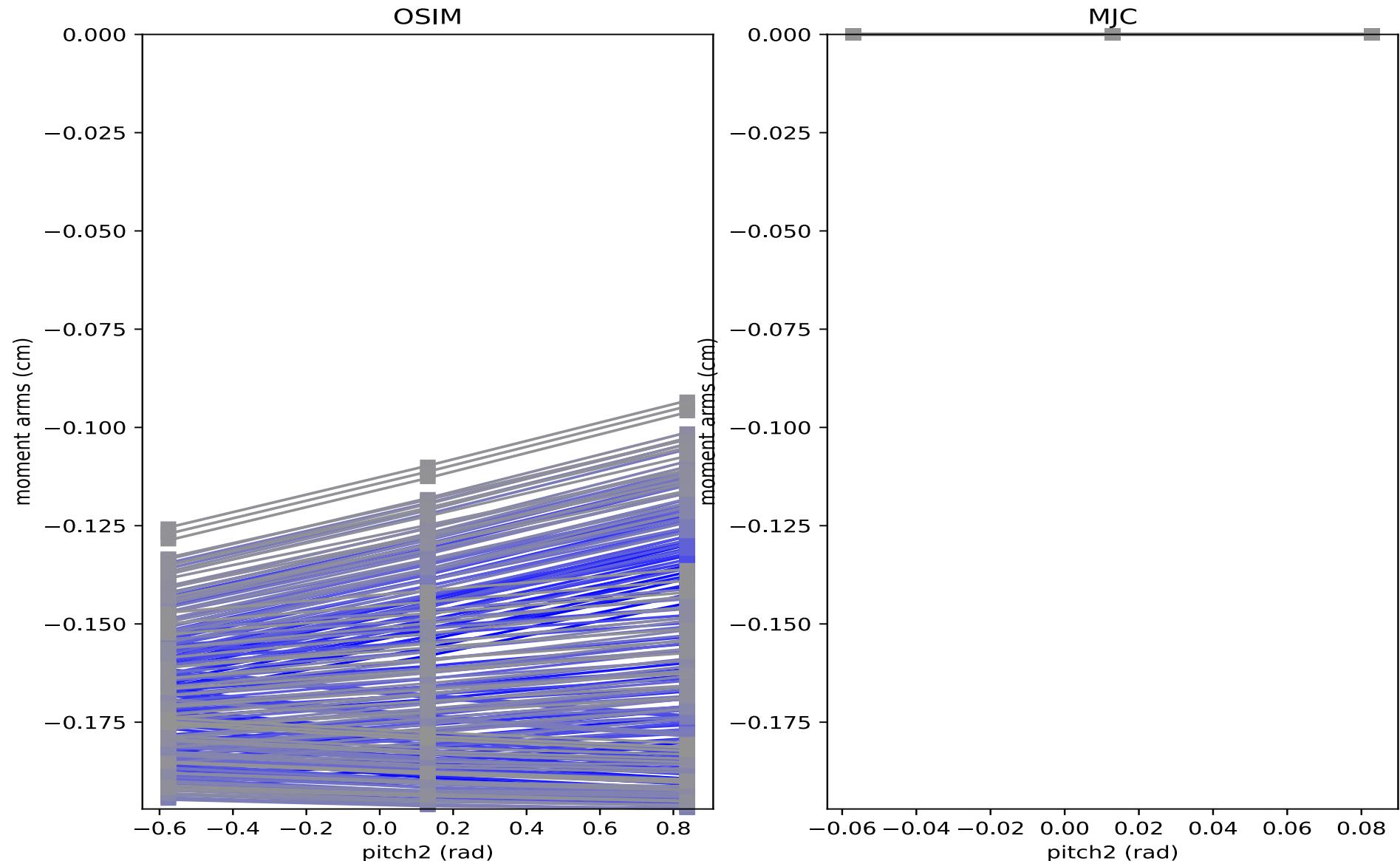
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch1 - roll1 - yaw1



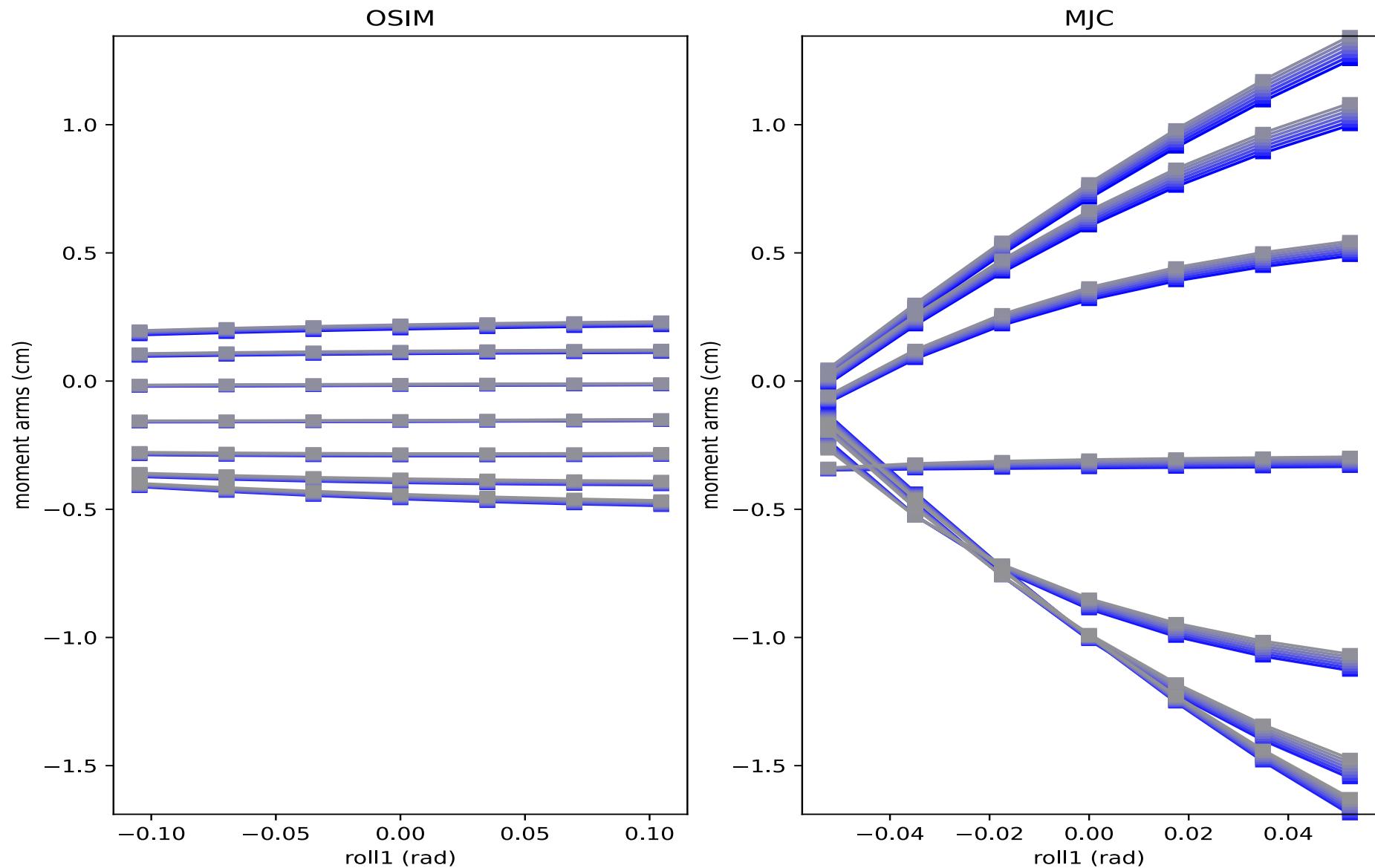
Muscle specific moment arm comparison with Osim model after optimization

digastric_post - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



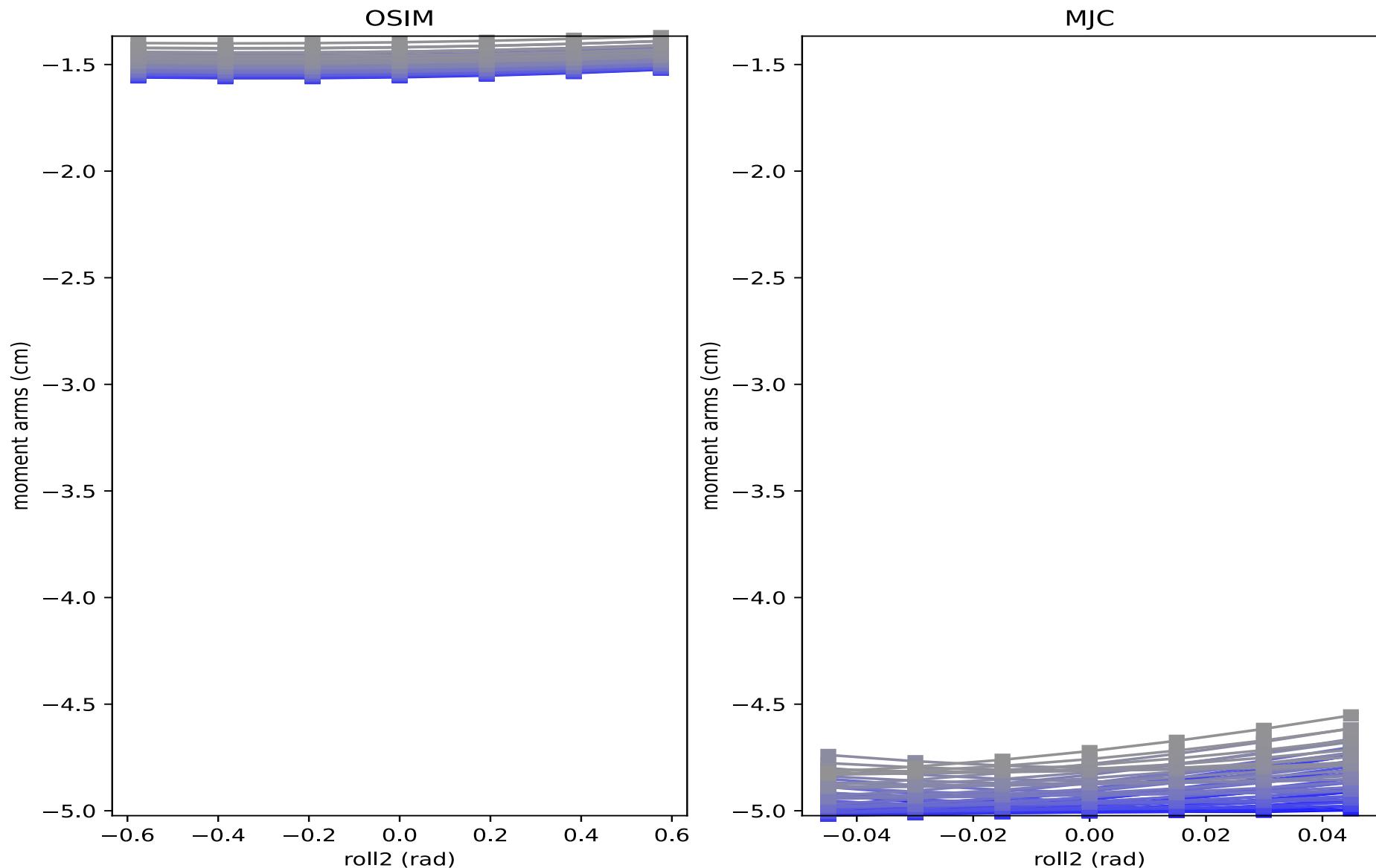
Muscle specific moment arm comparison with Osim model after optimization

long_col_c1thx_L - pitch1 - roll1 - yaw1



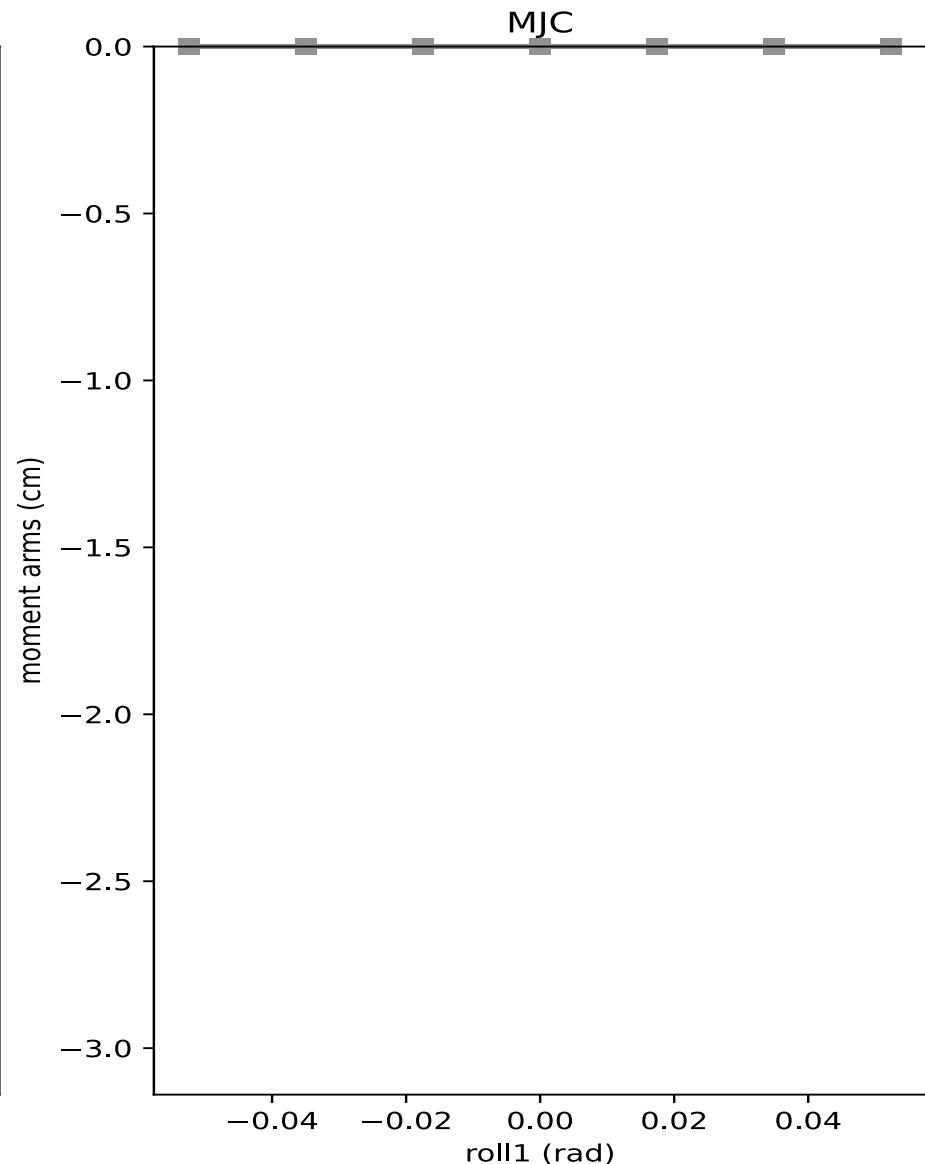
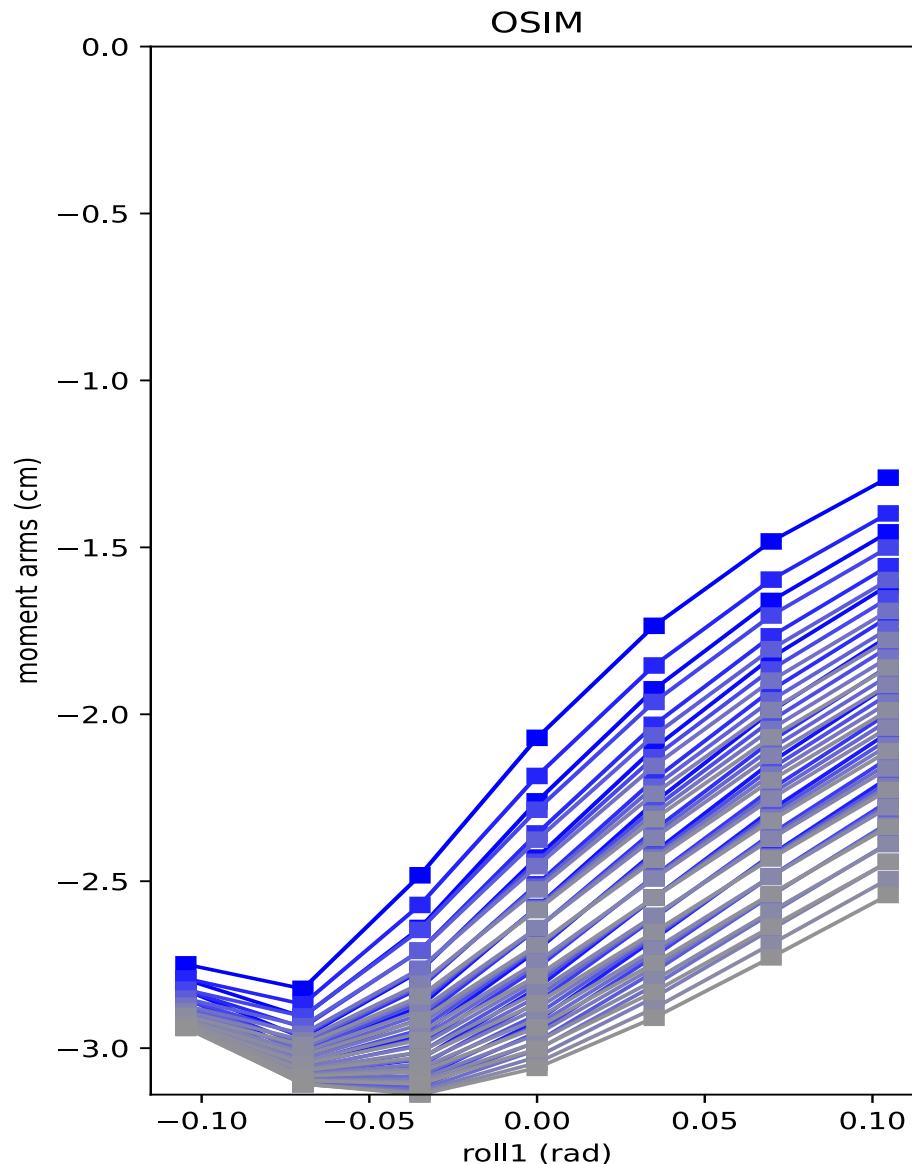
Muscle specific moment arm comparison with Osim model after optimization

scalenus_post_L - pitch2 - roll2 - yaw2



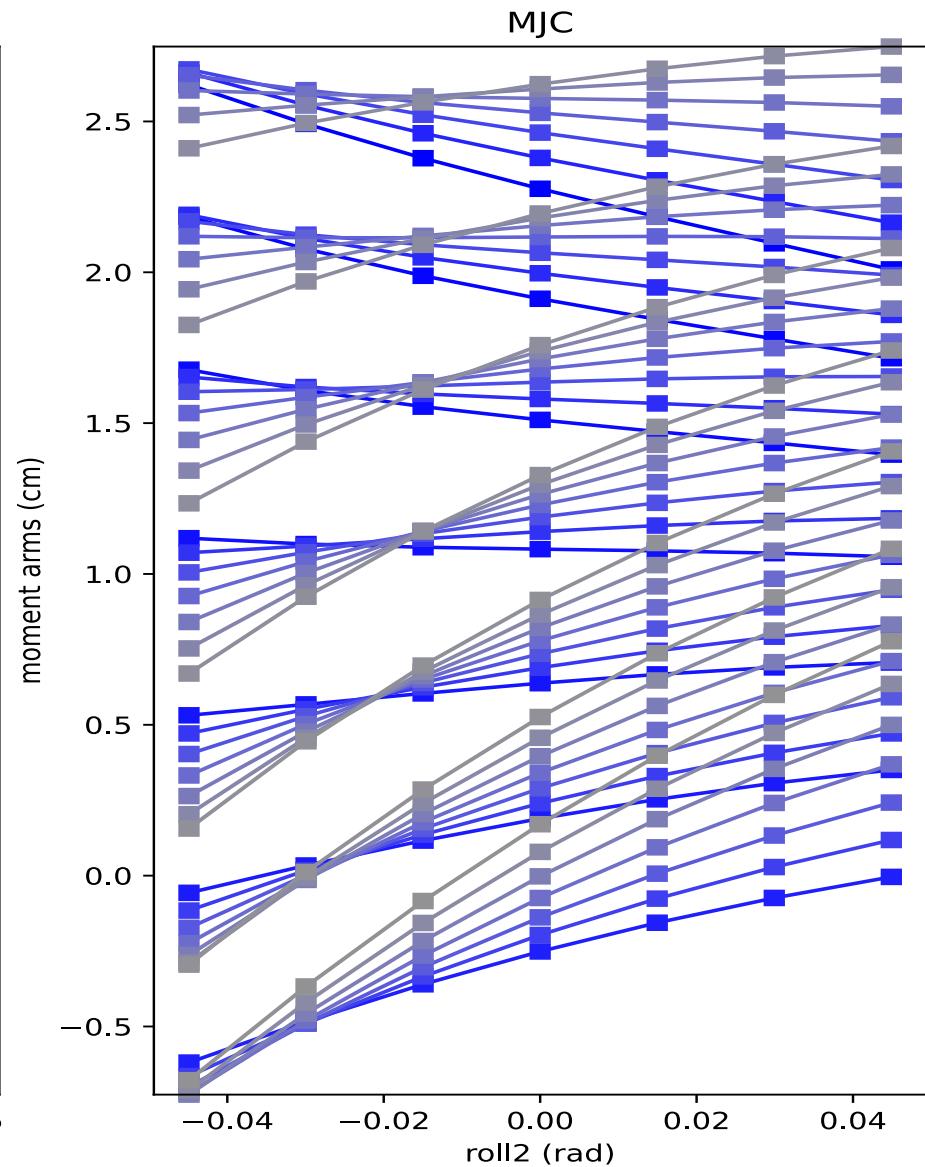
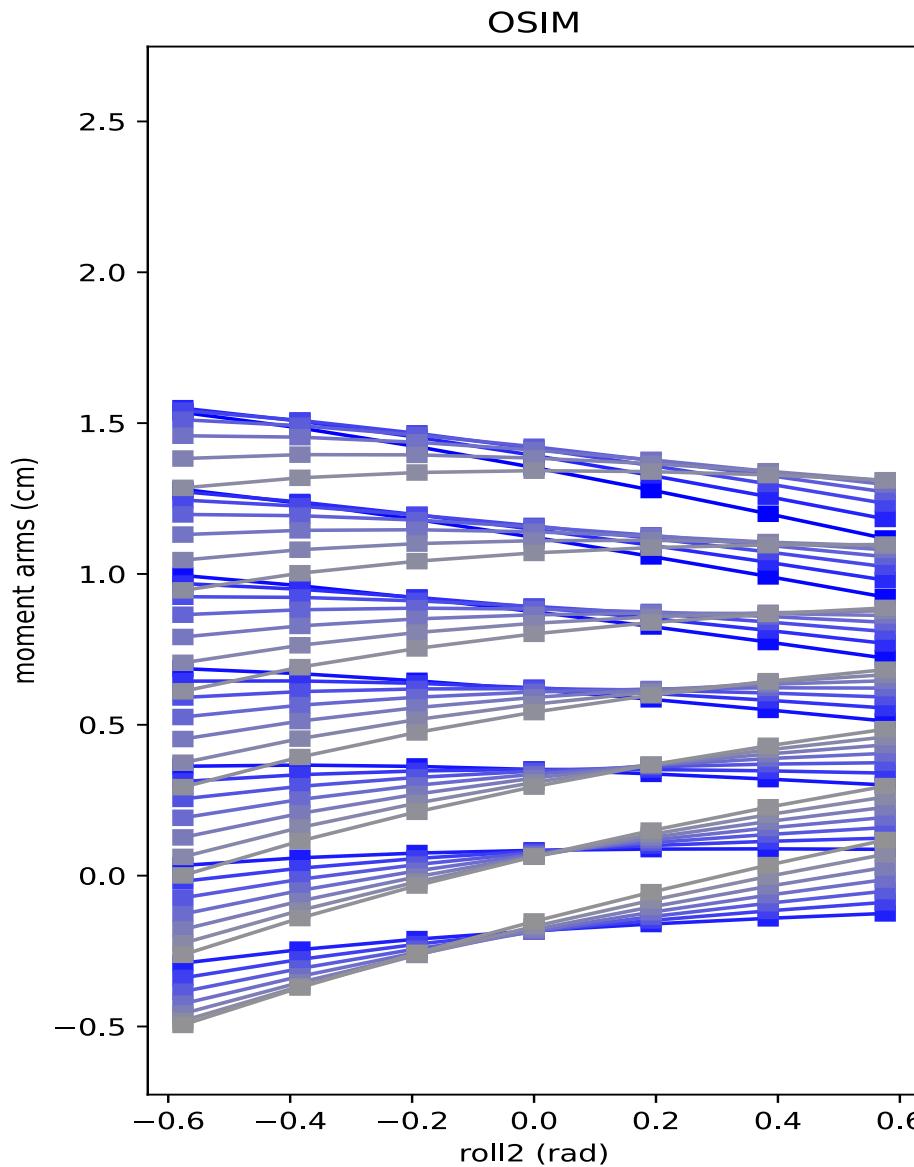
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant_L - pitch1 - roll1 - yaw1



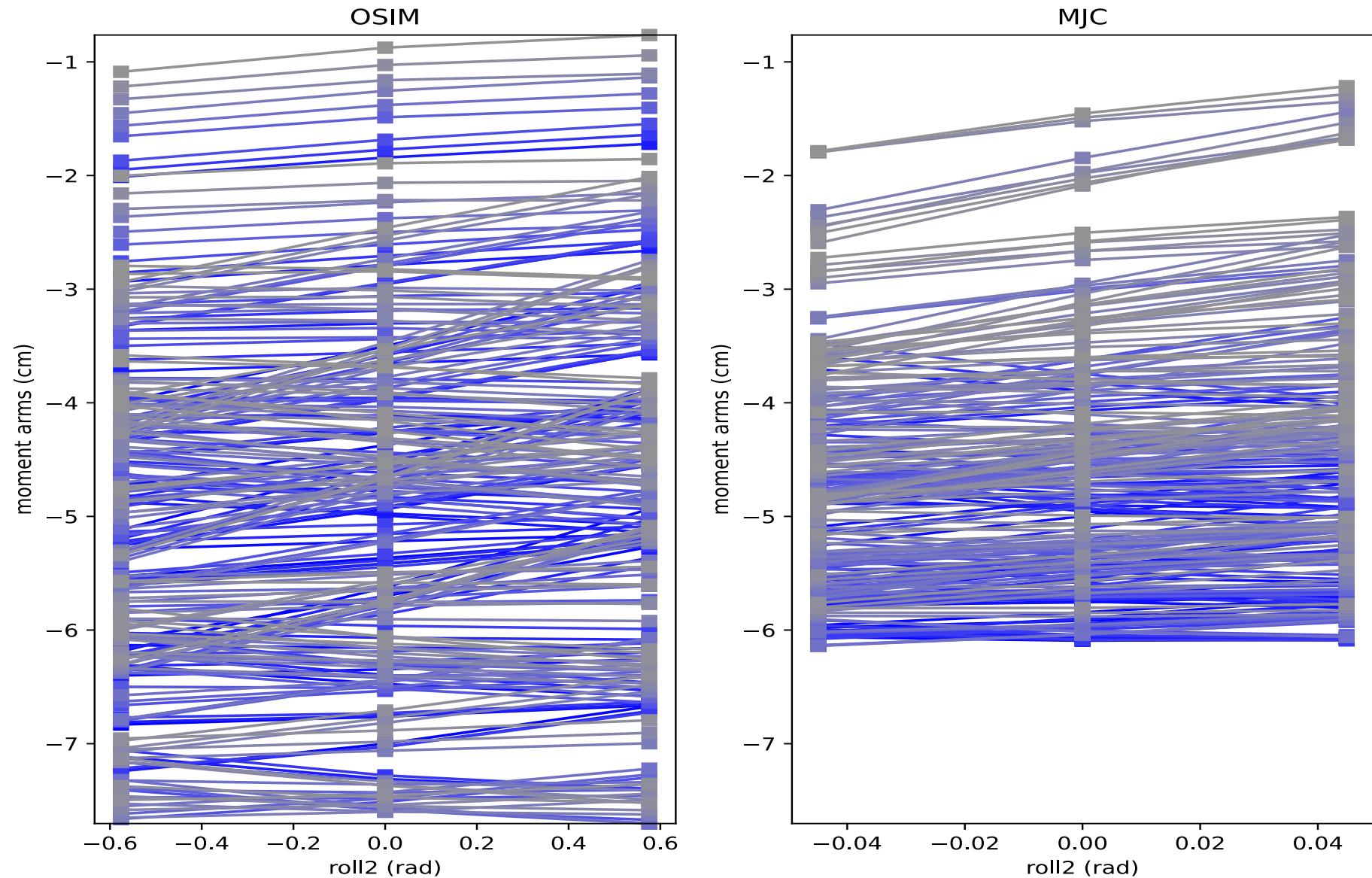
Muscle specific moment arm comparison with Osim model after optimization

Sterno_hyoid - pitch2 - roll2 - yaw2



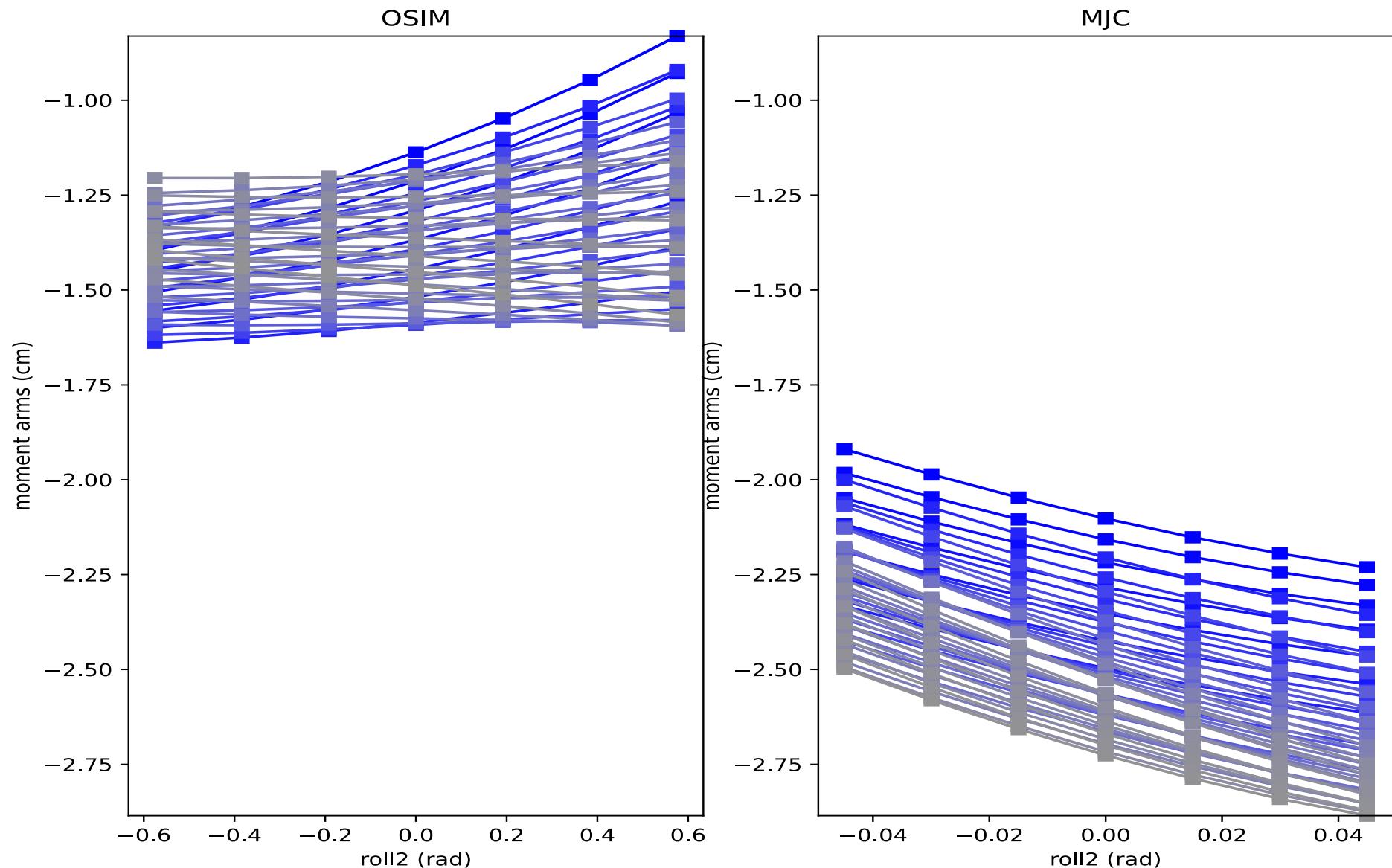
Muscle specific moment arm comparison with Osim model after optimization

cleid_occ_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



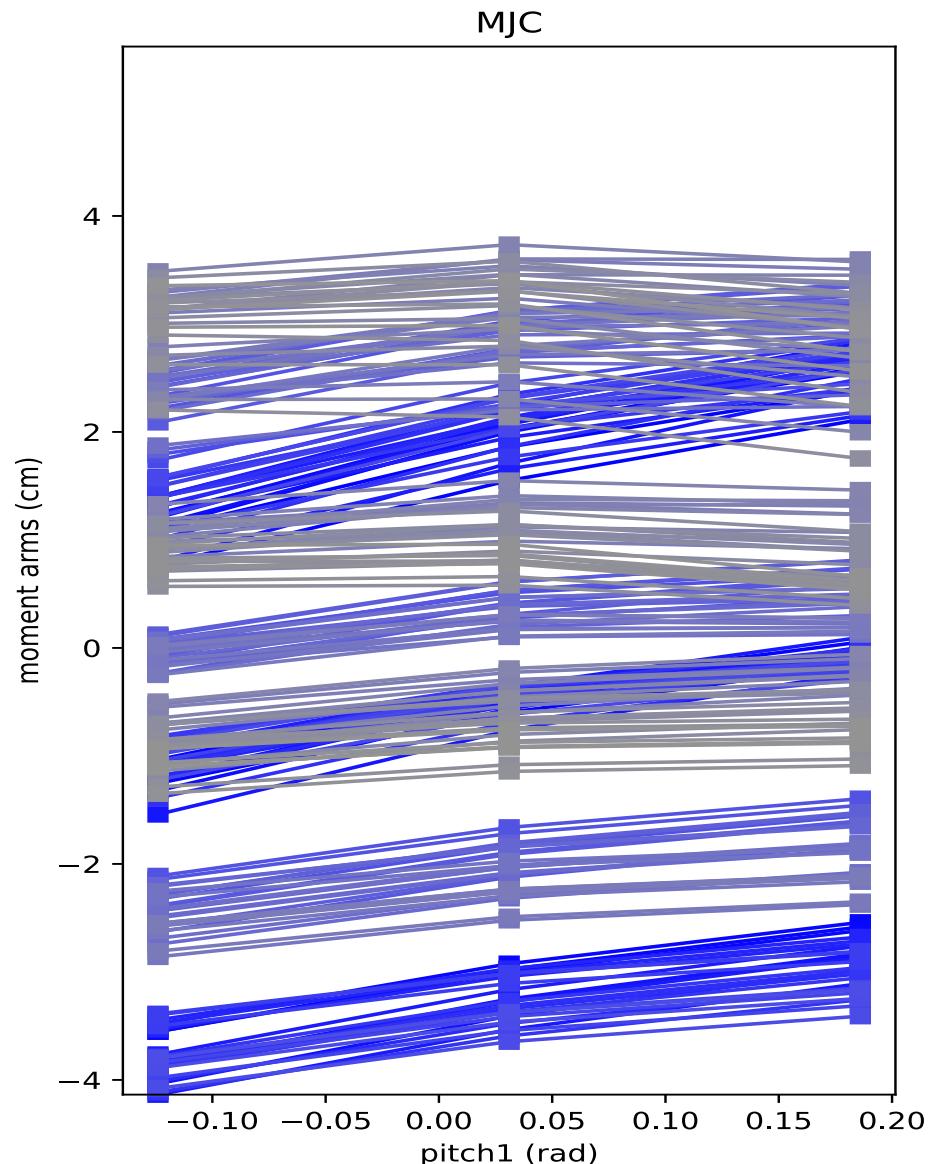
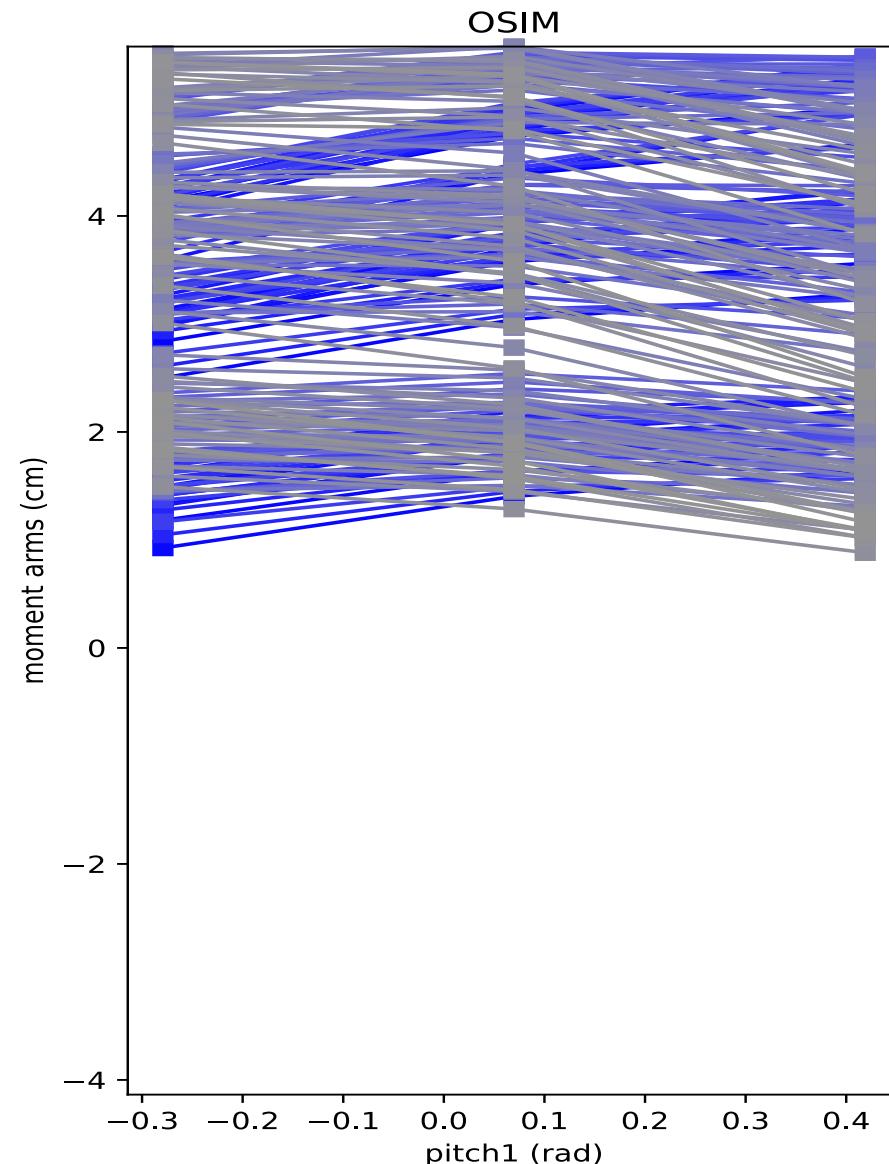
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx_L - pitch2 - roll2 - yaw2



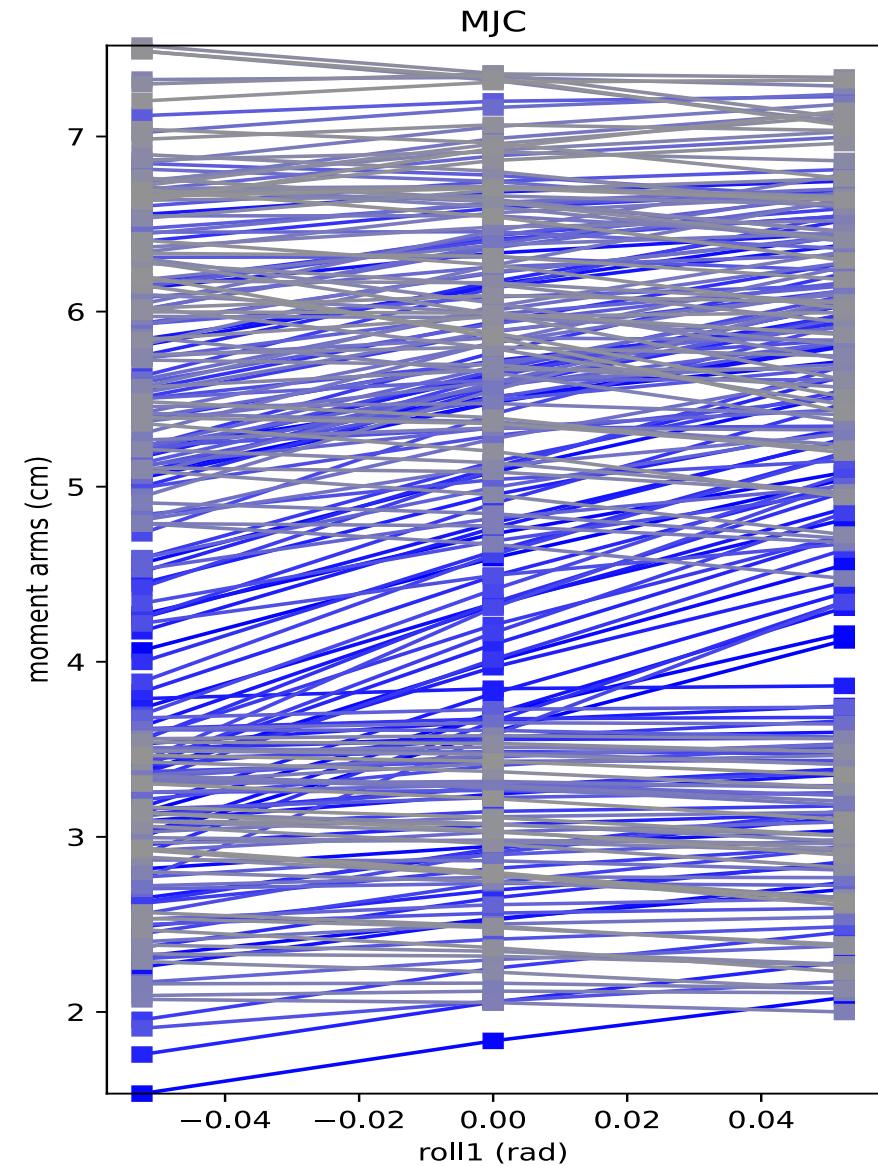
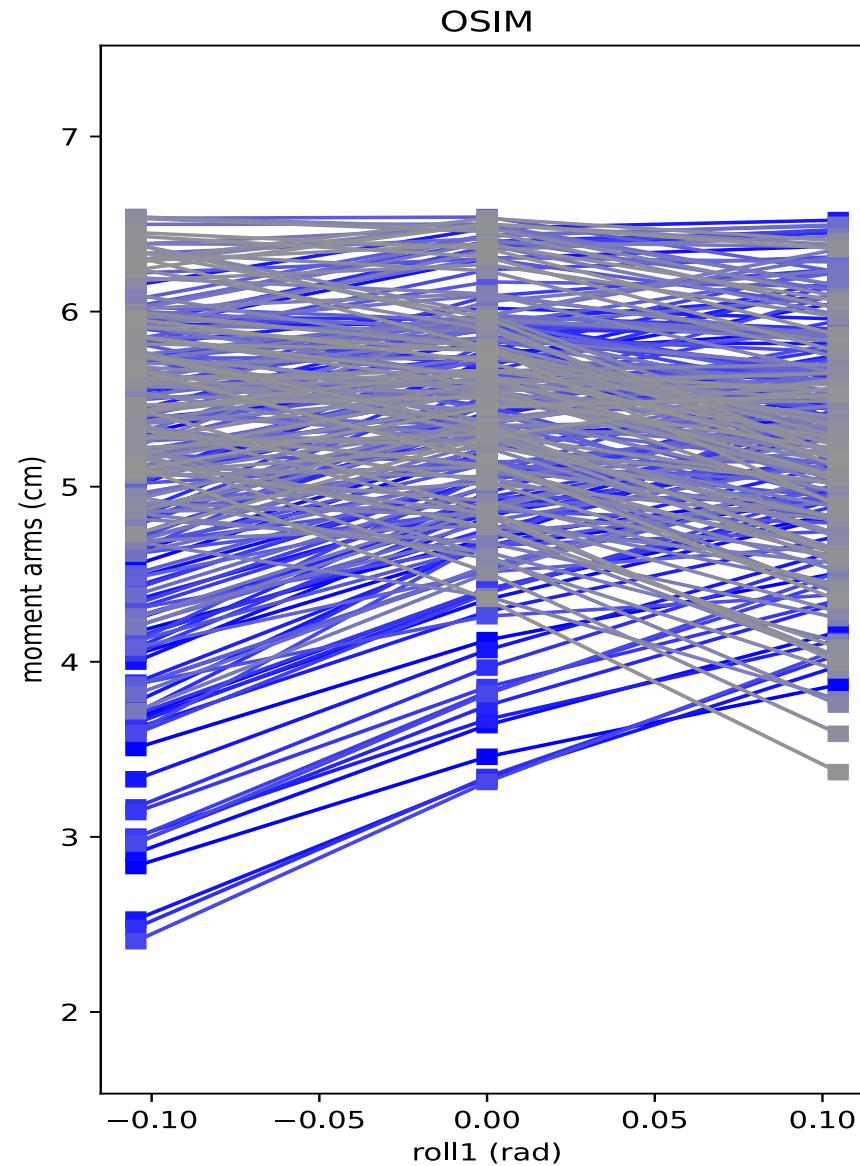
Muscle specific moment arm comparison with Osim model after optimization

splen_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



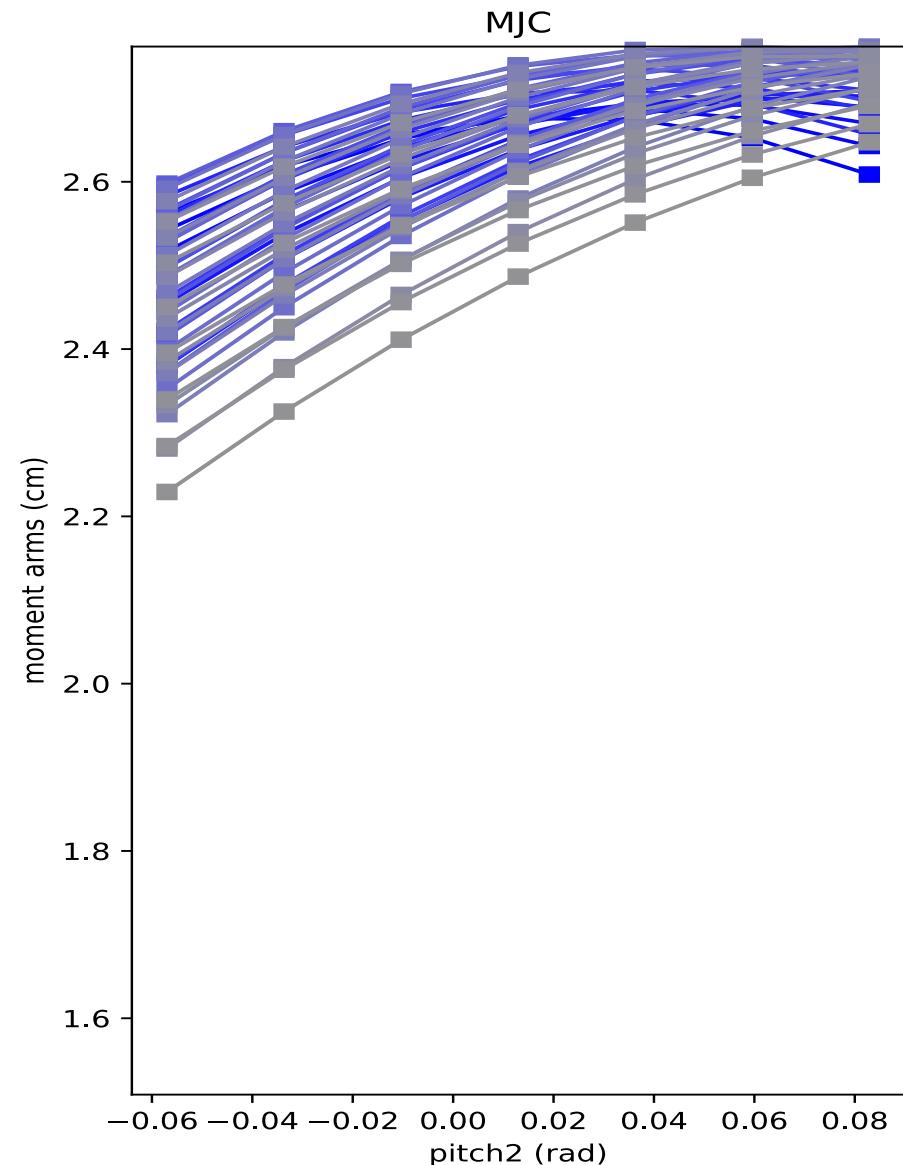
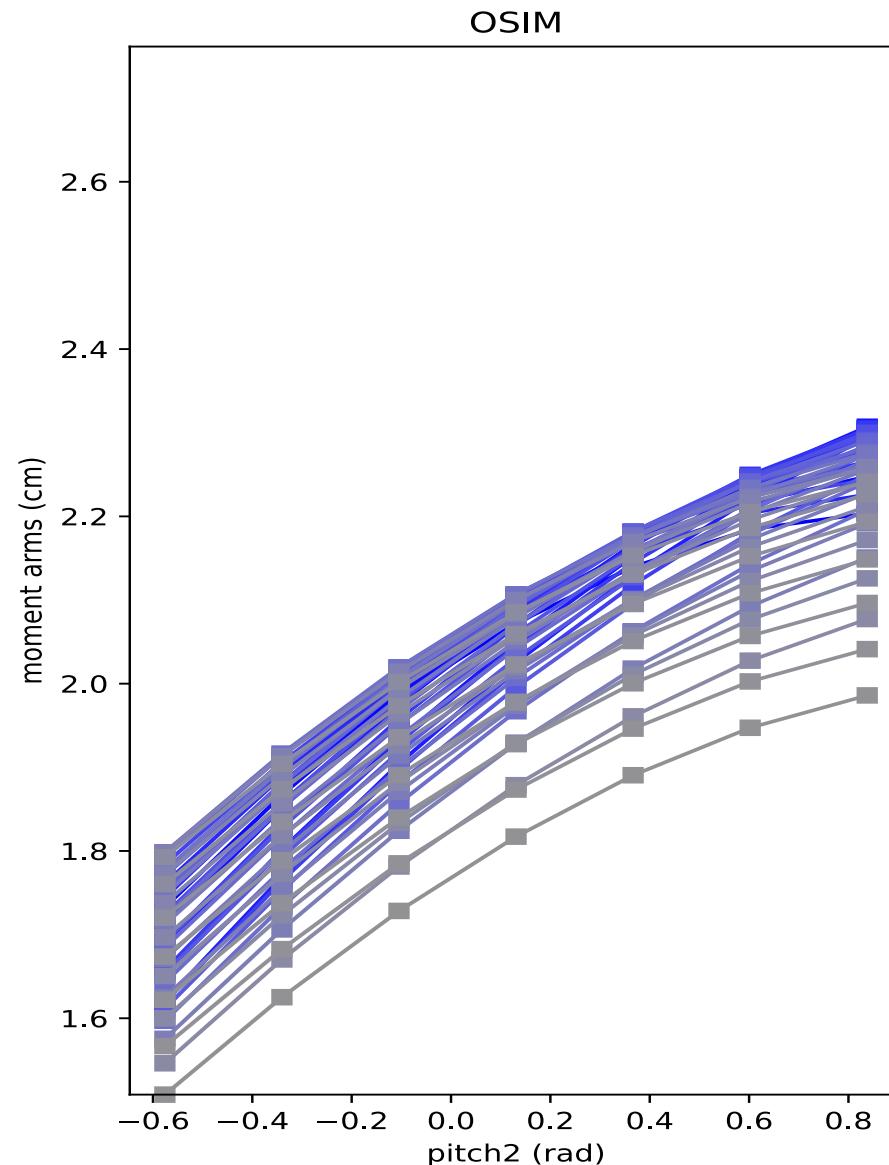
Muscle specific moment arm comparison with Osim model after optimization

cleid_mast - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



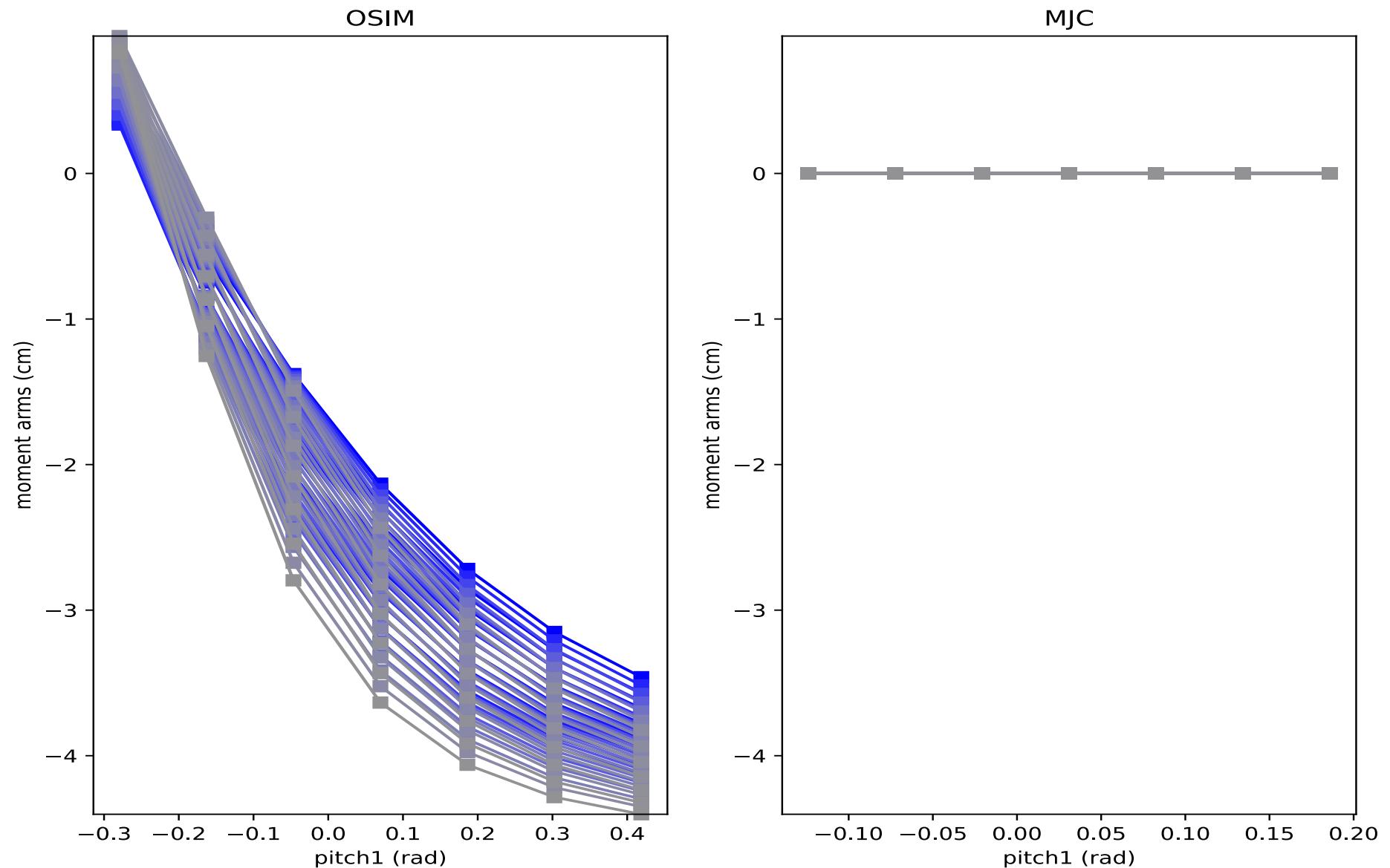
Muscle specific moment arm comparison with Osim model after optimization

longissi_cerv_c4thx - pitch2 - roll2 - yaw2



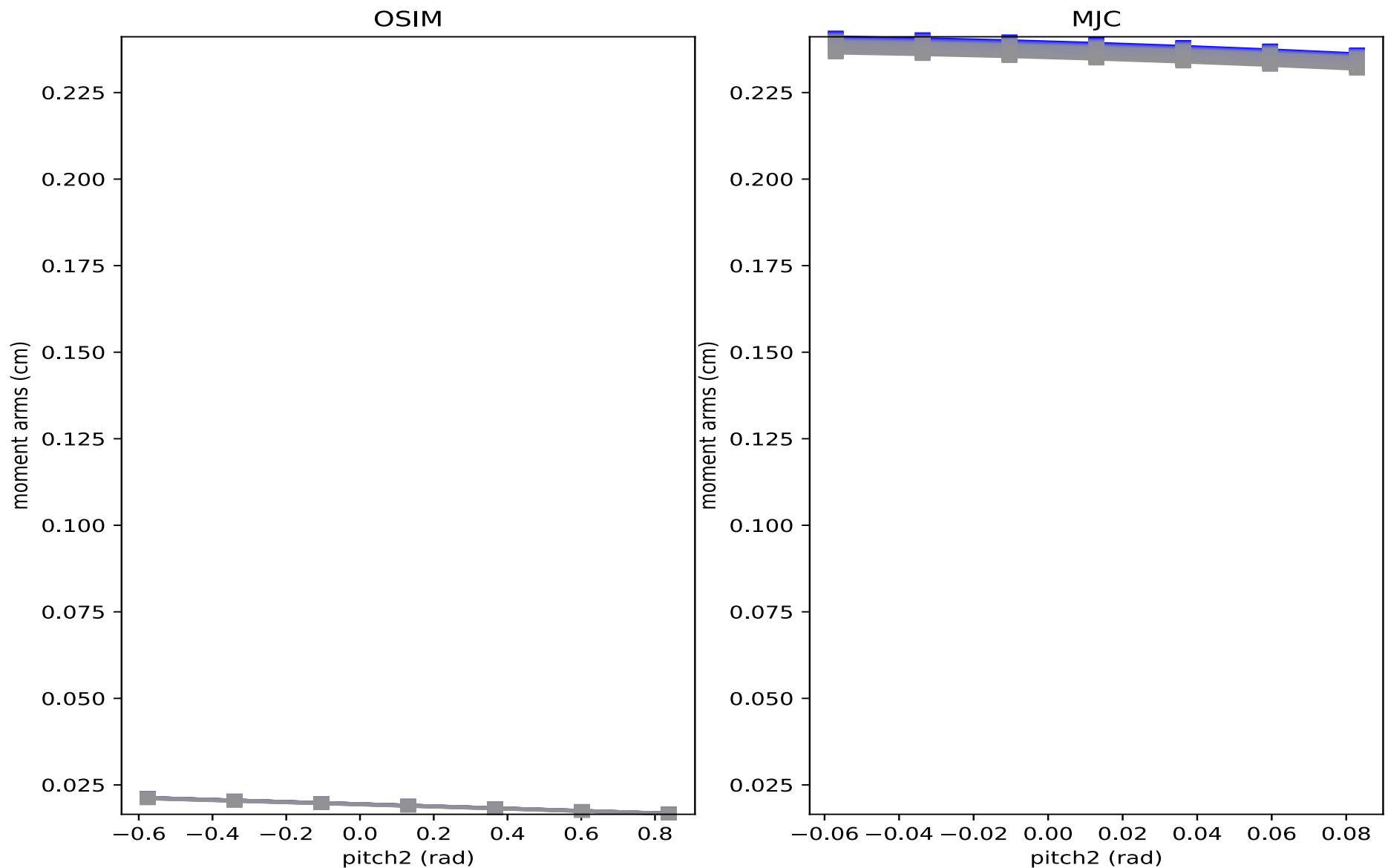
Muscle specific moment arm comparison with Osim model after optimization

Mylohyoid_Ant - pitch1 - roll1 - yaw1



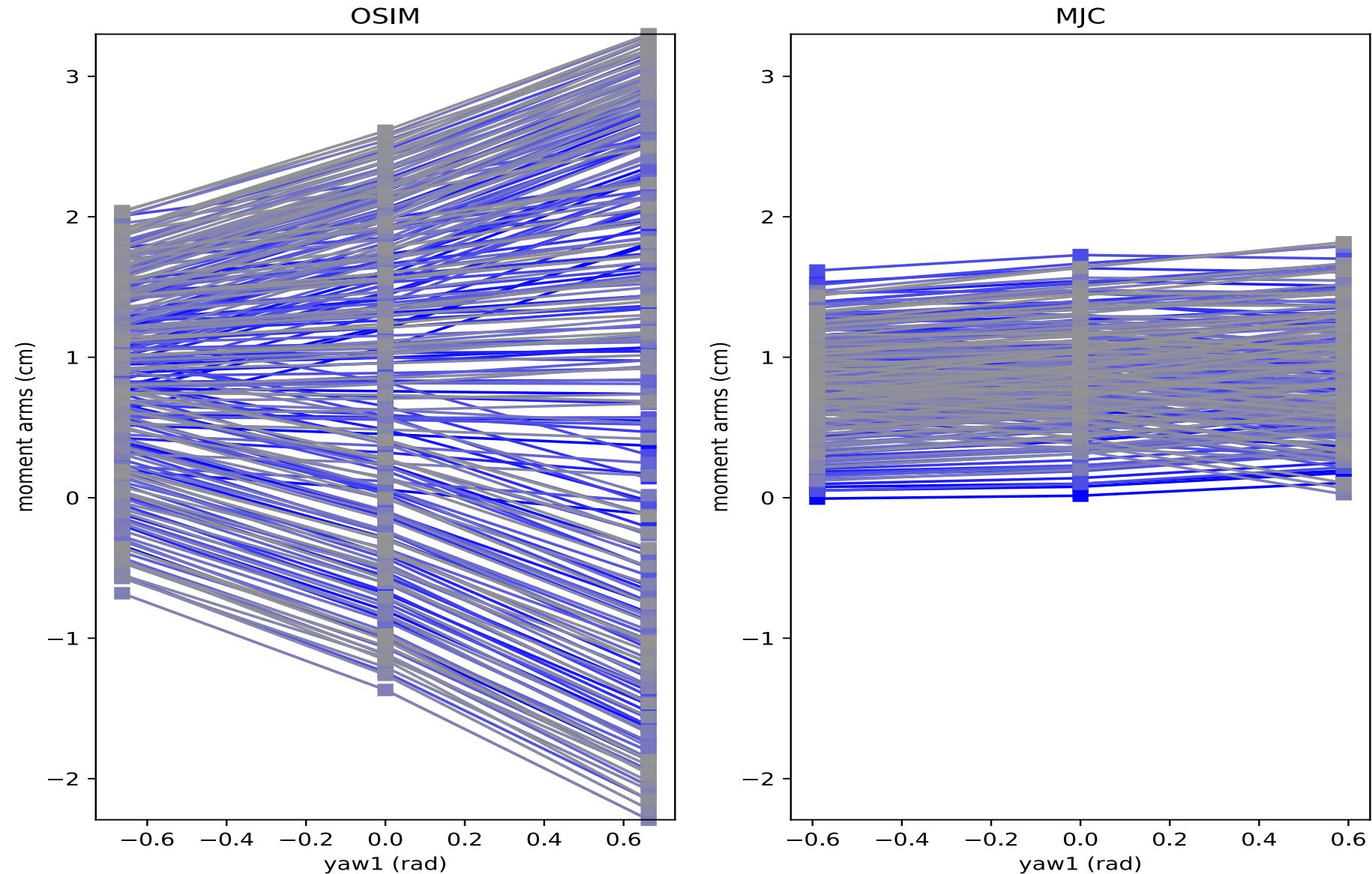
Muscle specific moment arm comparison with Osim model after optimization

trap_acr_L - pitch2 - roll2 - yaw2



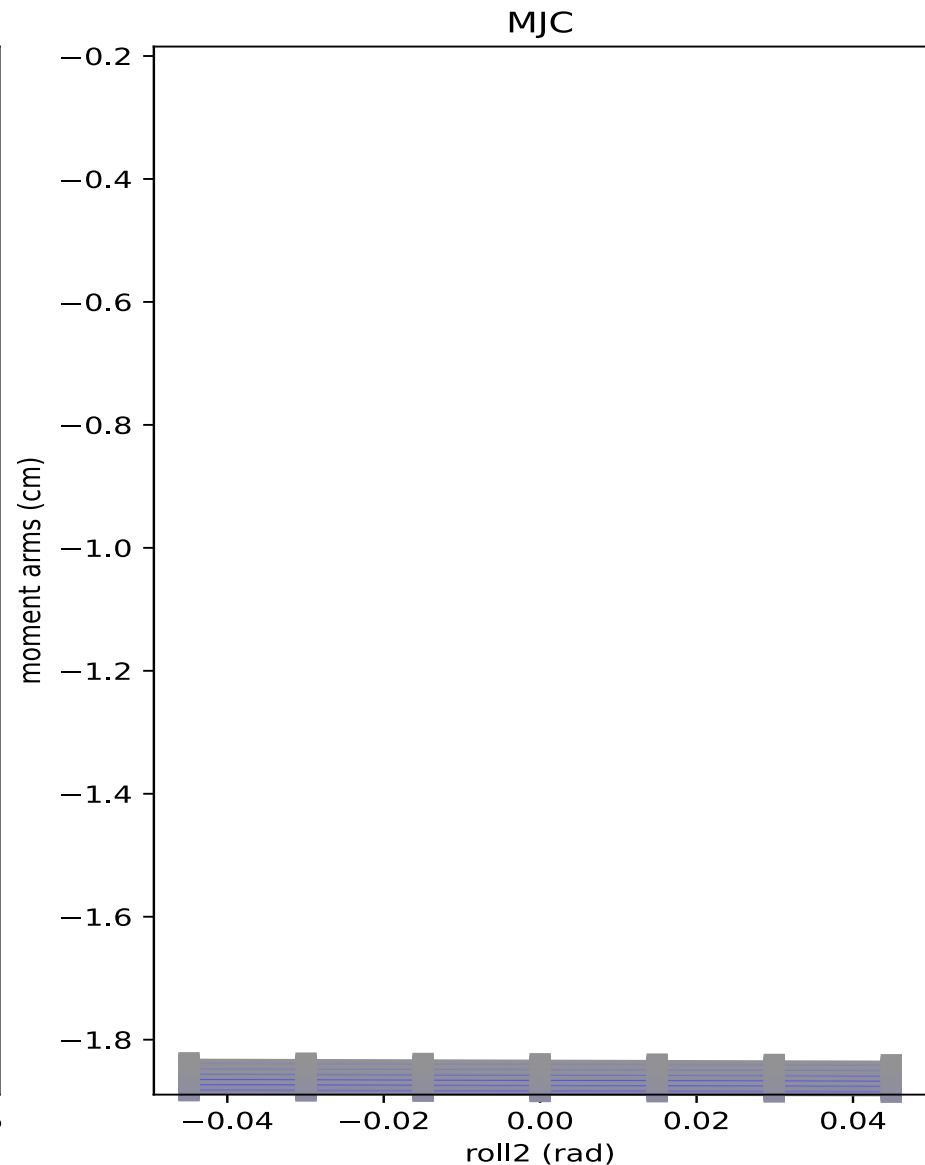
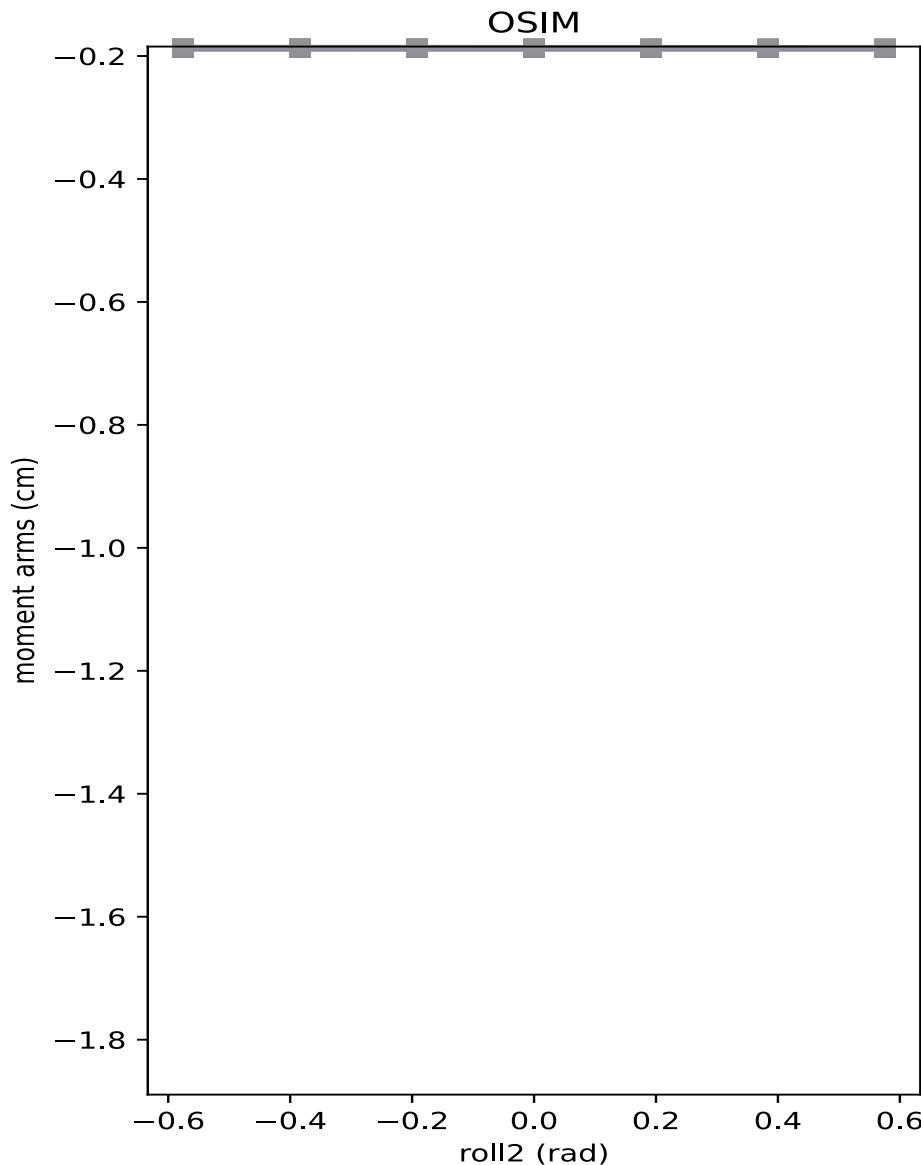
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



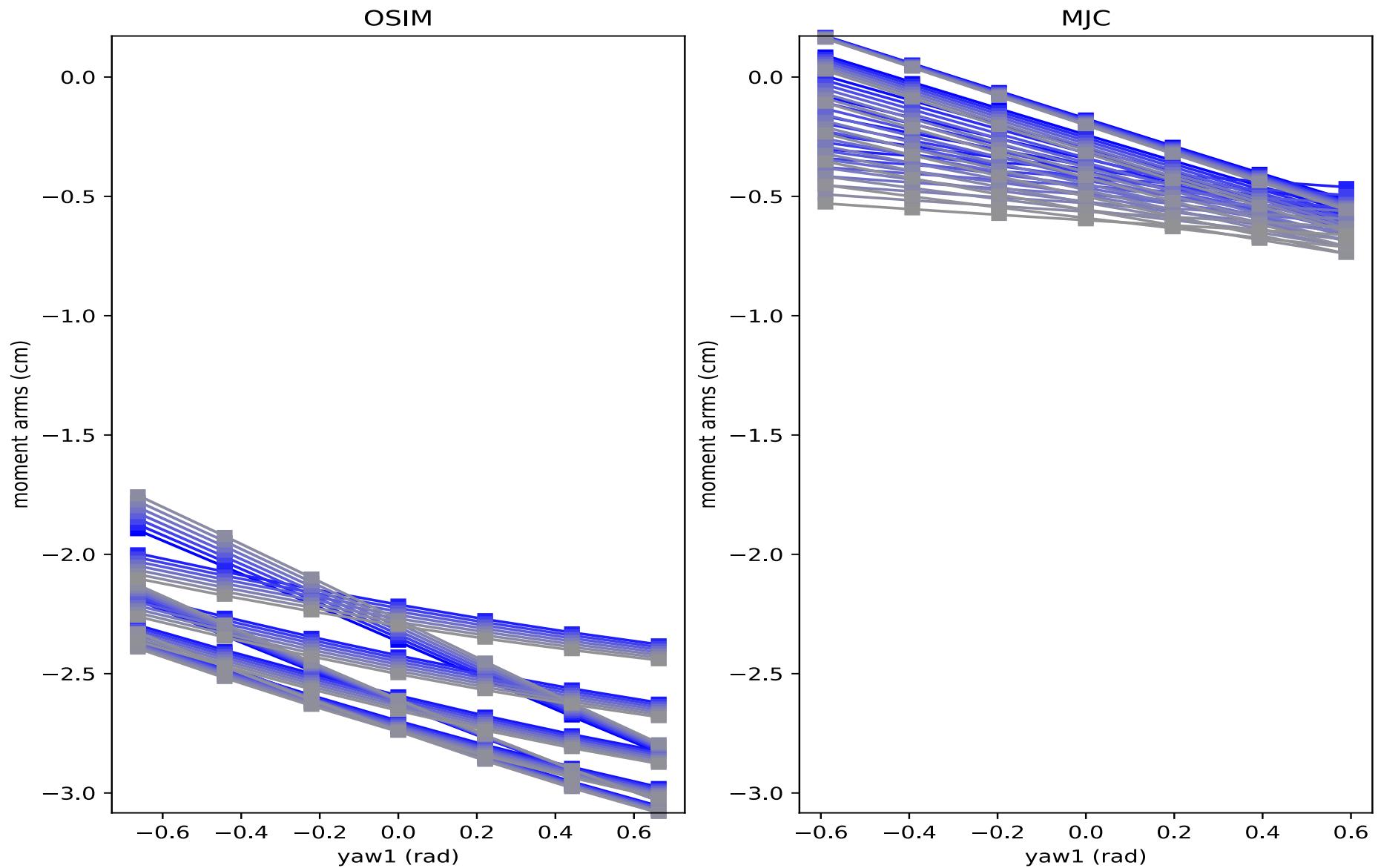
Muscle specific moment arm comparison with Osim model after optimization

trap_acr_L - pitch2 - roll2 - yaw2



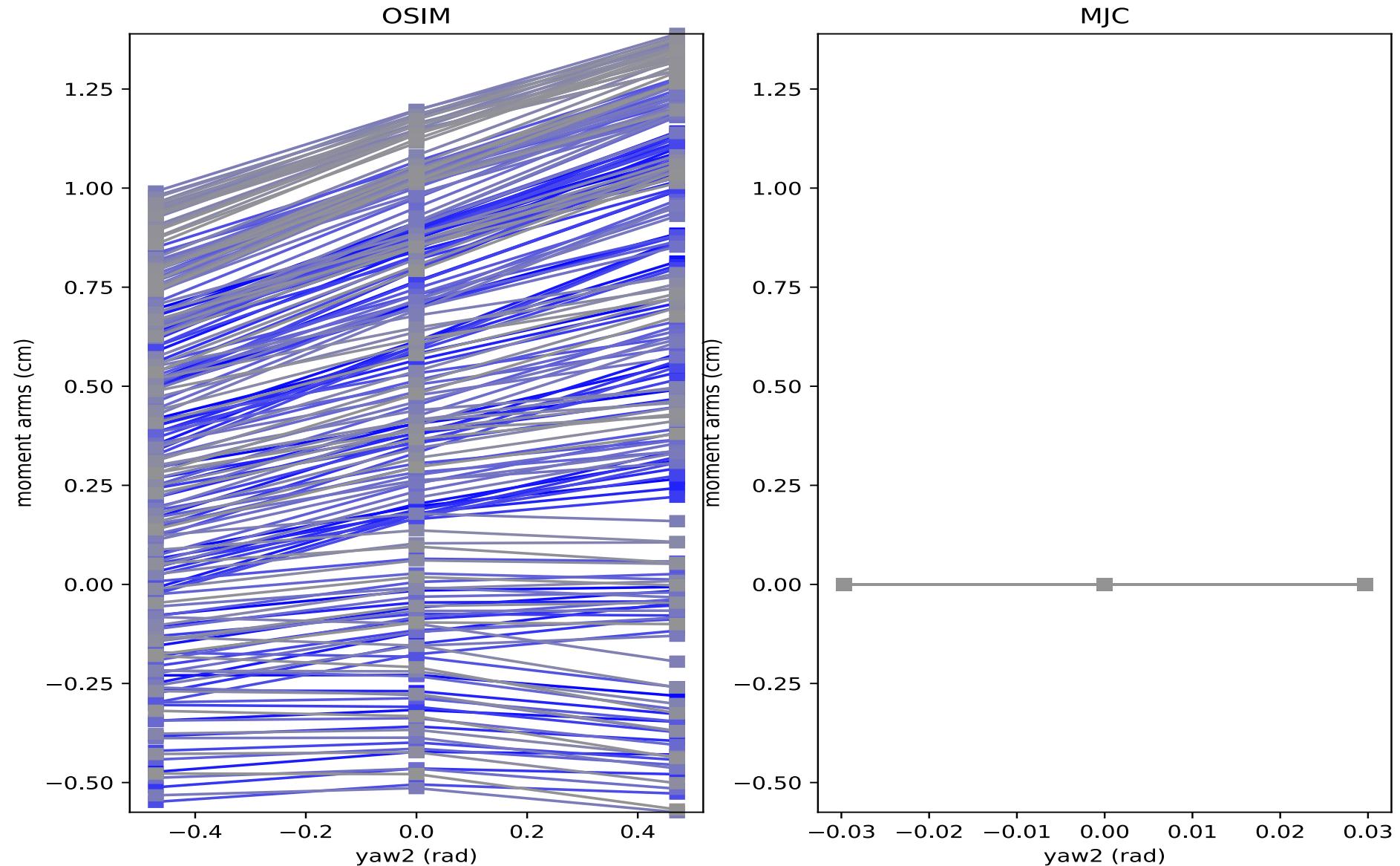
Muscle specific moment arm comparison with Osim model after optimization

obl_cap_inf - pitch1 - roll1 - yaw1



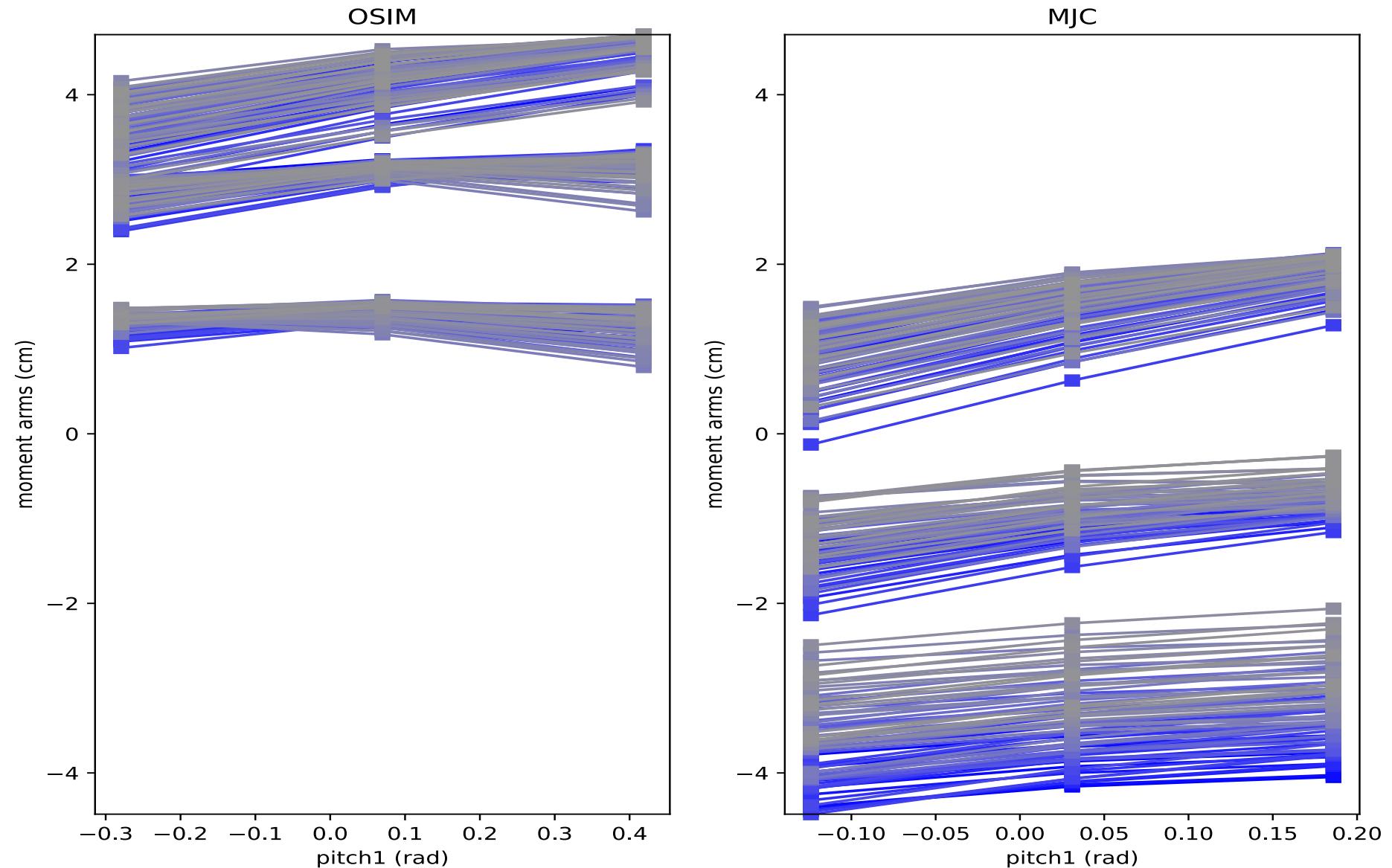
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklc5 - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



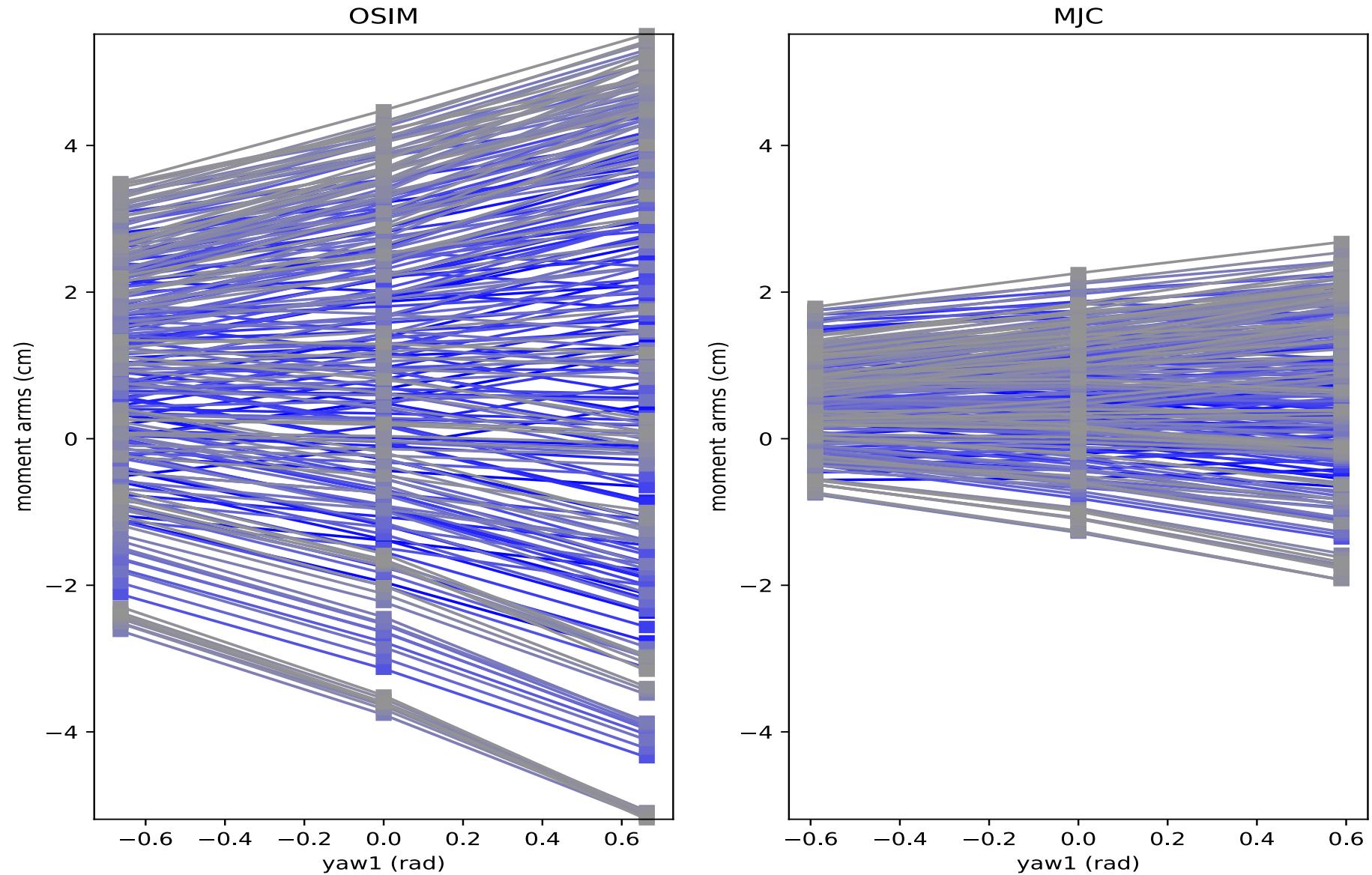
Muscle specific moment arm comparison with Osim model after optimization

longissi_cap_sklc6_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



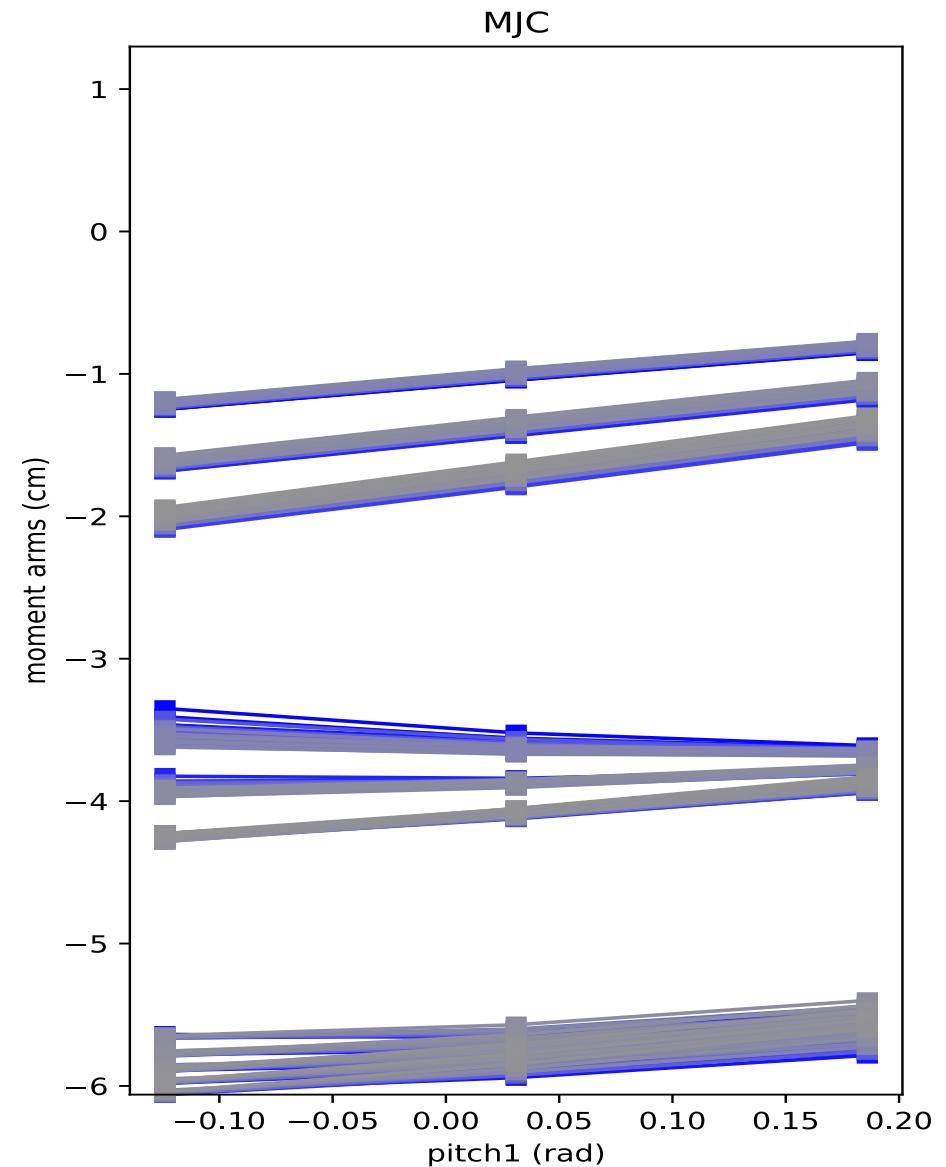
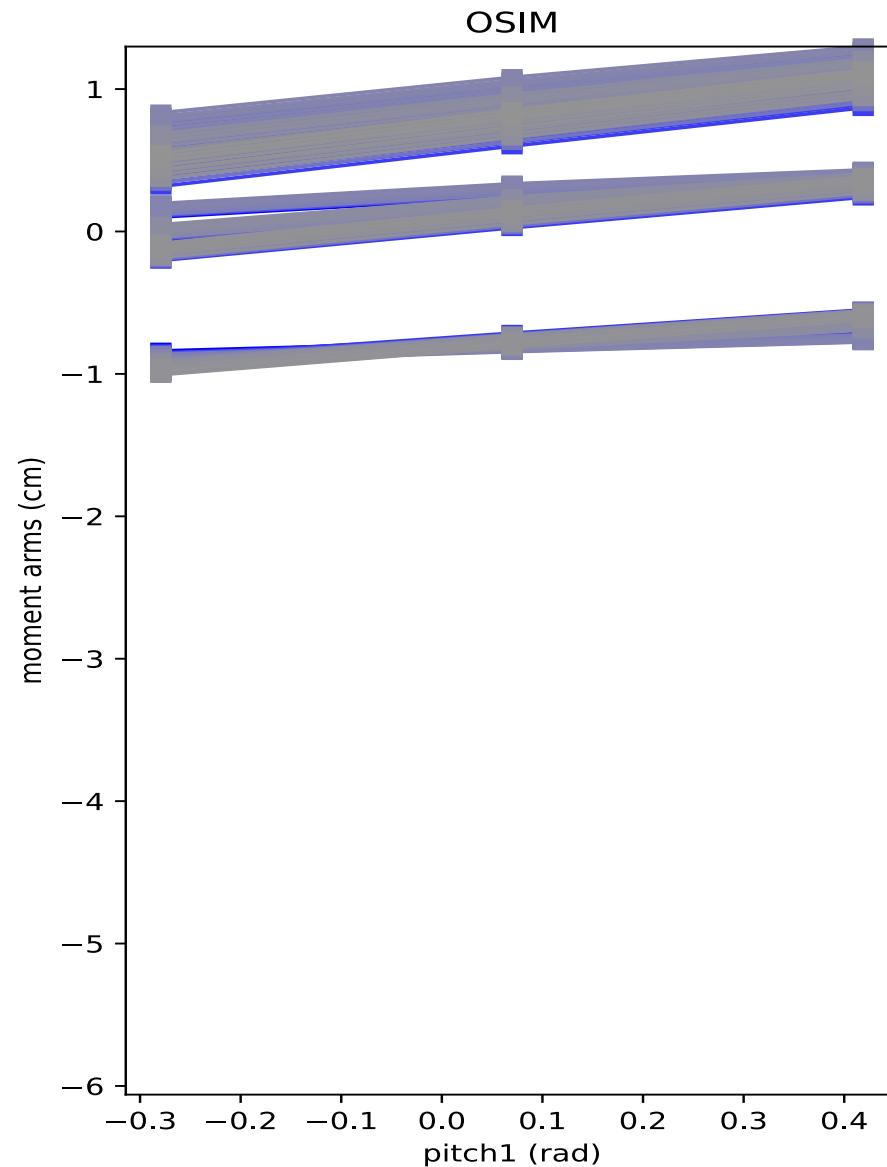
Muscle specific moment arm comparison with Osim model after optimization

semi_cap_sklthx - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



Muscle specific moment arm comparison with Osim model after optimization

digastric_post_L - pitch1 - pitch2 - roll1 - roll2 - yaw1 - yaw2



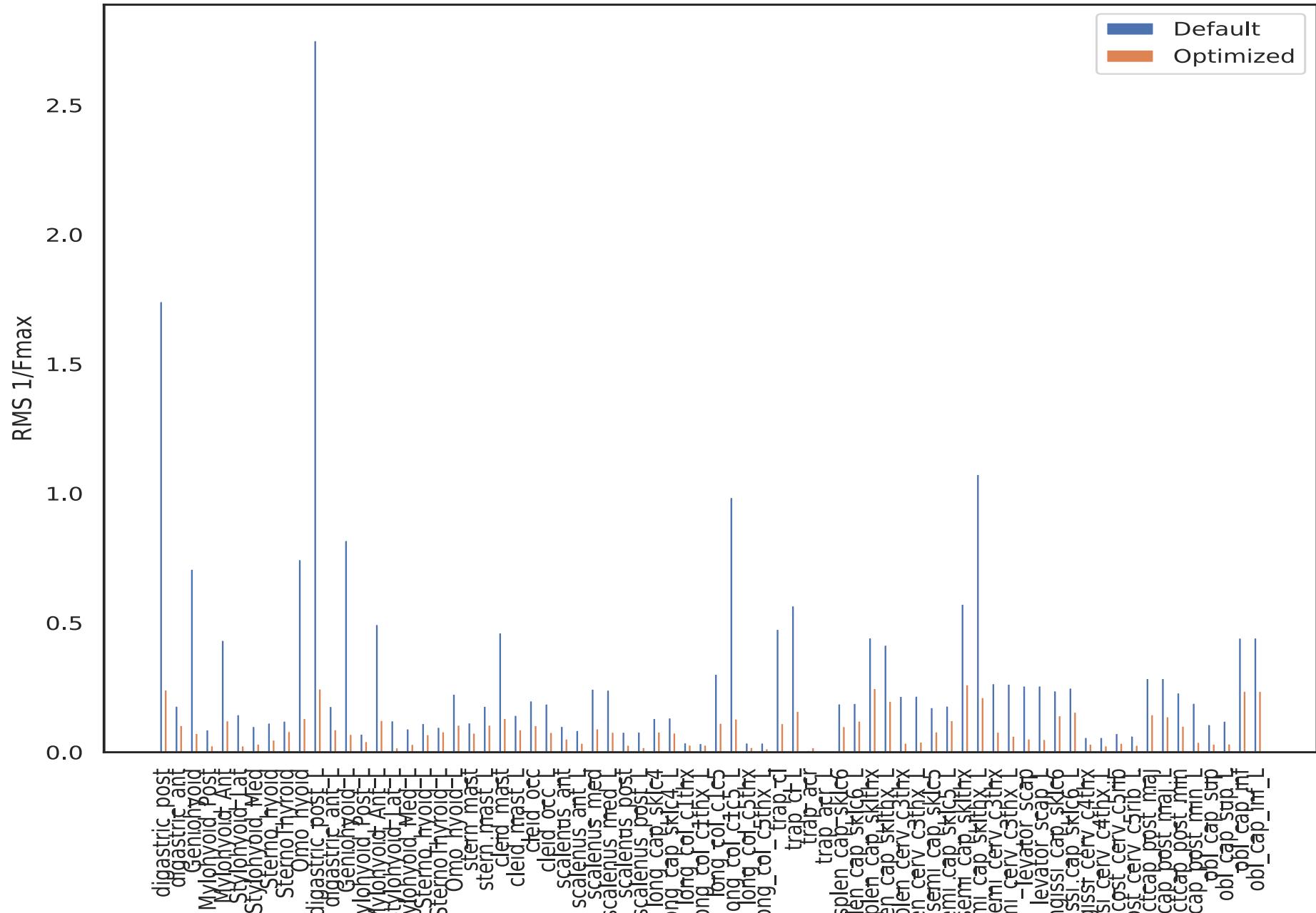
Step 3: Muscle Kinetic Validation

Muscle force-length property are compared between Osim and Mjc models. This force-length property only depends on muscle-fiber-tendon unit lengths. We made it isolated with the moment arm, so that the change in moment arms will not affect the muscle force properties. The muscle-fiber-tendon unit lengths were roughly even extracted (from shorest to longest) with all possible body postures. A bar plot of the froce errors of all muscle before and after optimization is included. Then the detail force-length curve comparsion plot of each muscle is included.

How to interpret the plot:

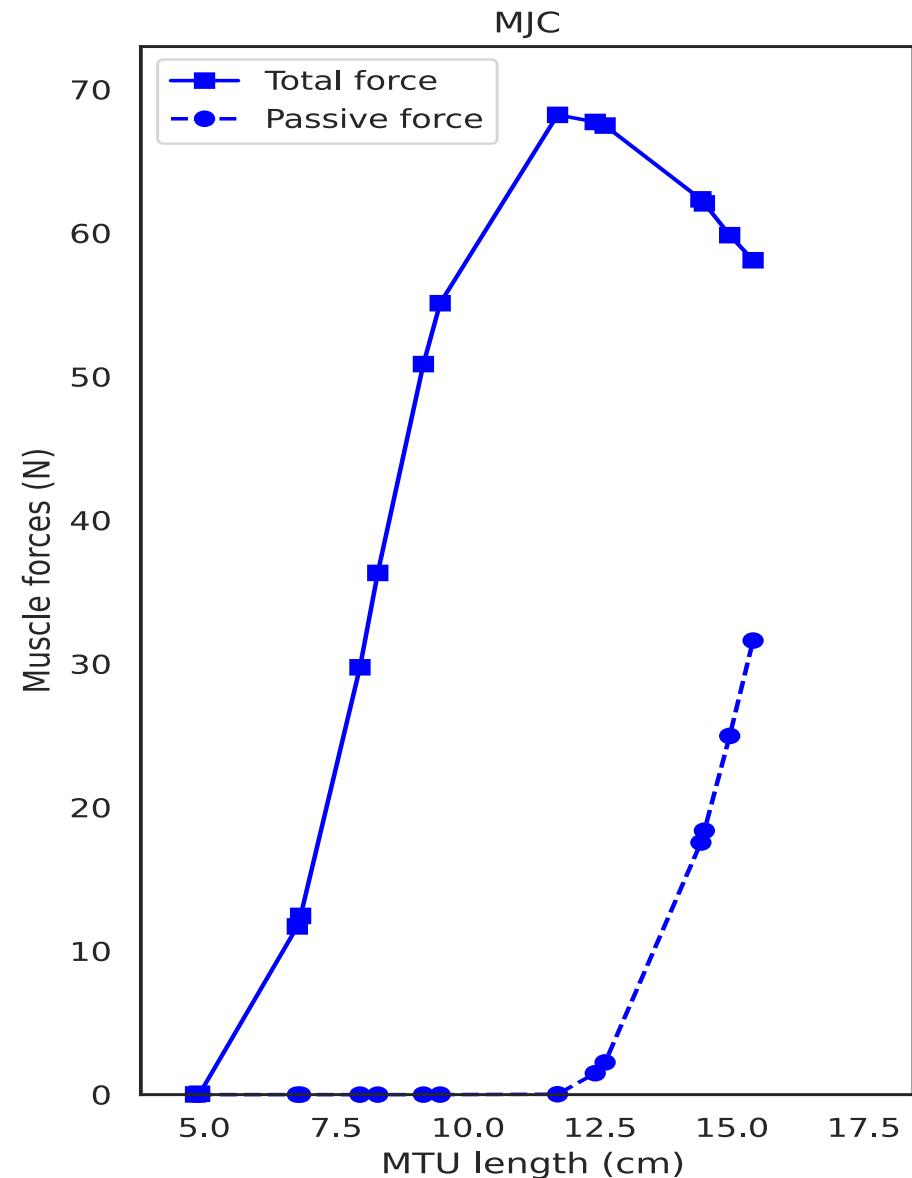
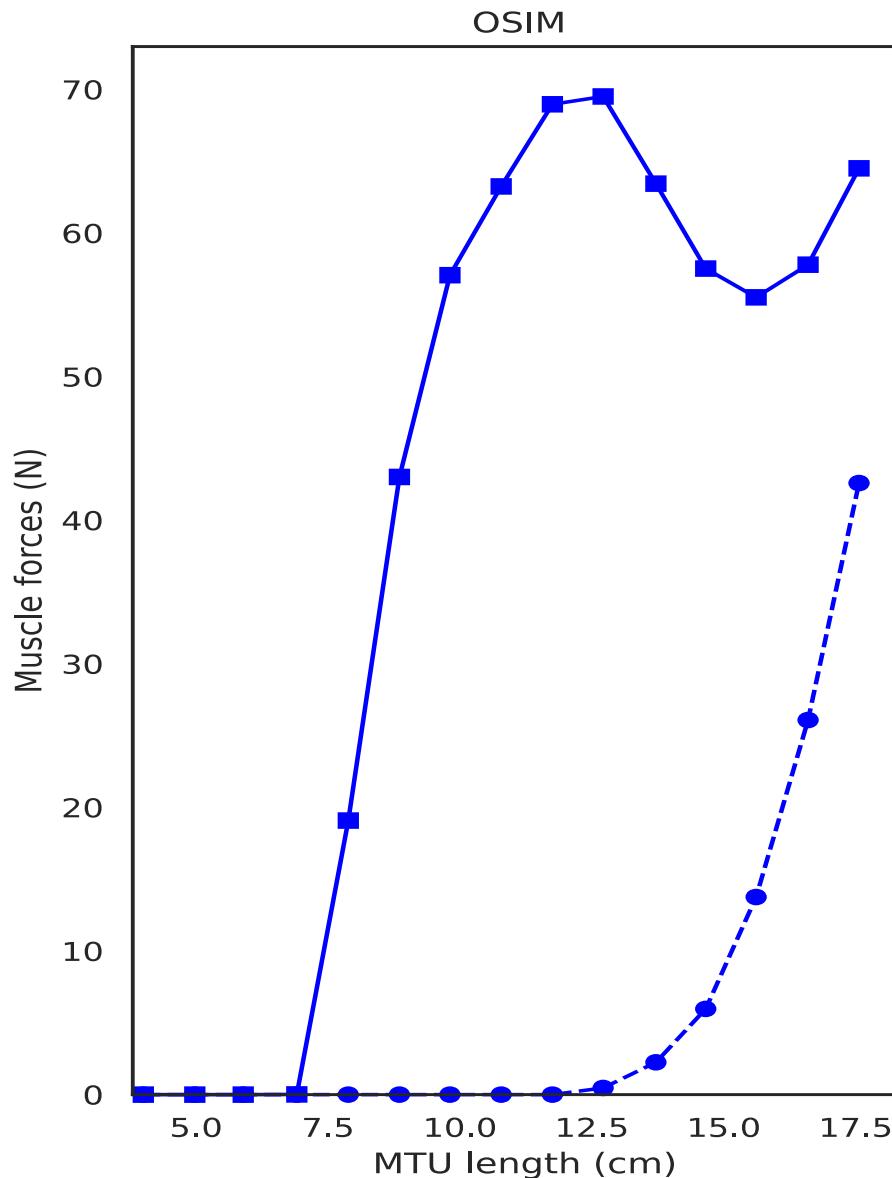
Global title indicate the muscle name. X axis indicate the muscle-fiber-tendon unit length. Y axis is the muscle force (unnormalized)

Overall comparison of muscle force-length relationship before/after optimization



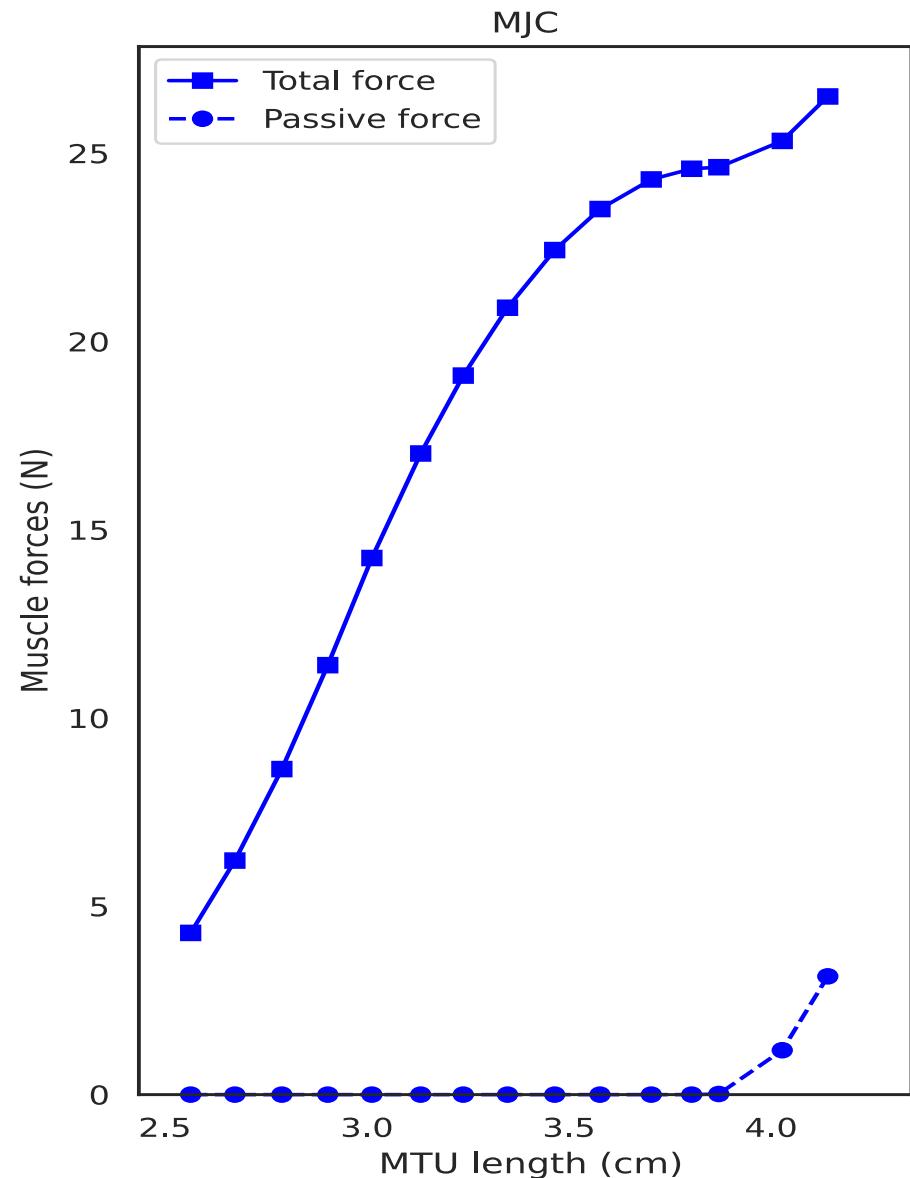
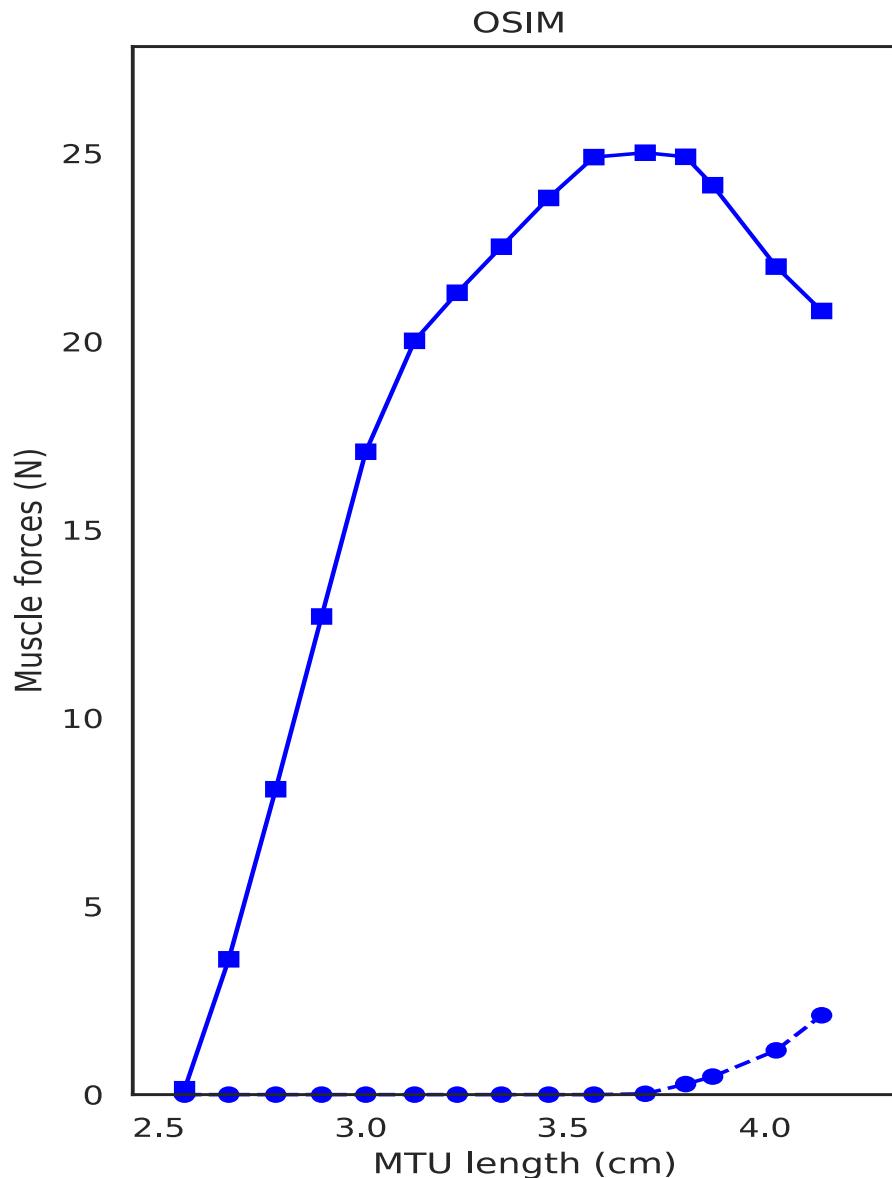
Muscle specific force comparison before/after optimization

splen_cap_sklc6



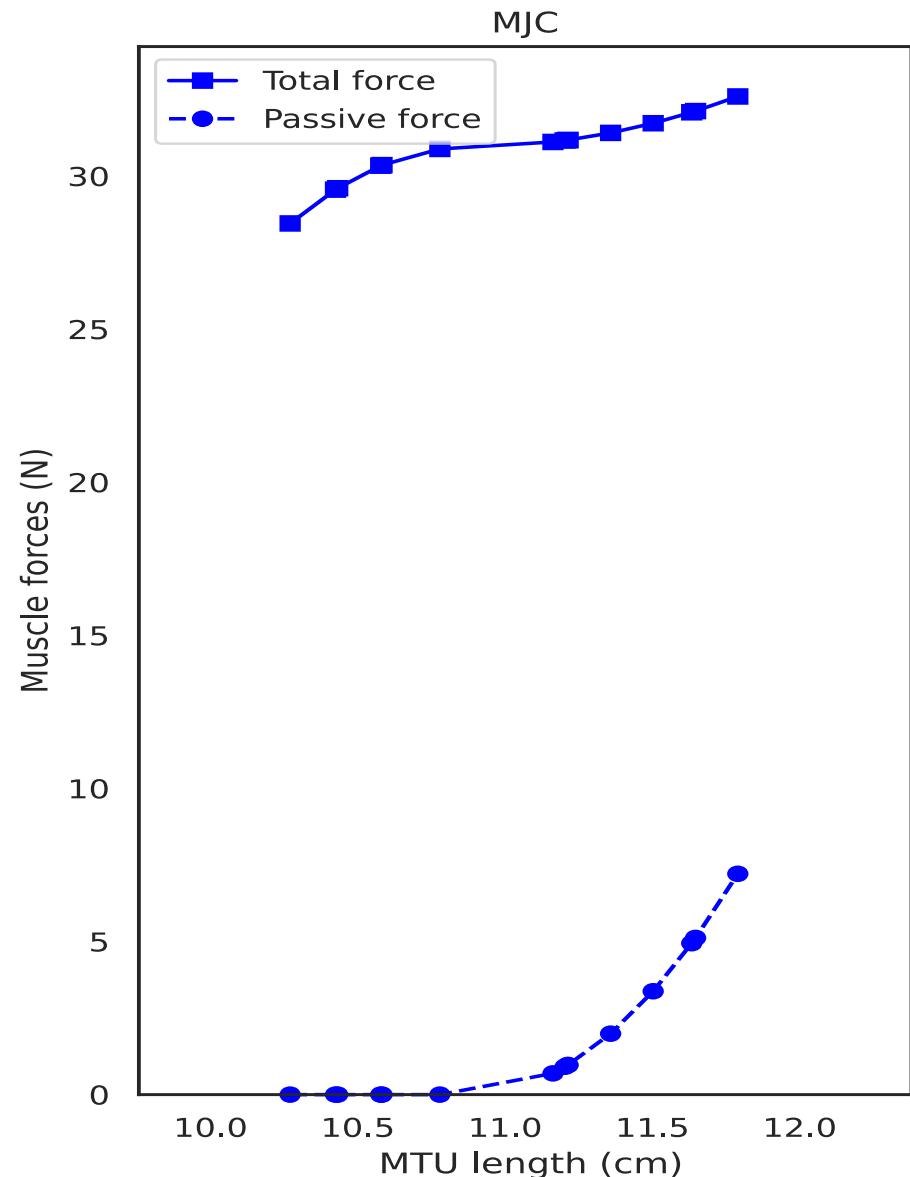
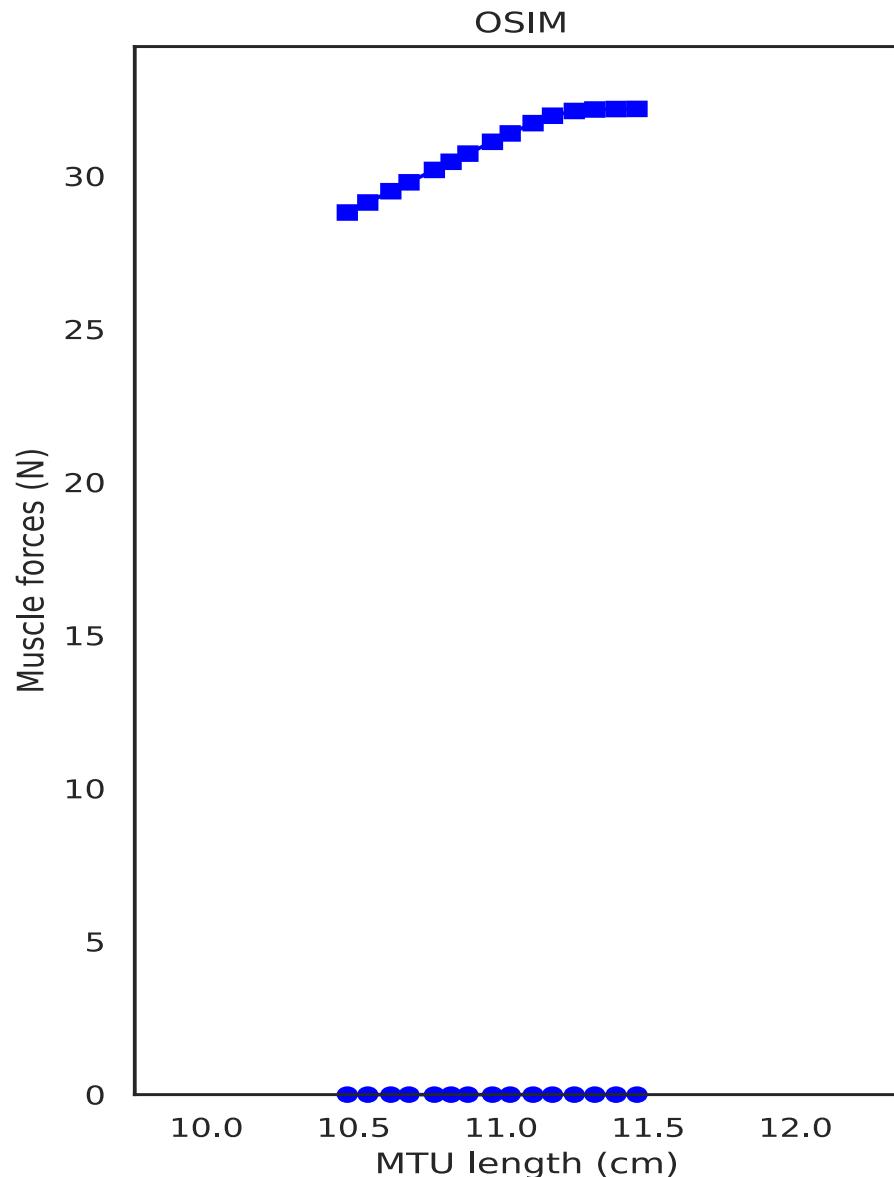
Muscle specific force comparison before/after optimization

rectcap_post_min



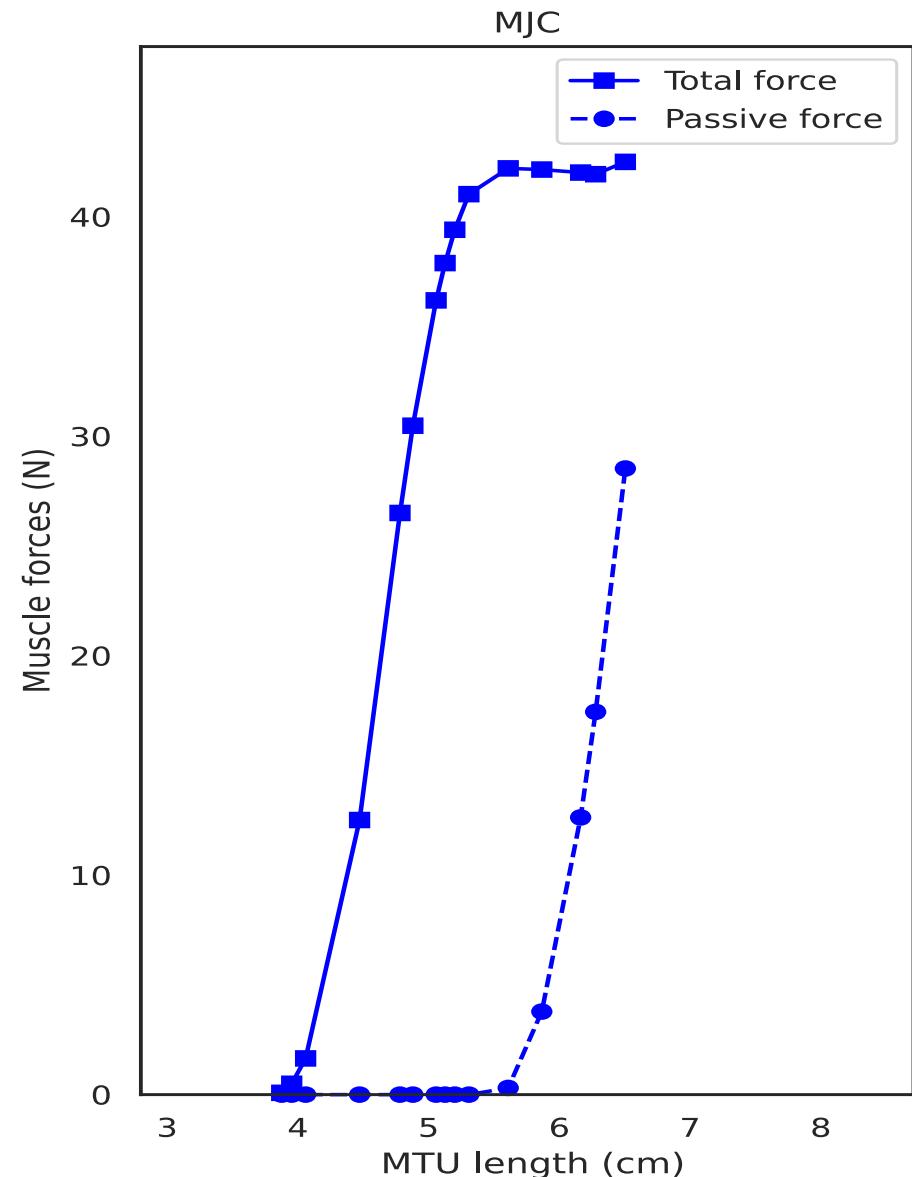
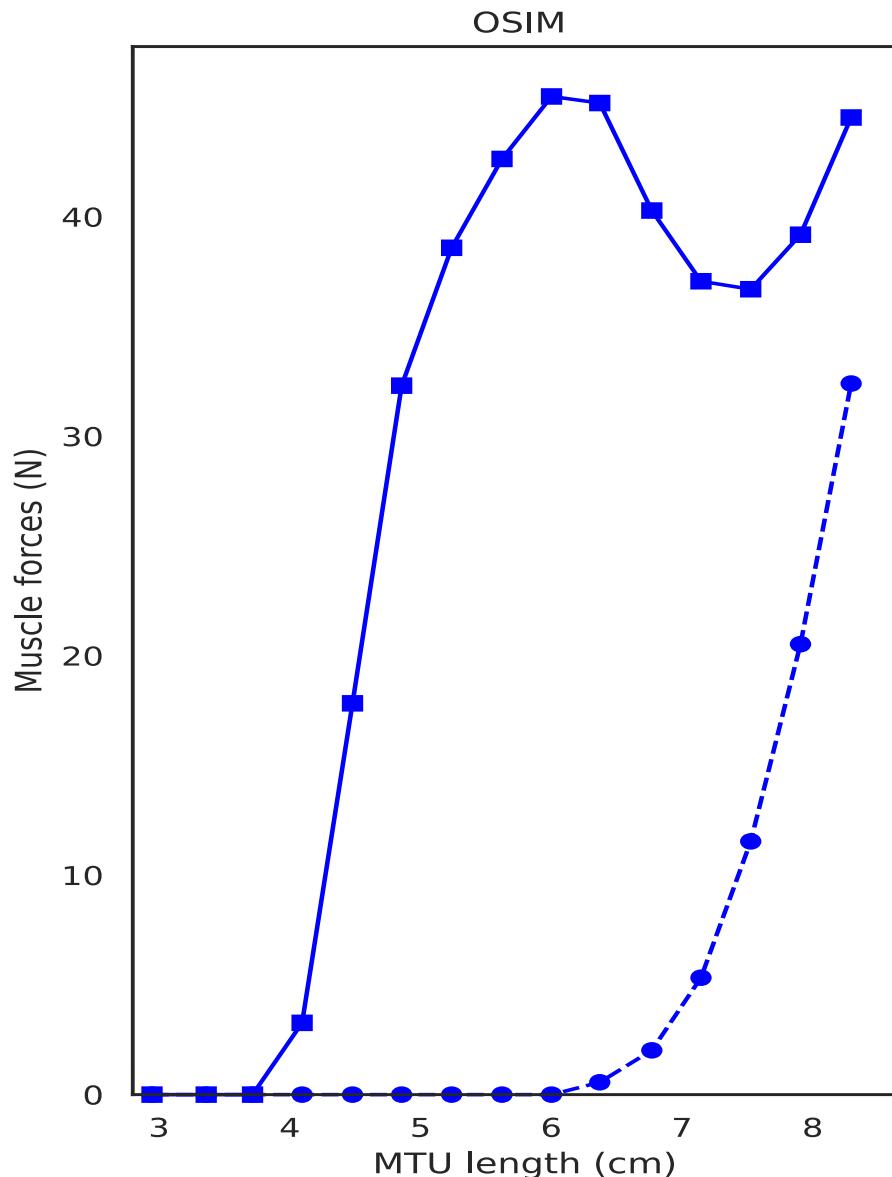
Muscle specific force comparison before/after optimization

long_col_c5thx_L

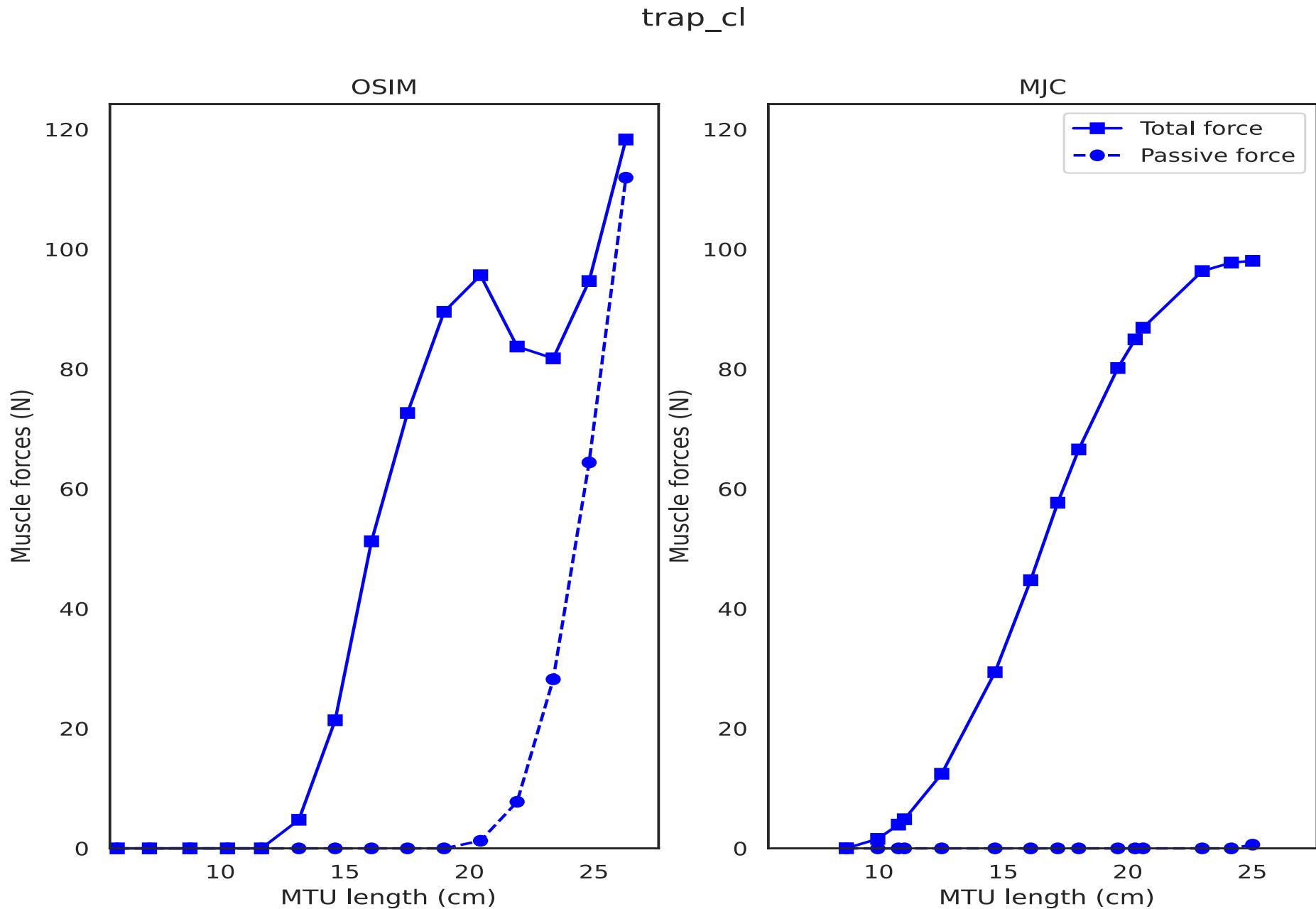


Muscle specific force comparison before/after optimization

rectcap_post_maj_L

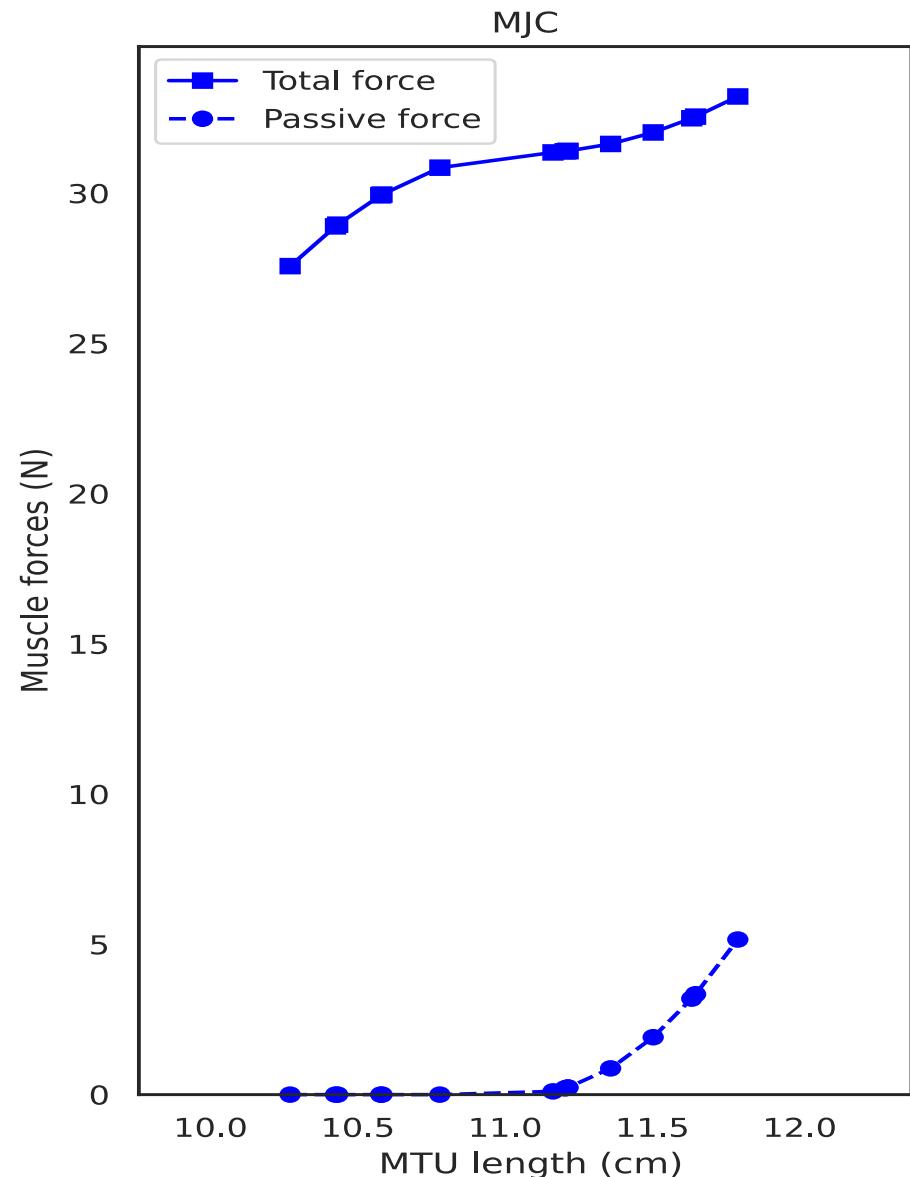
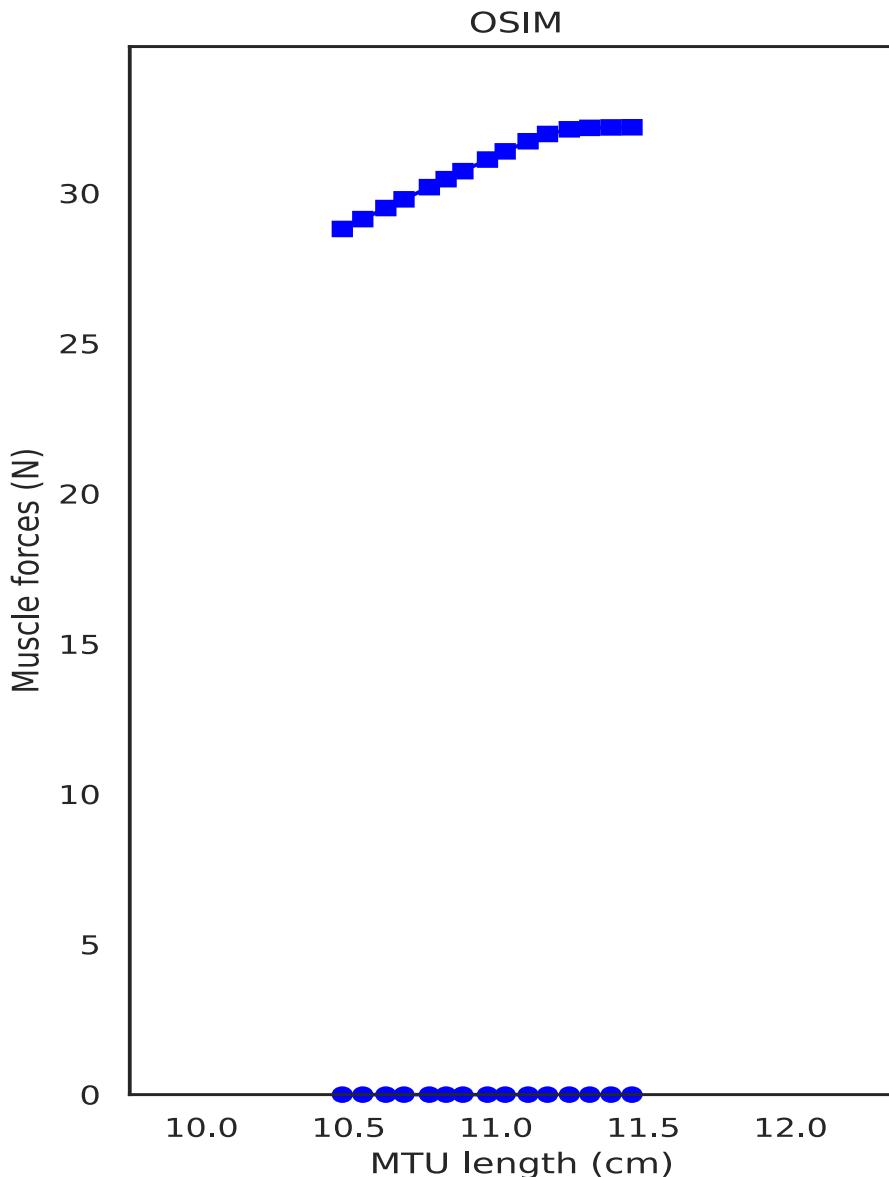


Muscle specific force comparison before/after optimization

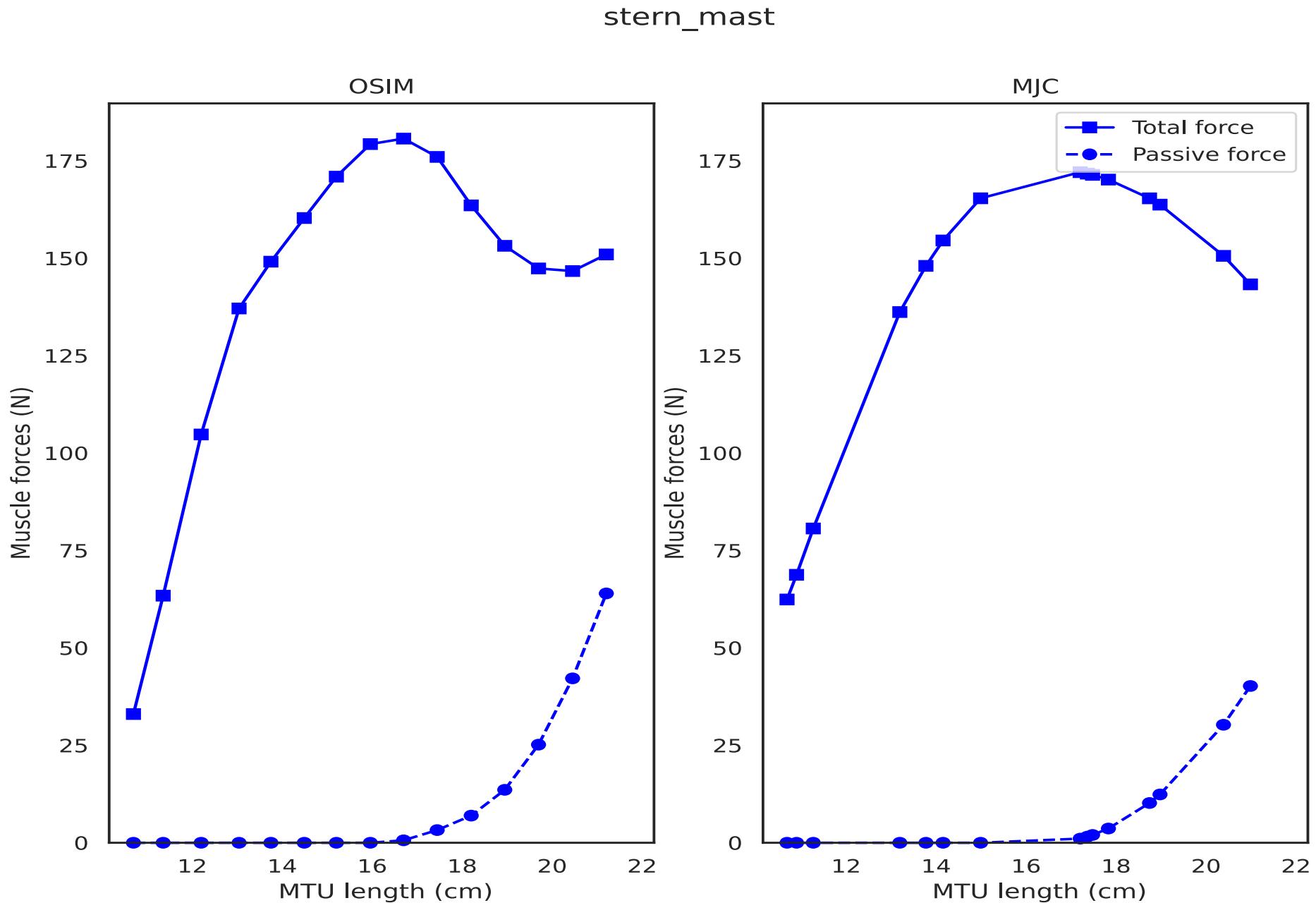


Muscle specific force comparison before/after optimization

long_col_c5thx

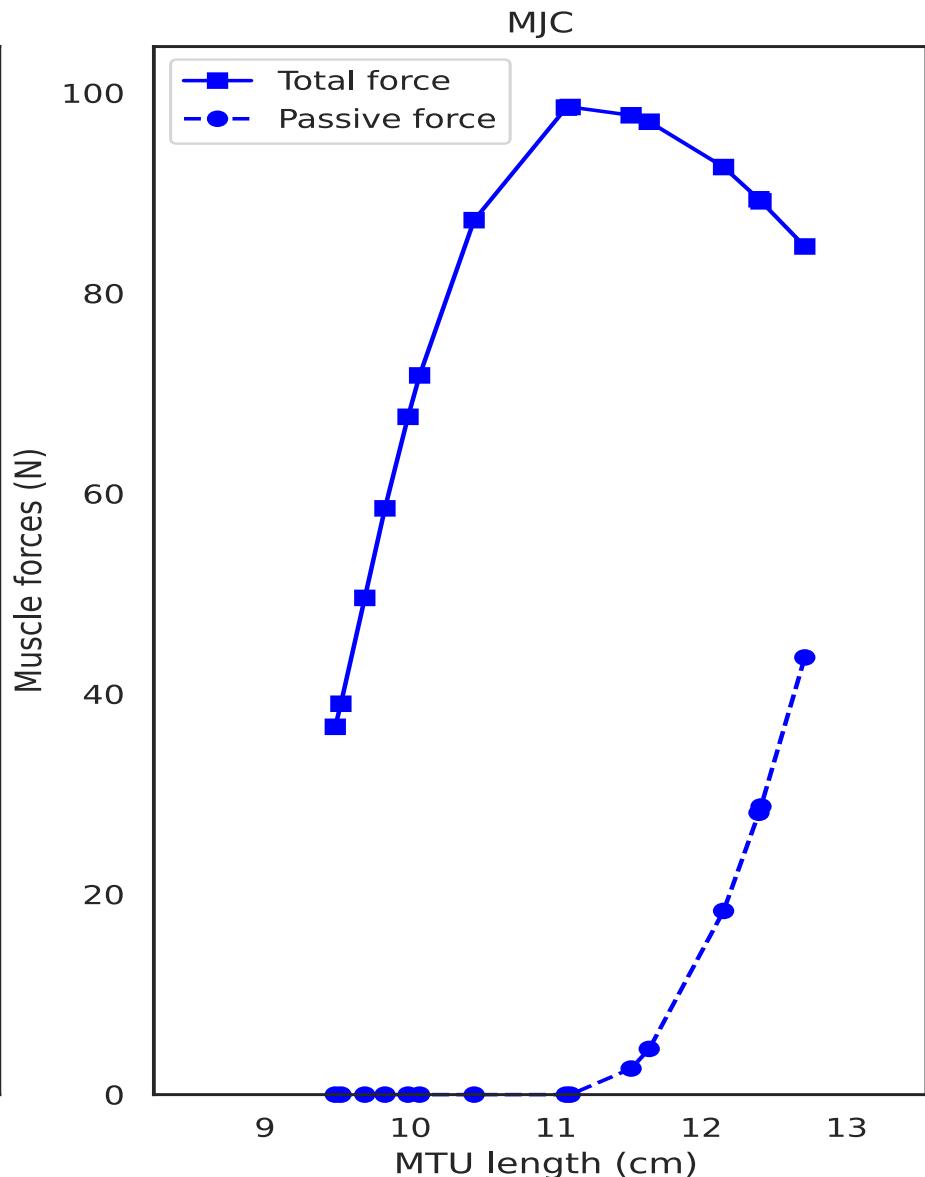
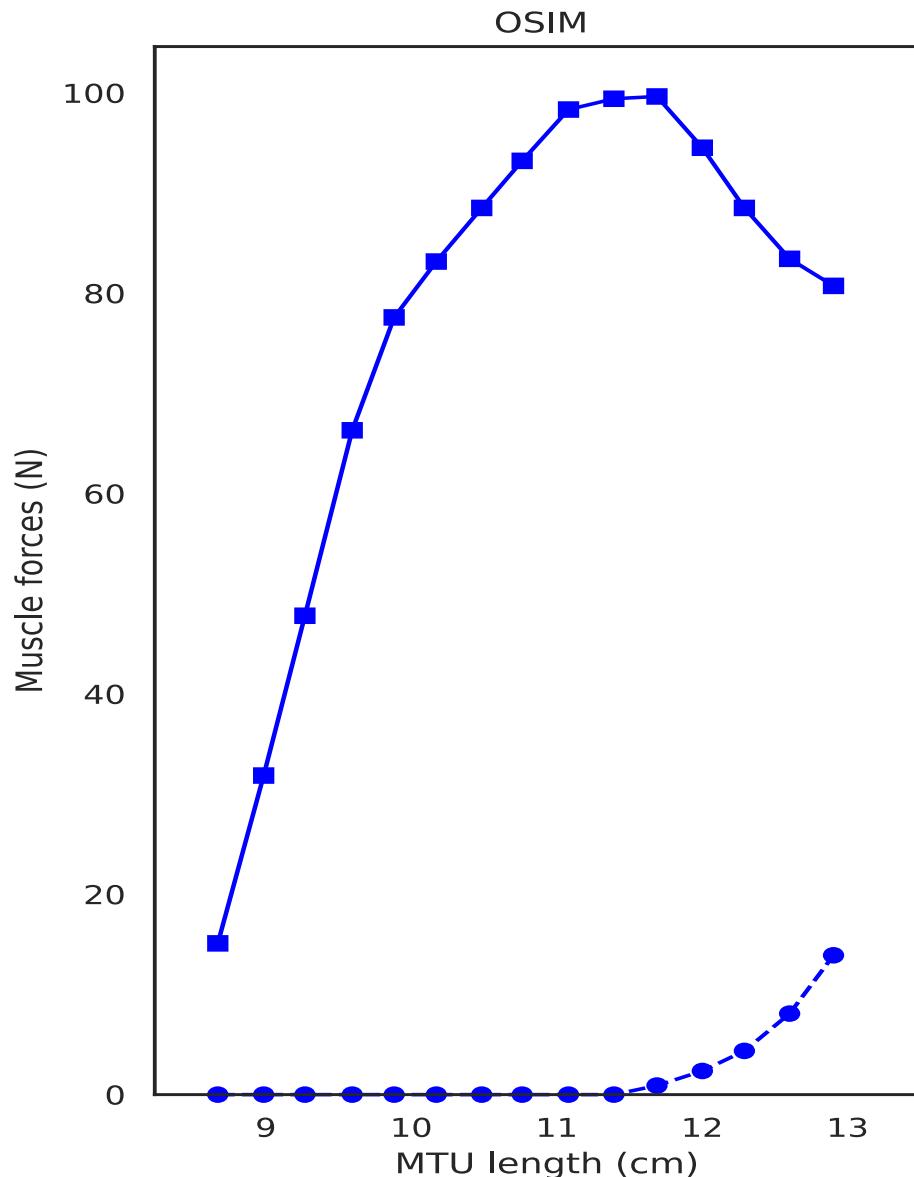


Muscle specific force comparison before/after optimization



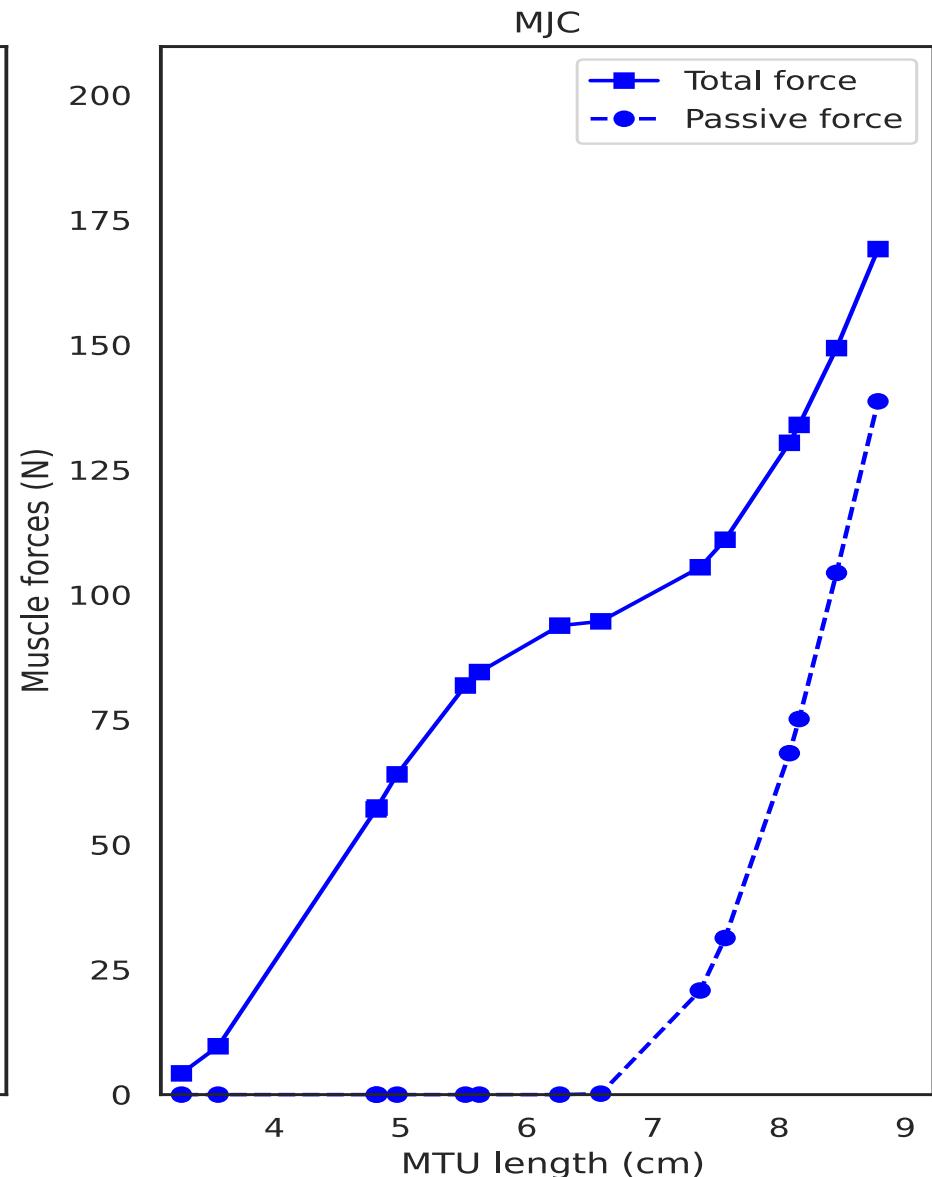
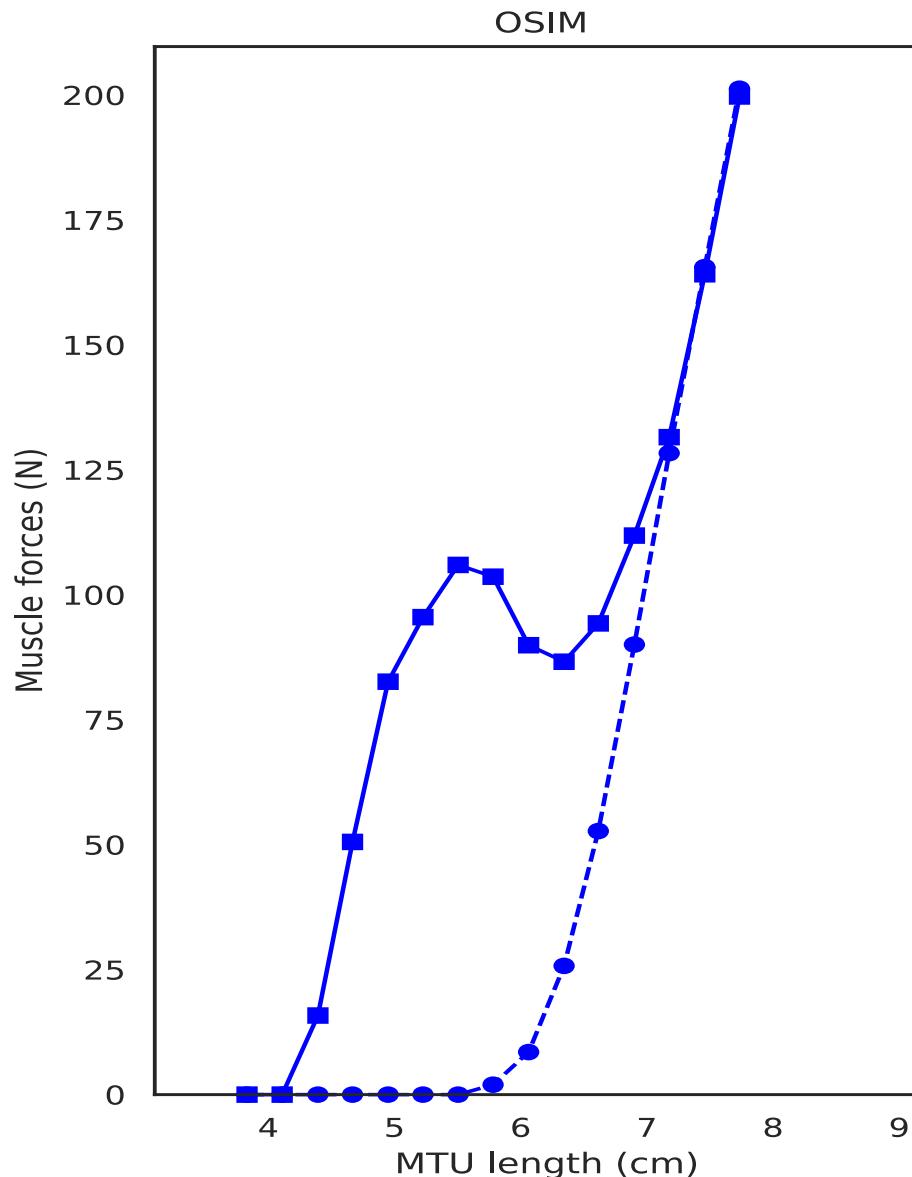
Muscle specific force comparison before/after optimization

scalenus_med_L



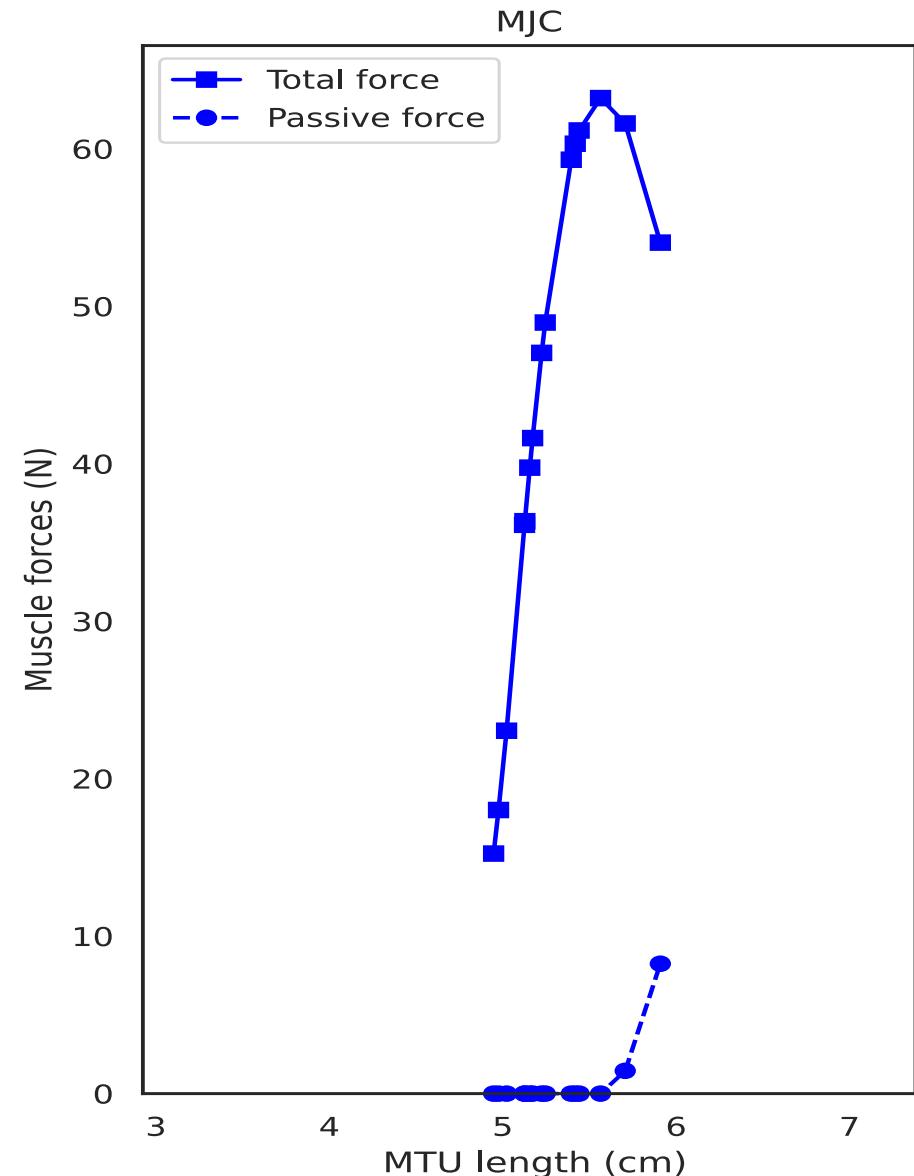
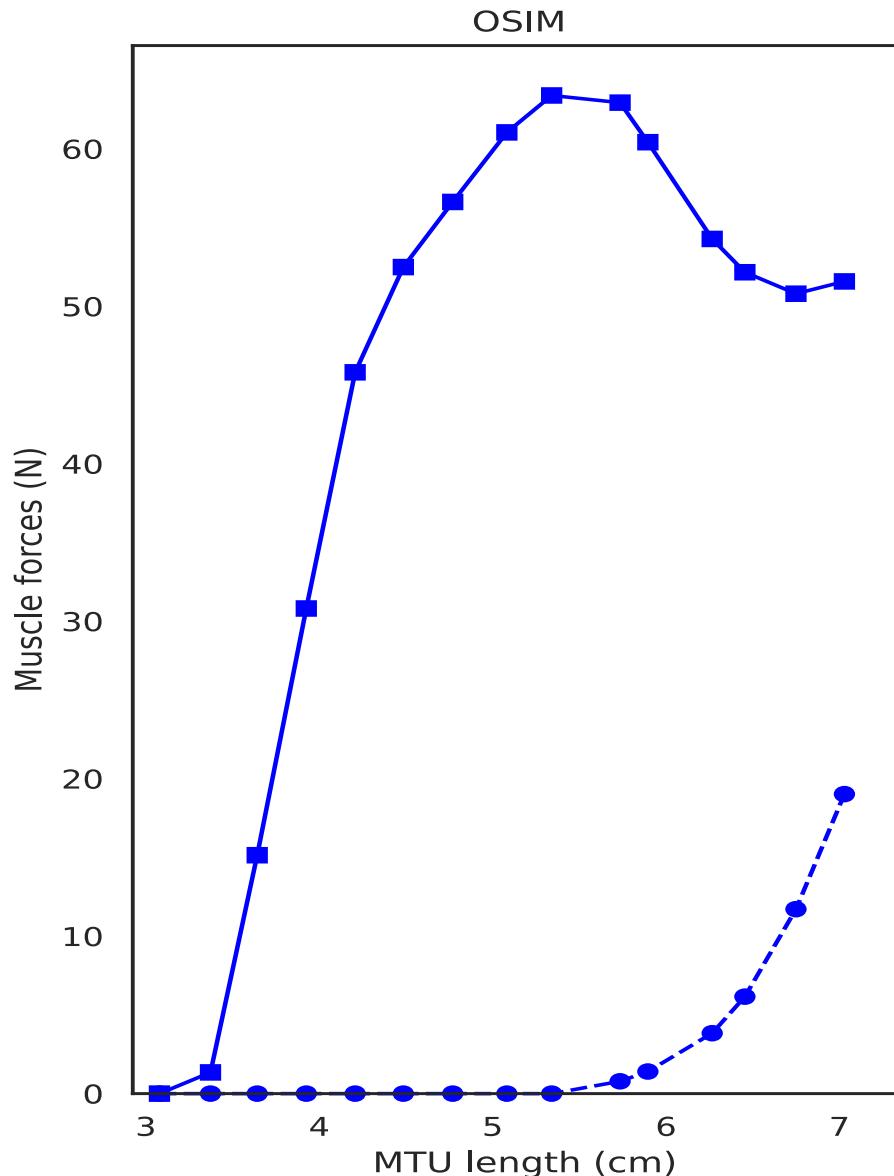
Muscle specific force comparison before/after optimization

digastric_post



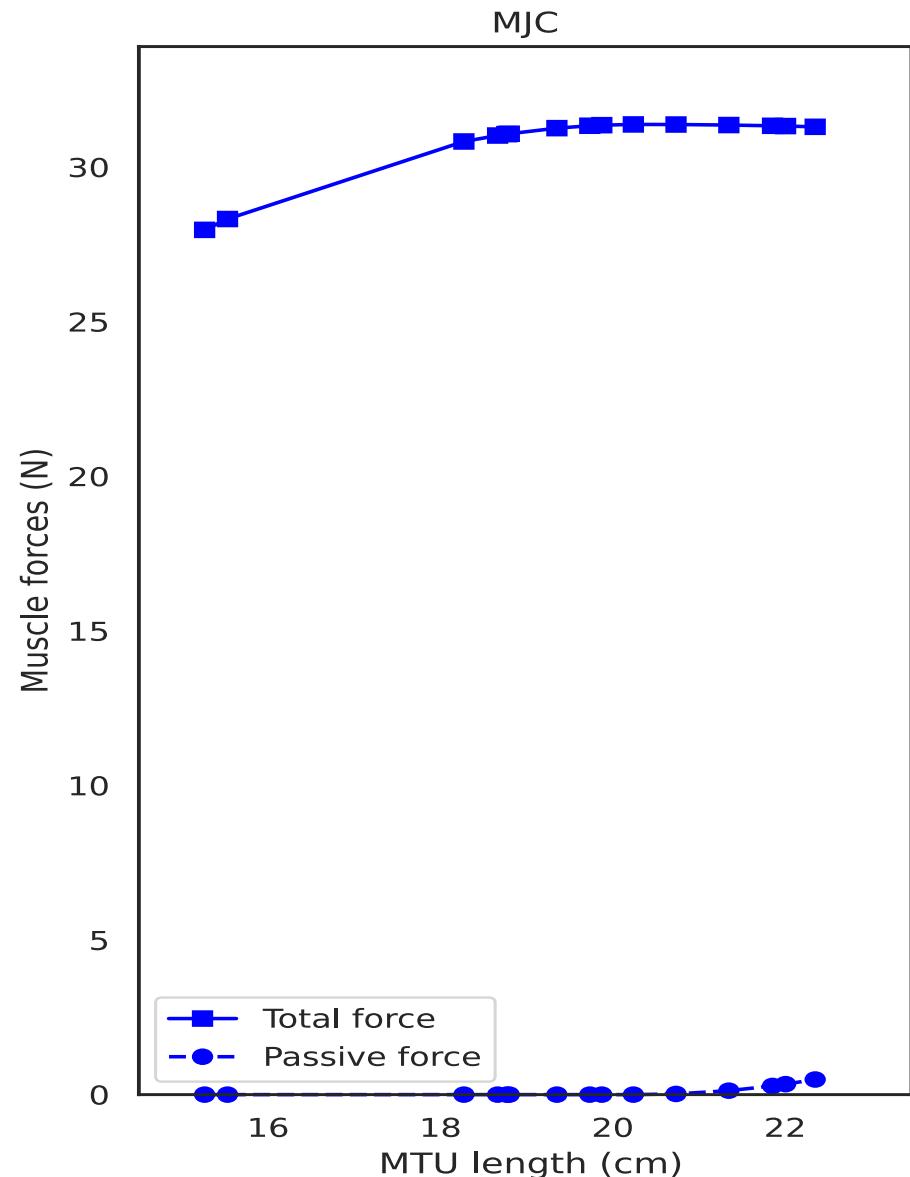
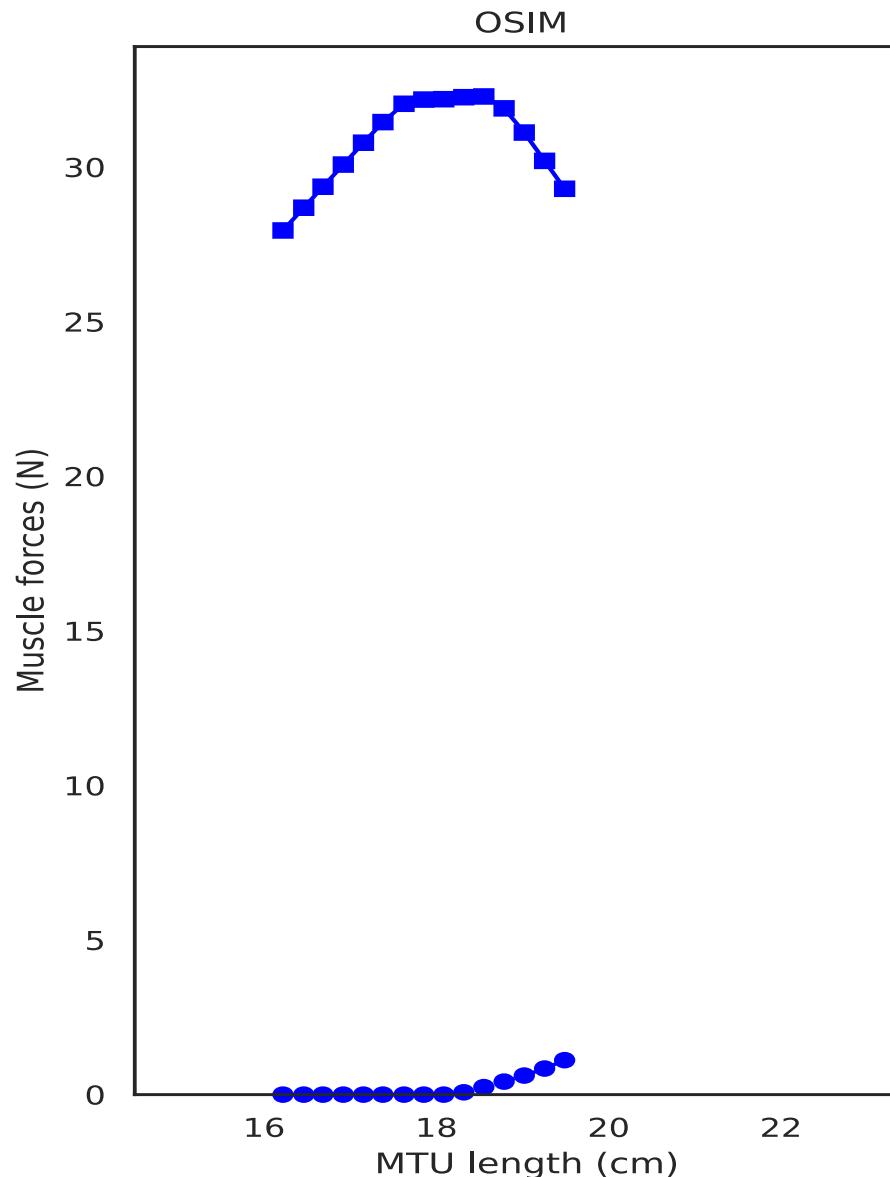
Muscle specific force comparison before/after optimization

obl_cap_inf



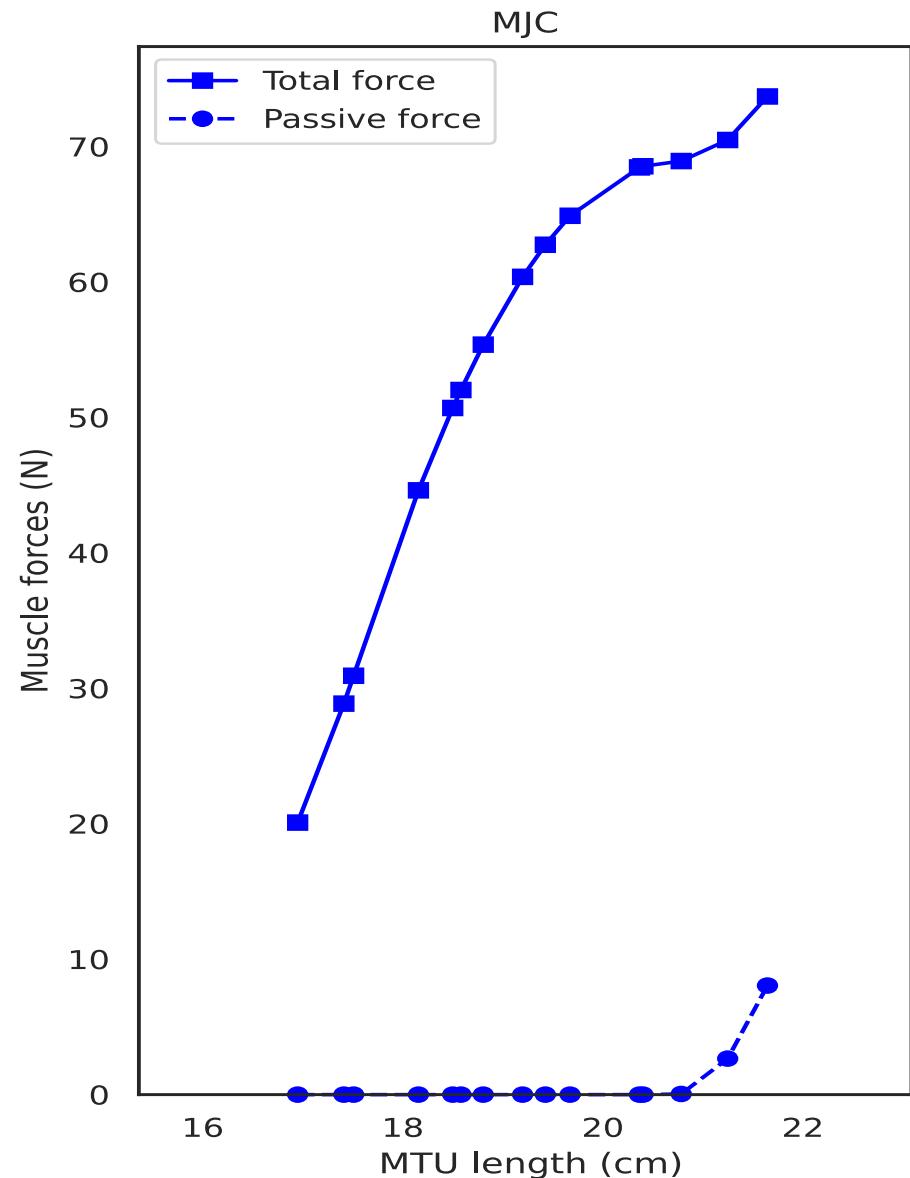
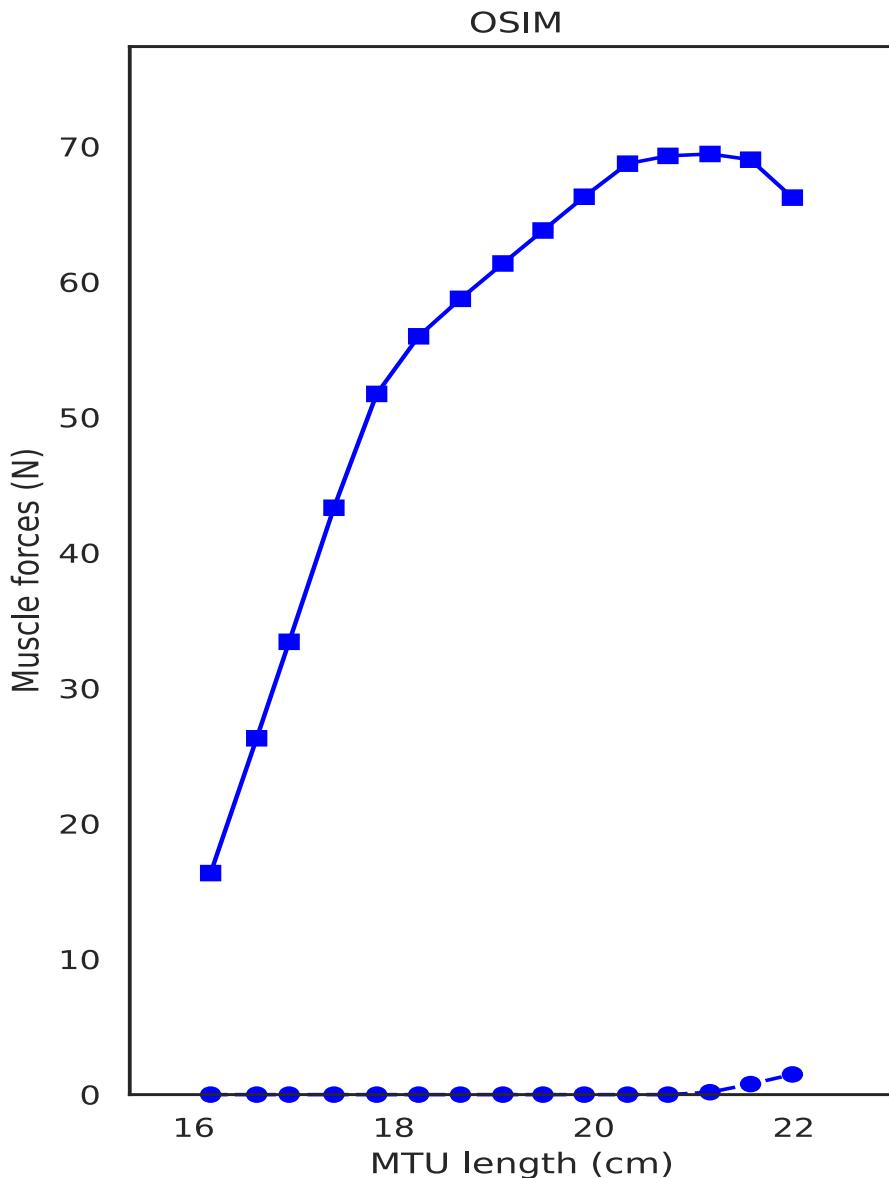
Muscle specific force comparison before/after optimization

long_col_c1thx_L



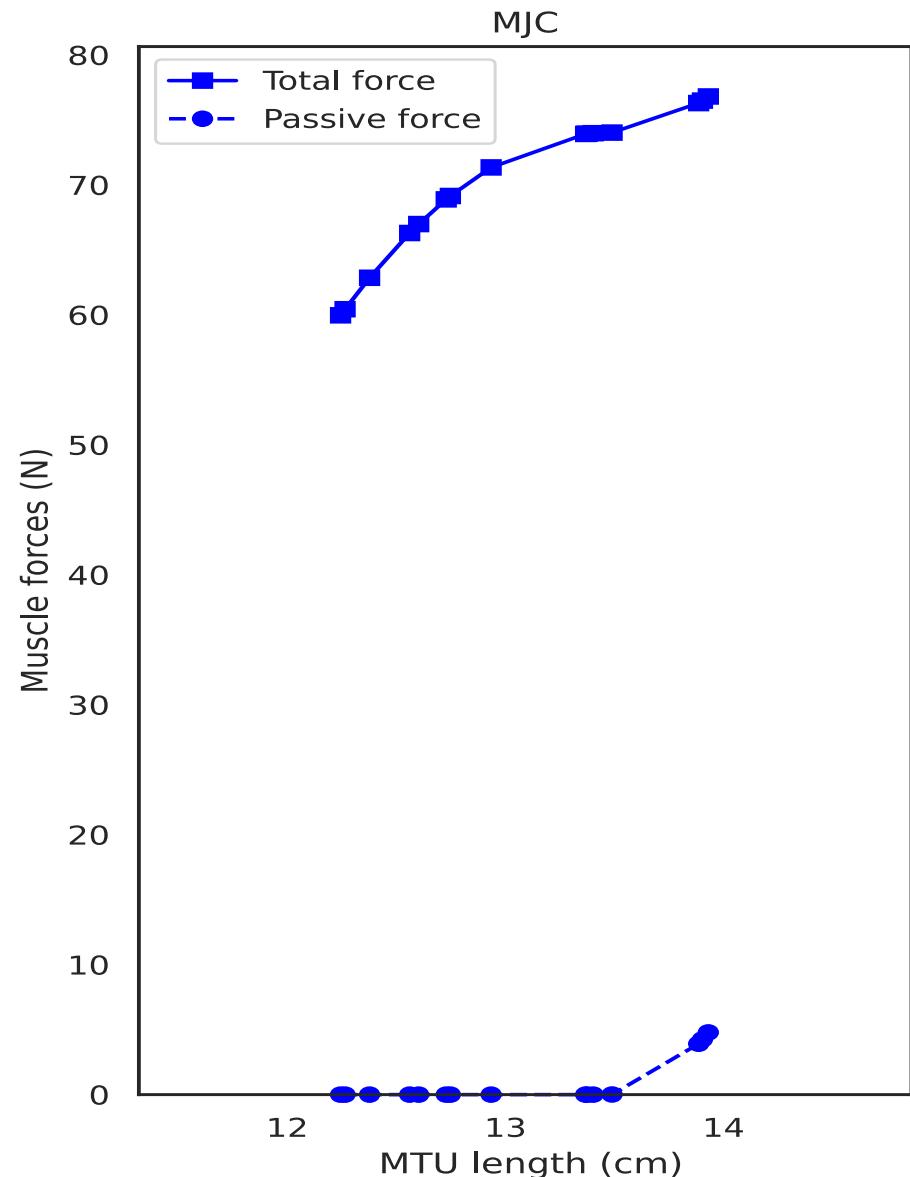
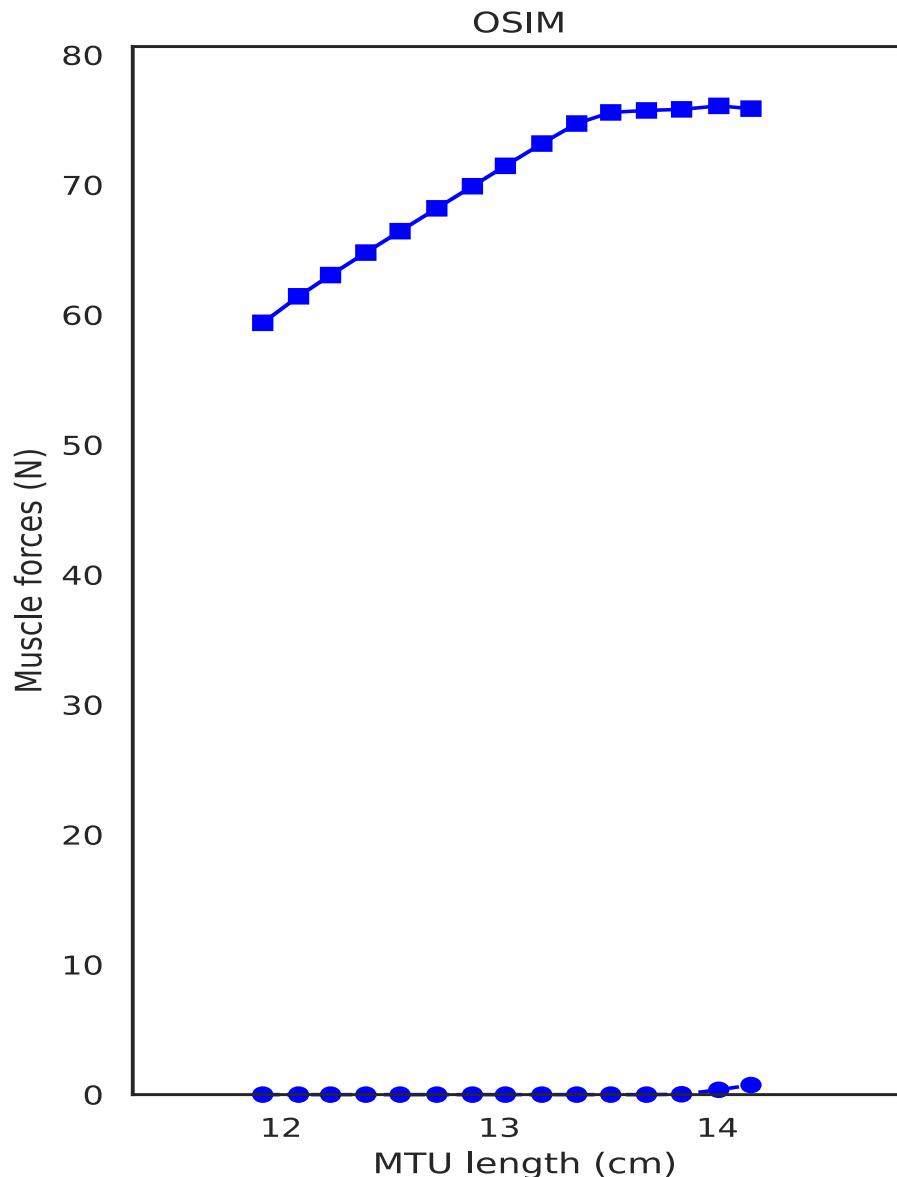
Muscle specific force comparison before/after optimization

splen_cerv_c3thx_L



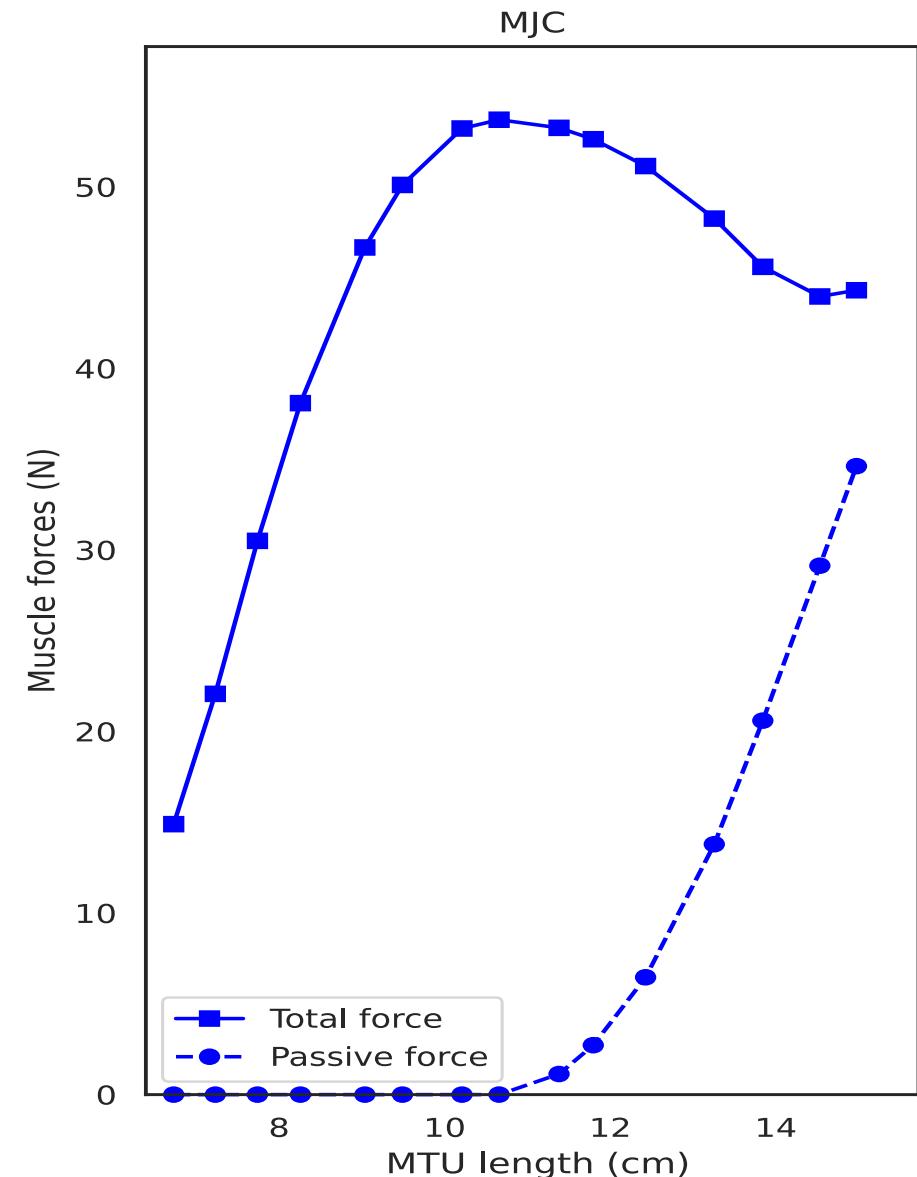
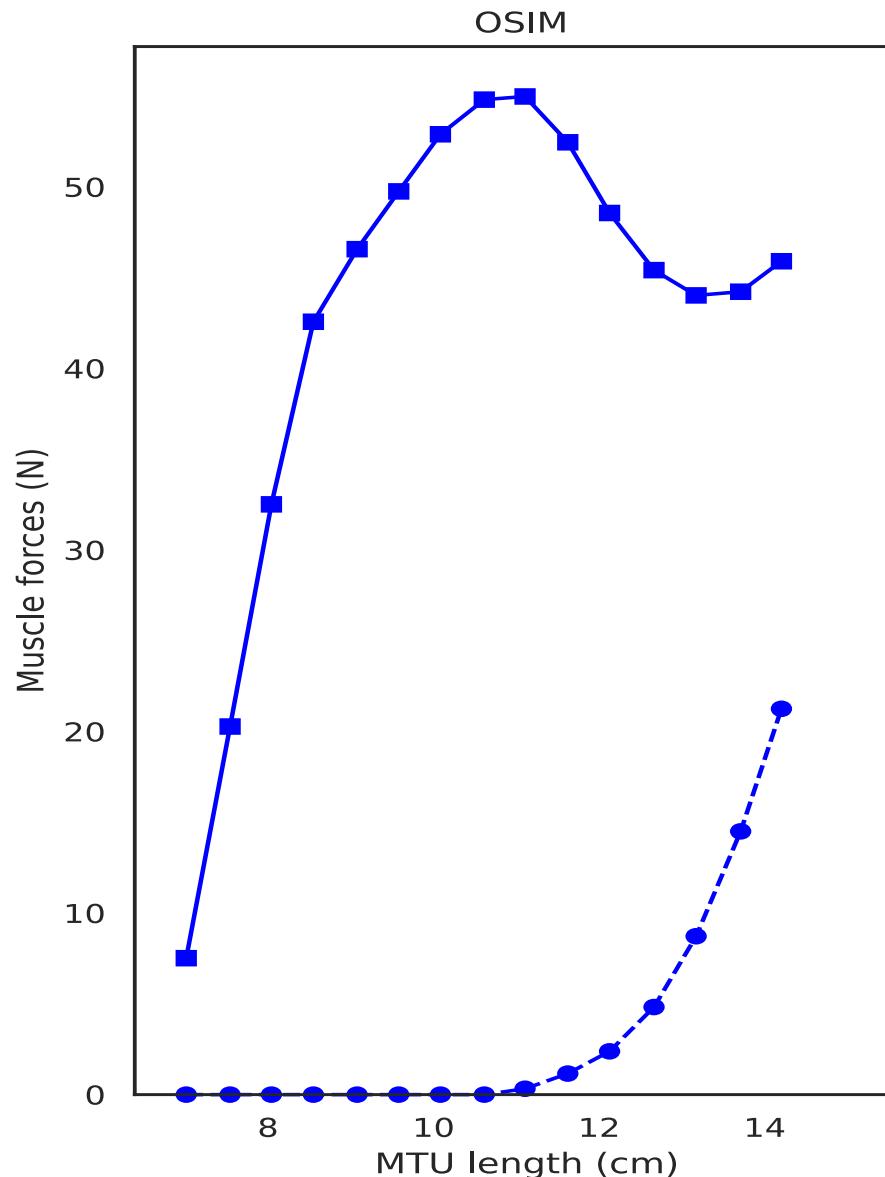
Muscle specific force comparison before/after optimization

scalenus_post_L

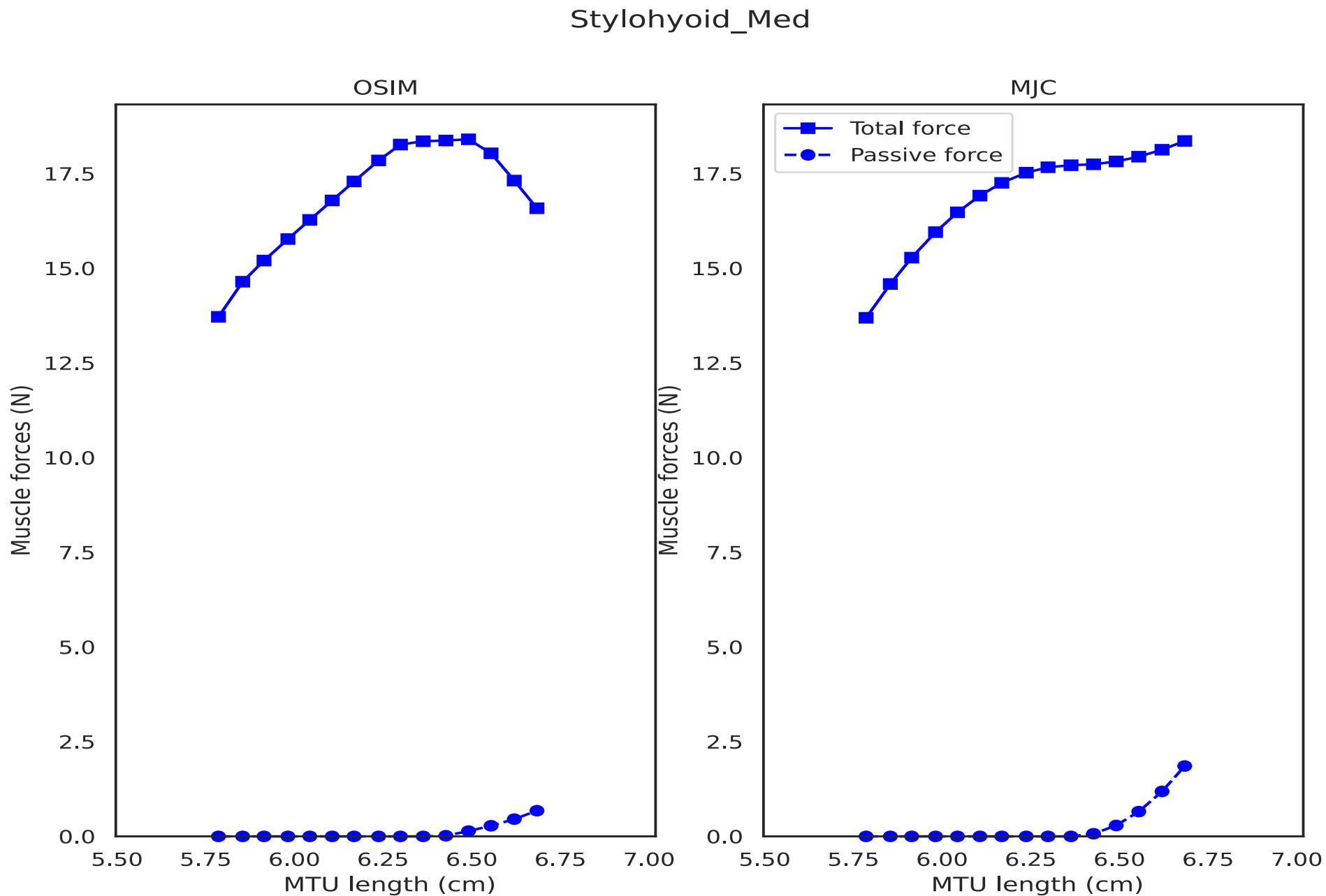


Muscle specific force comparison before/after optimization

Sterno_hyoid

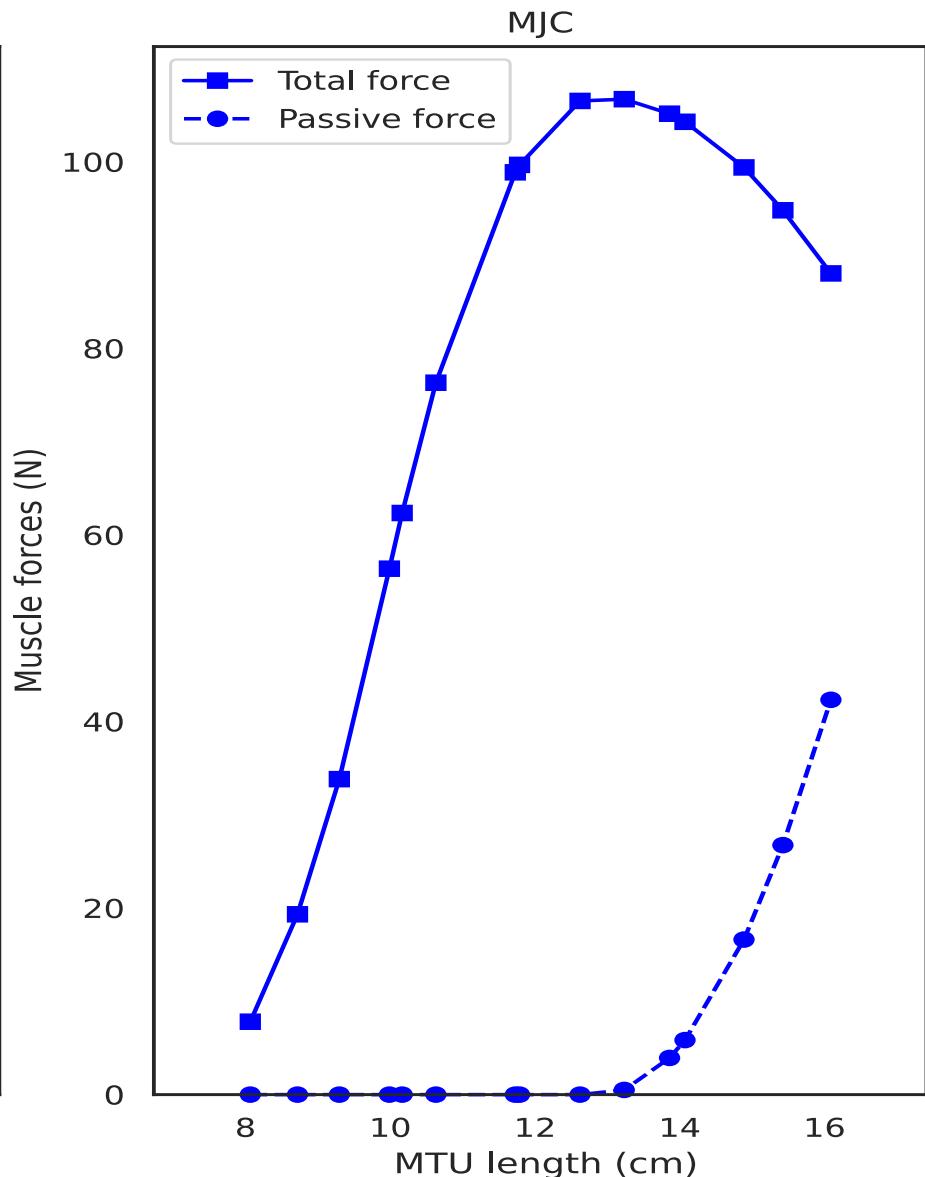
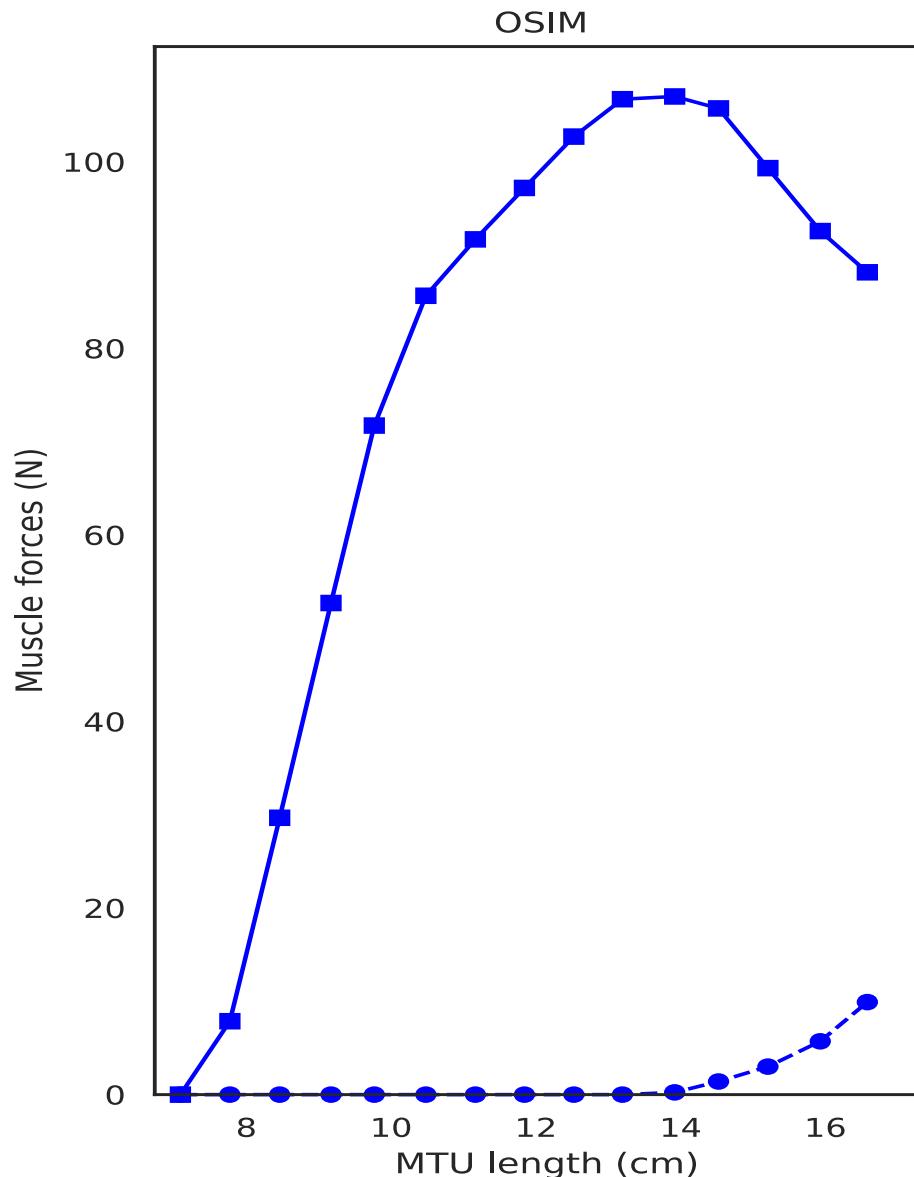


Muscle specific force comparison before/after optimization



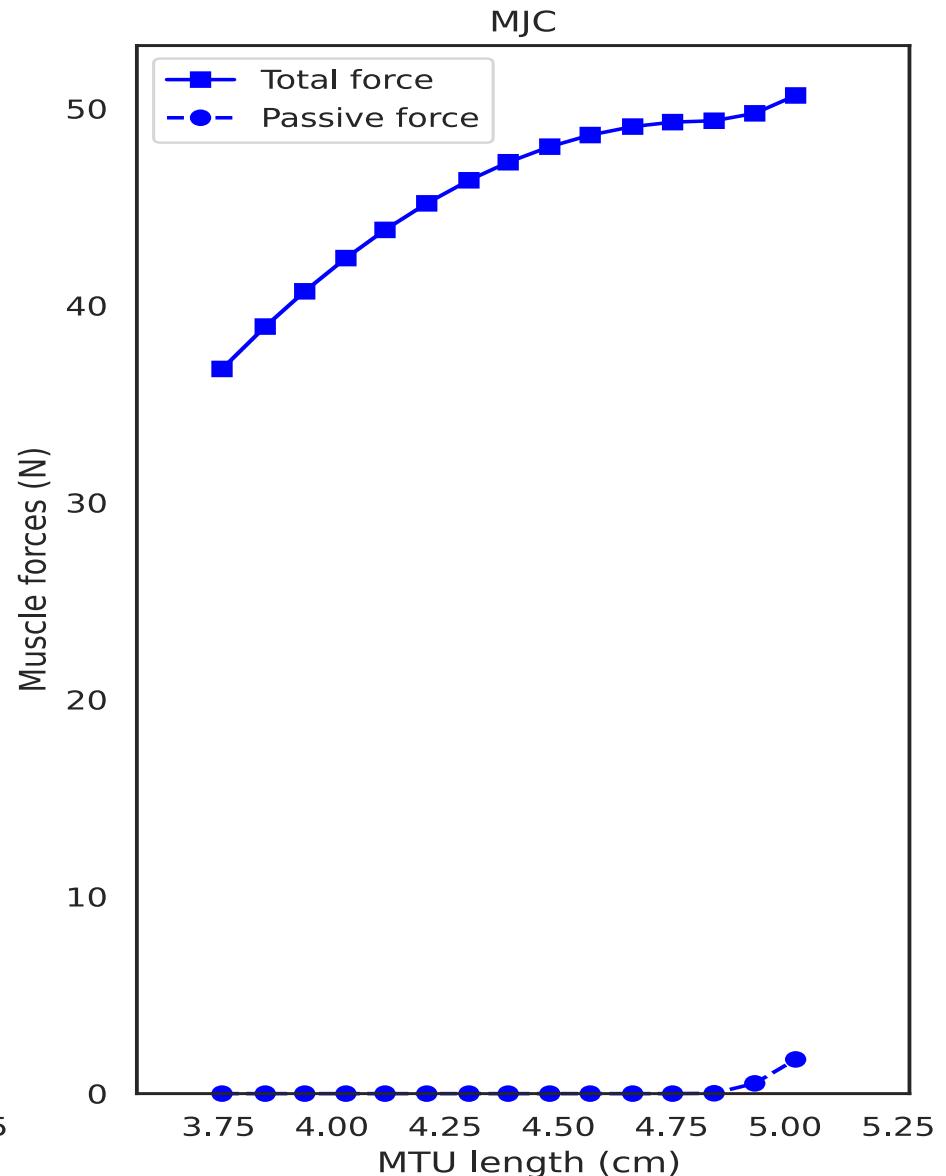
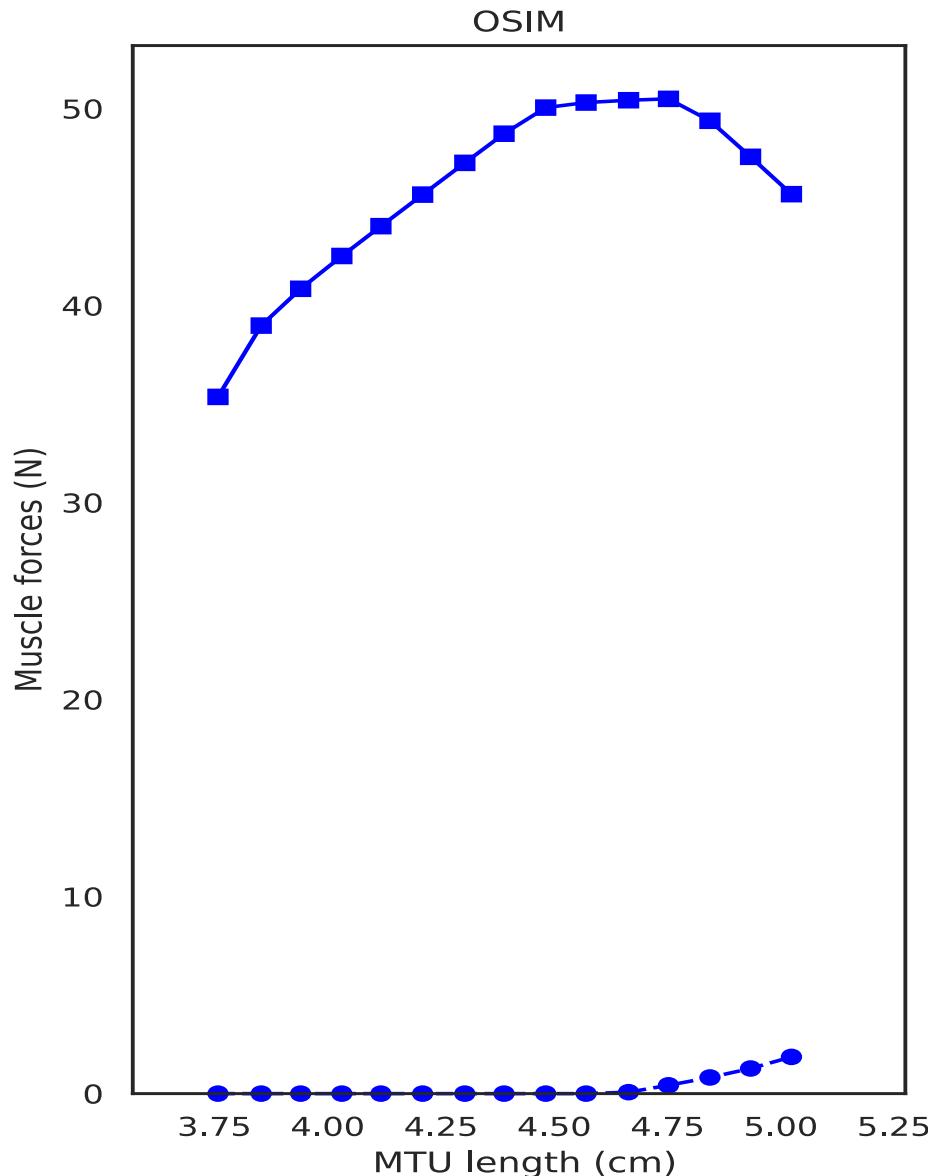
Muscle specific force comparison before/after optimization

levator_scap



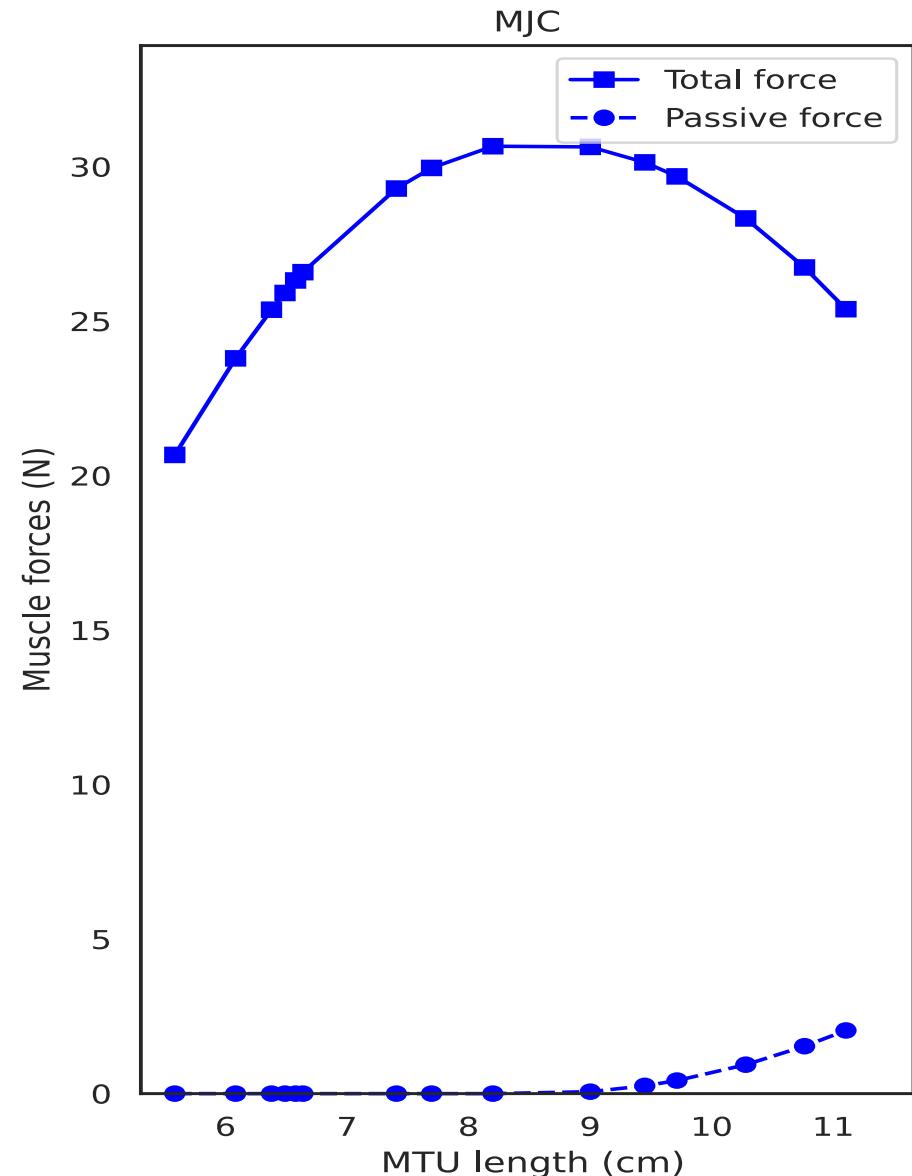
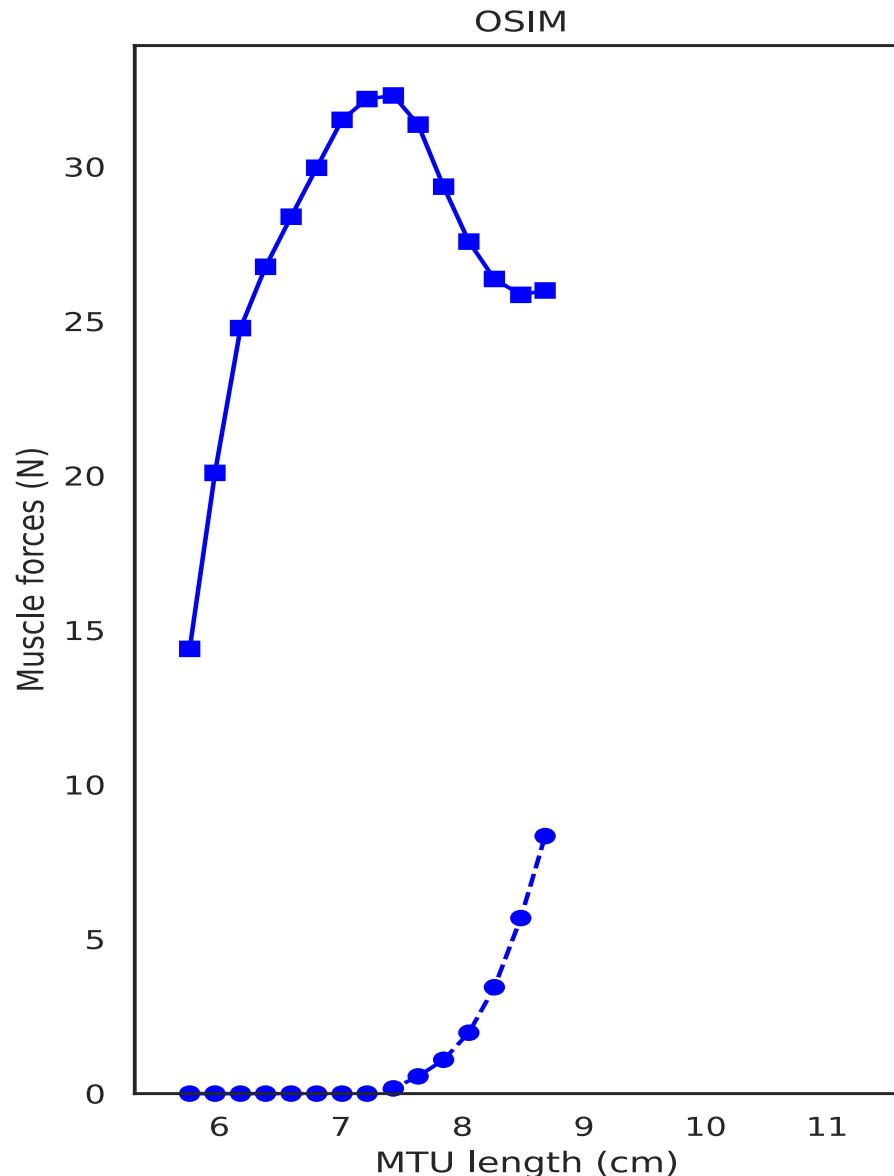
Muscle specific force comparison before/after optimization

obl_cap_sup_L



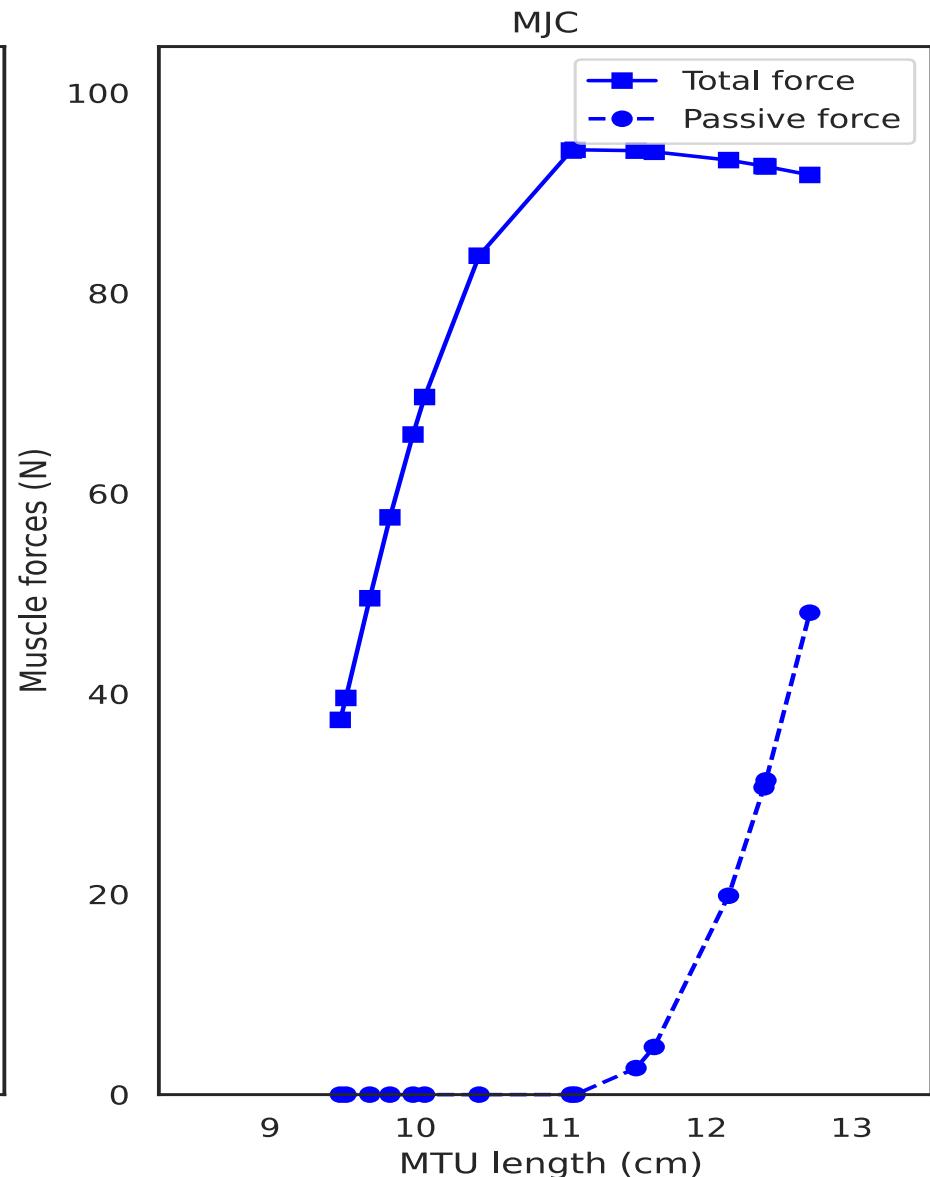
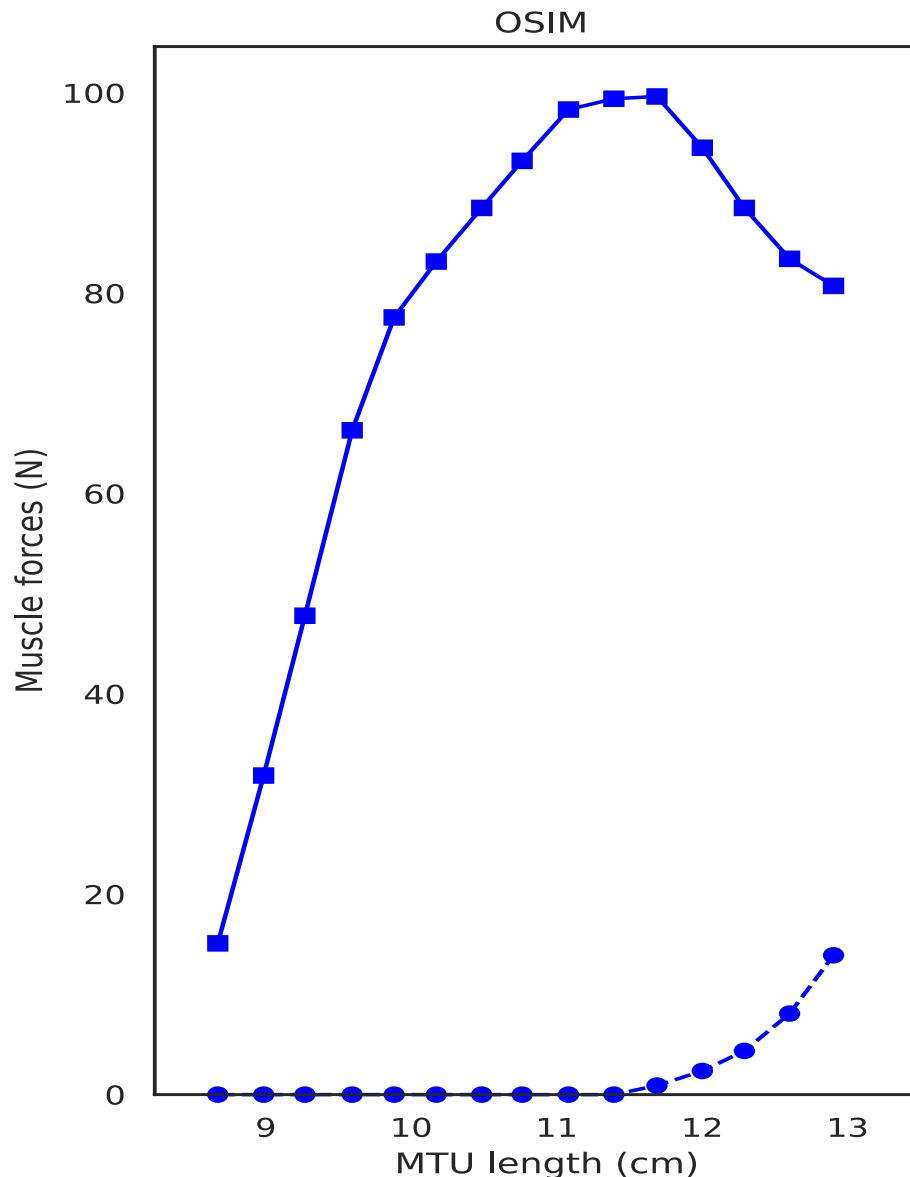
Muscle specific force comparison before/after optimization

long_col_c1c5

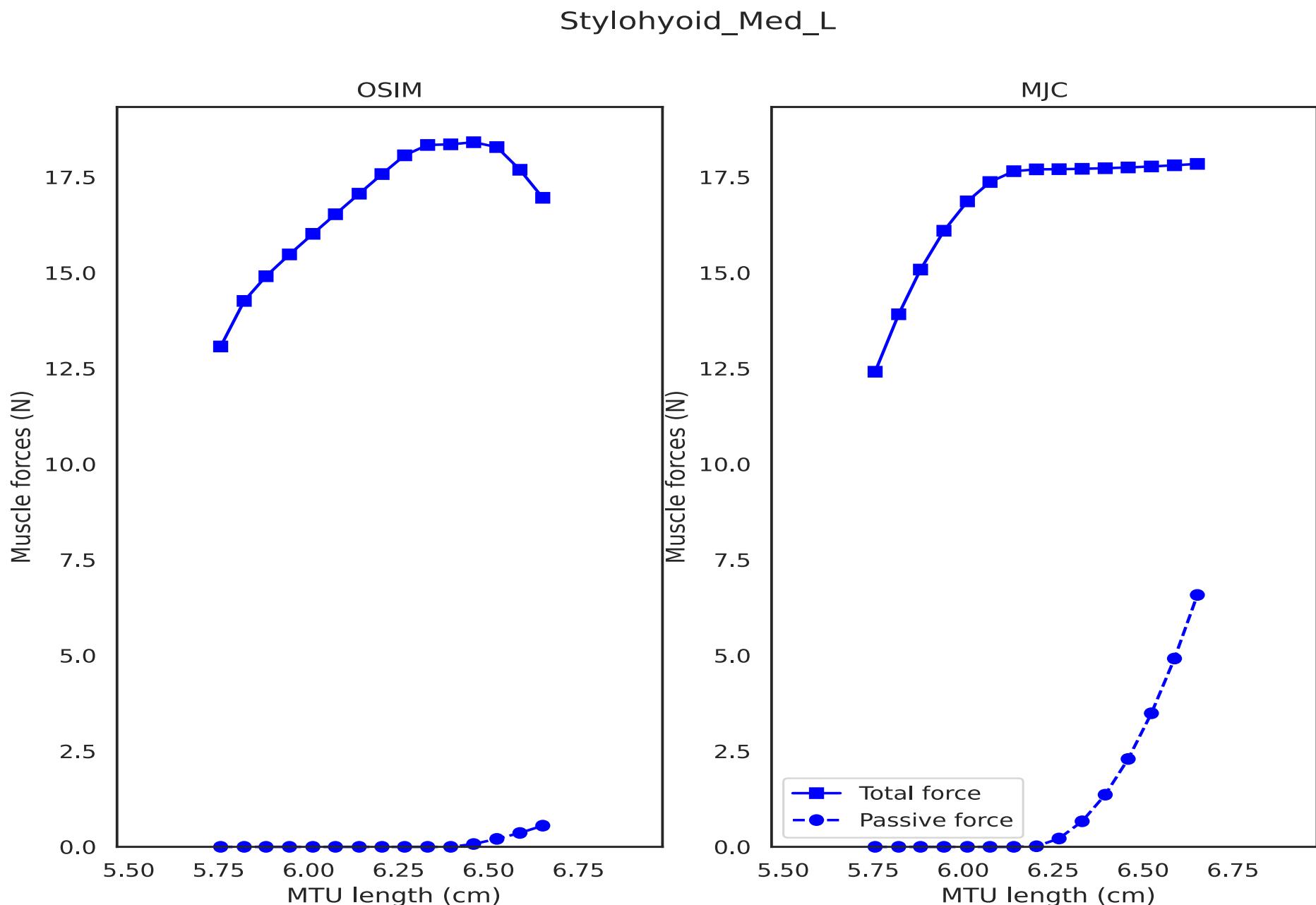


Muscle specific force comparison before/after optimization

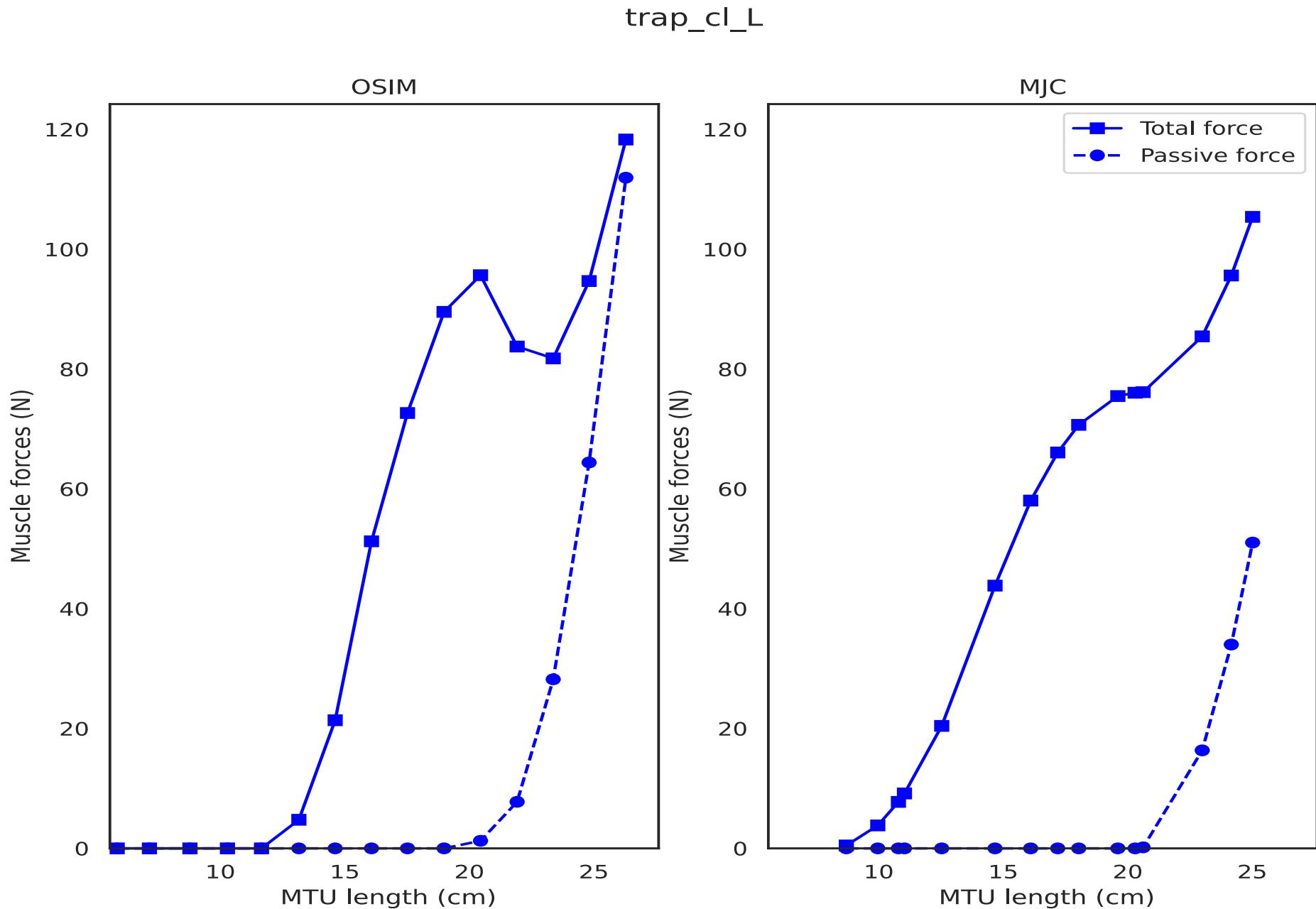
scalenus_med



Muscle specific force comparison before/after optimization

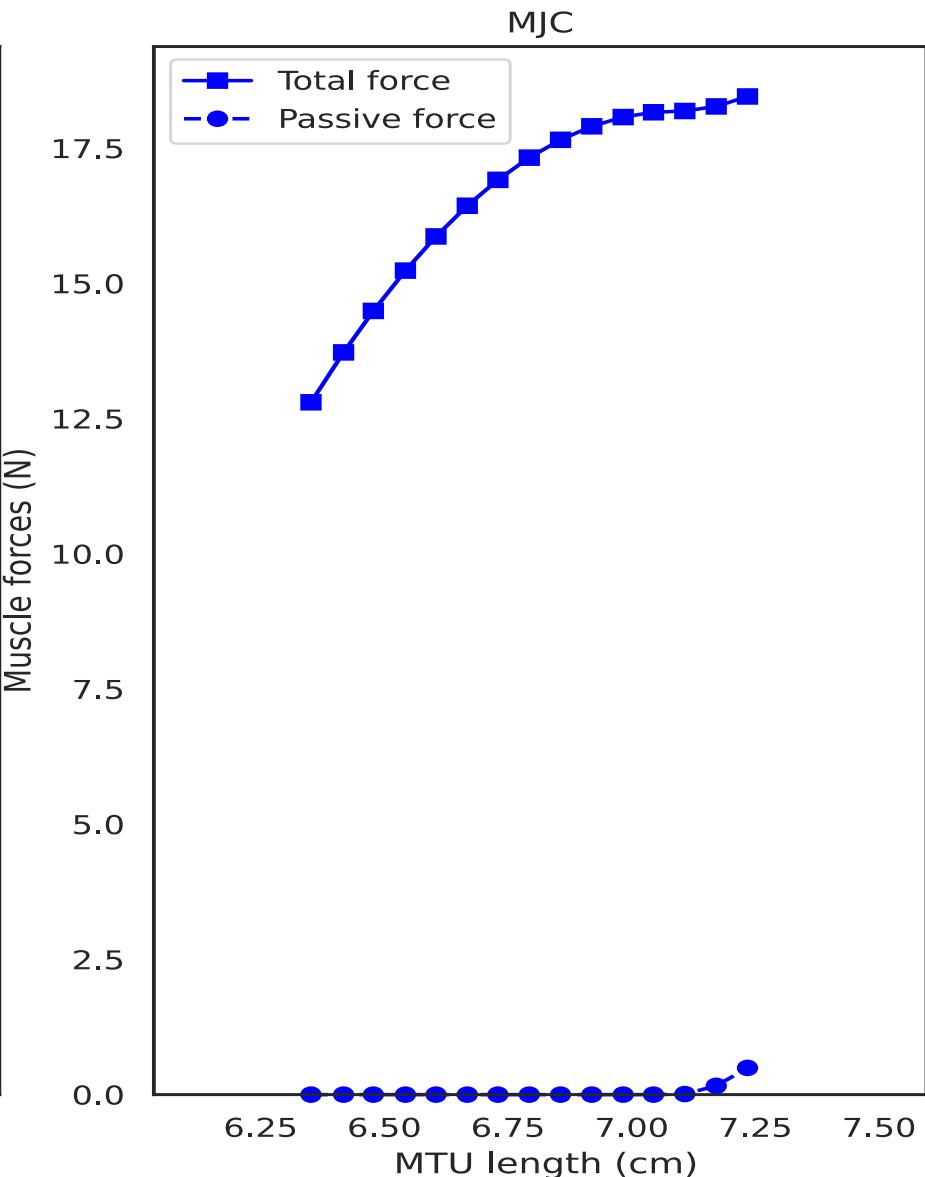
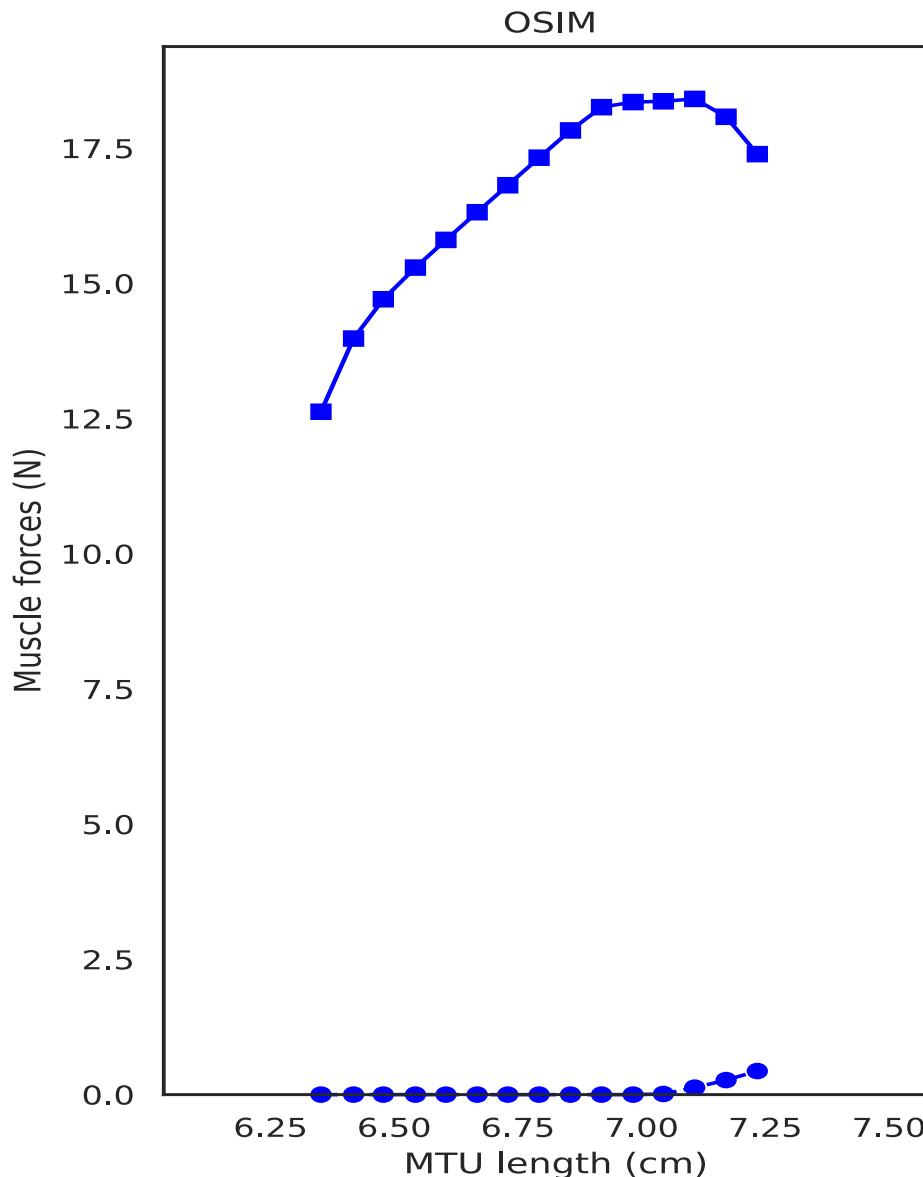


Muscle specific force comparison before/after optimization



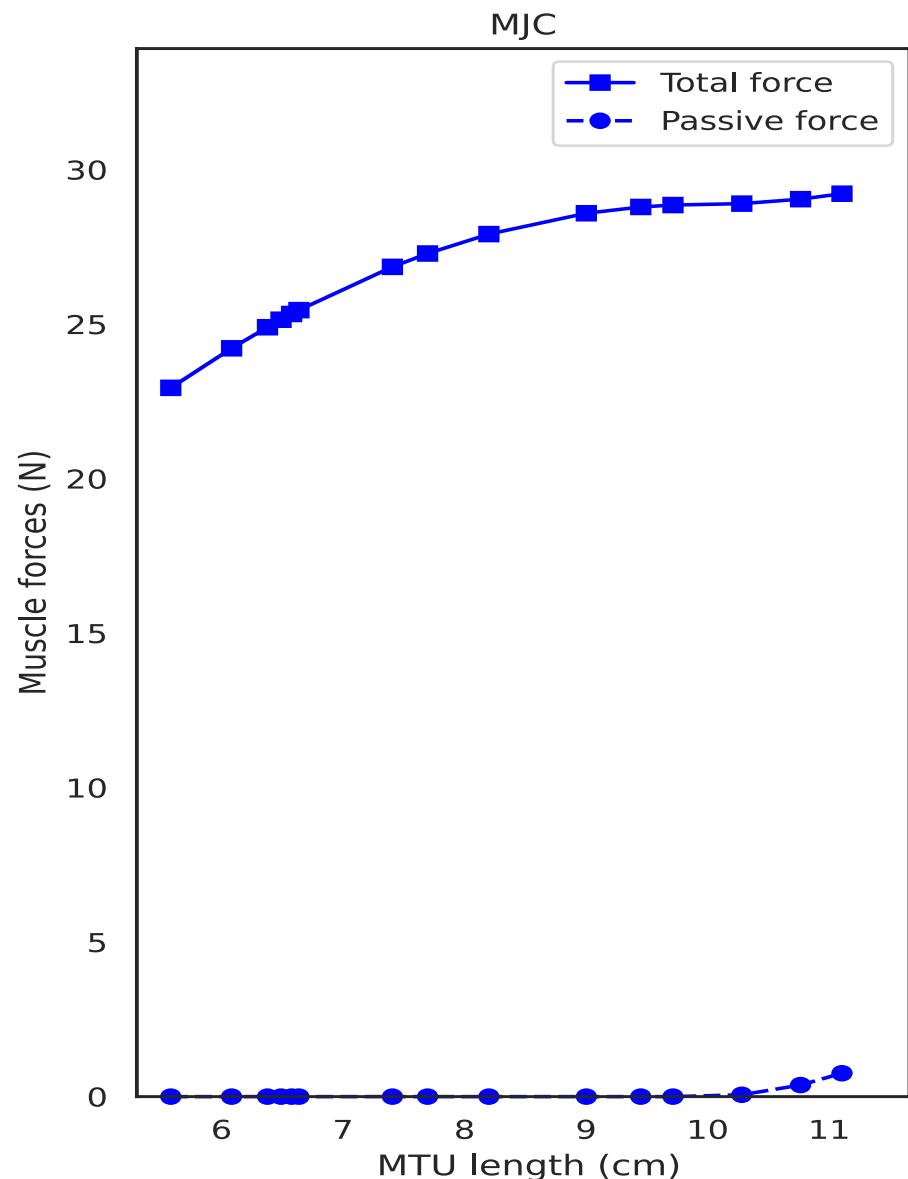
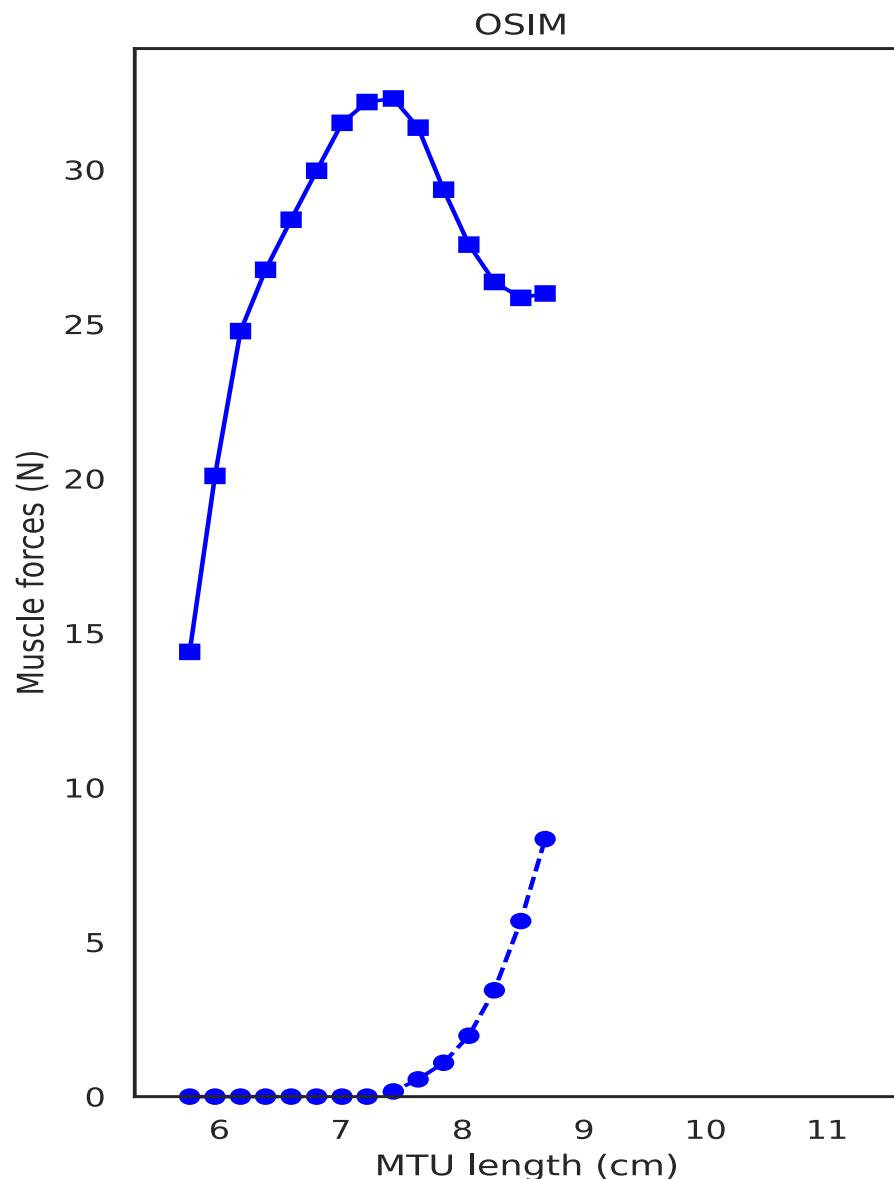
Muscle specific force comparison before/after optimization

Stylohyoid_Lat_L



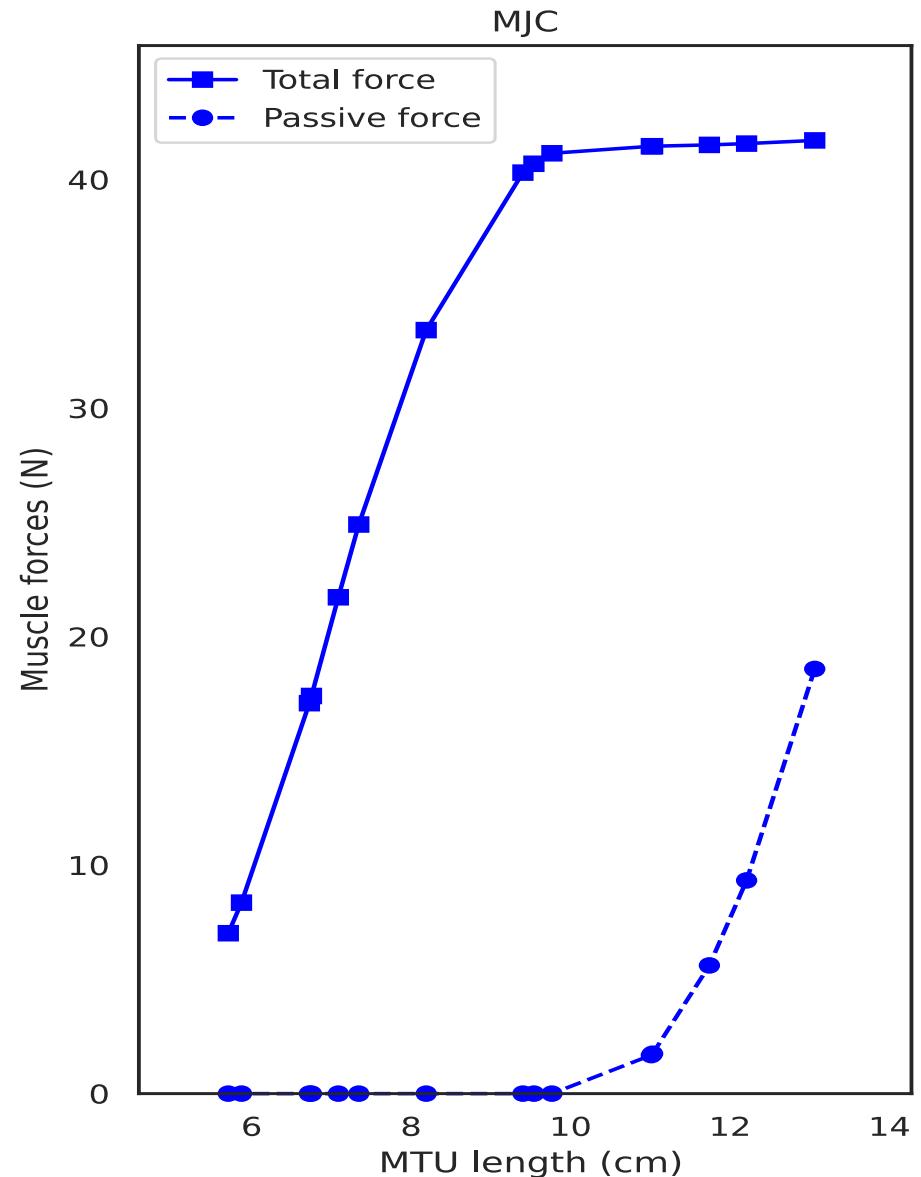
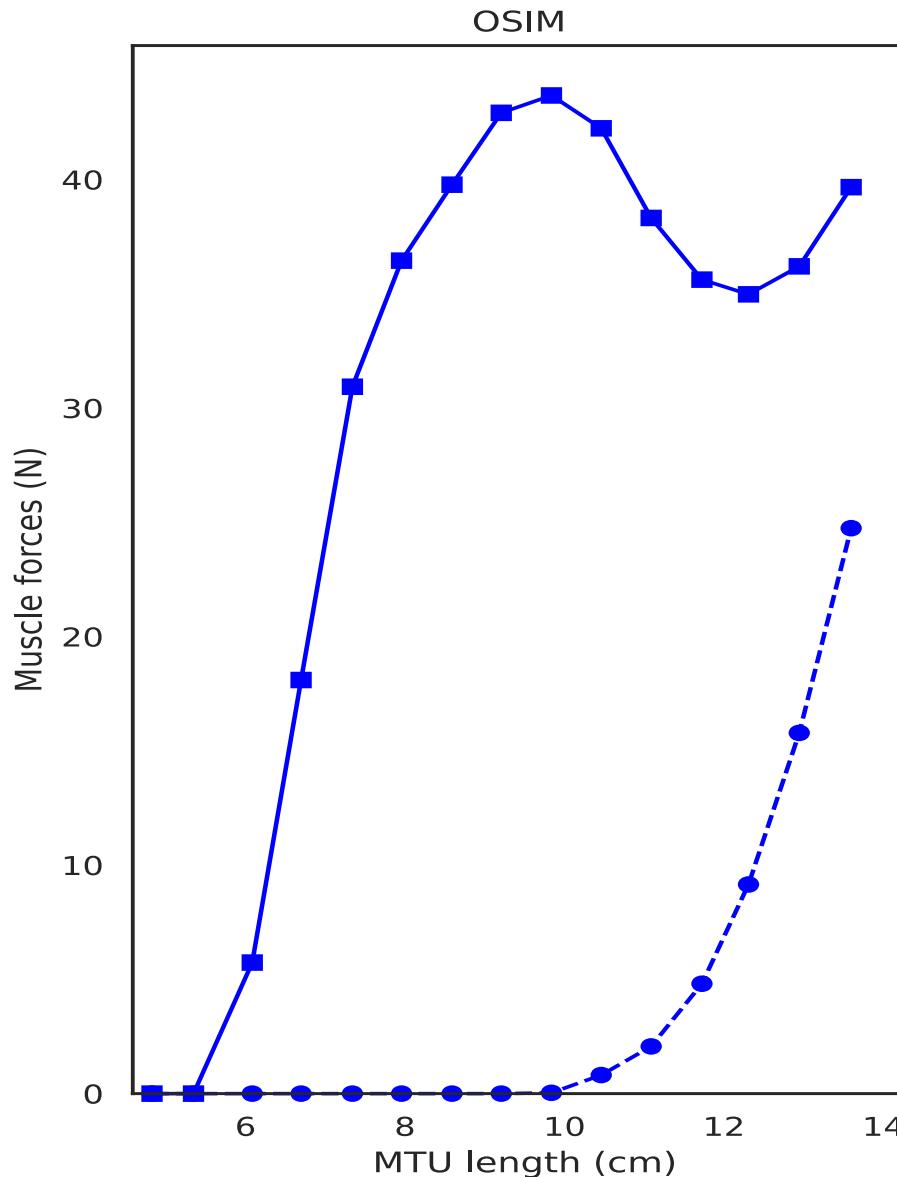
Muscle specific force comparison before/after optimization

long_col_c1c5_L



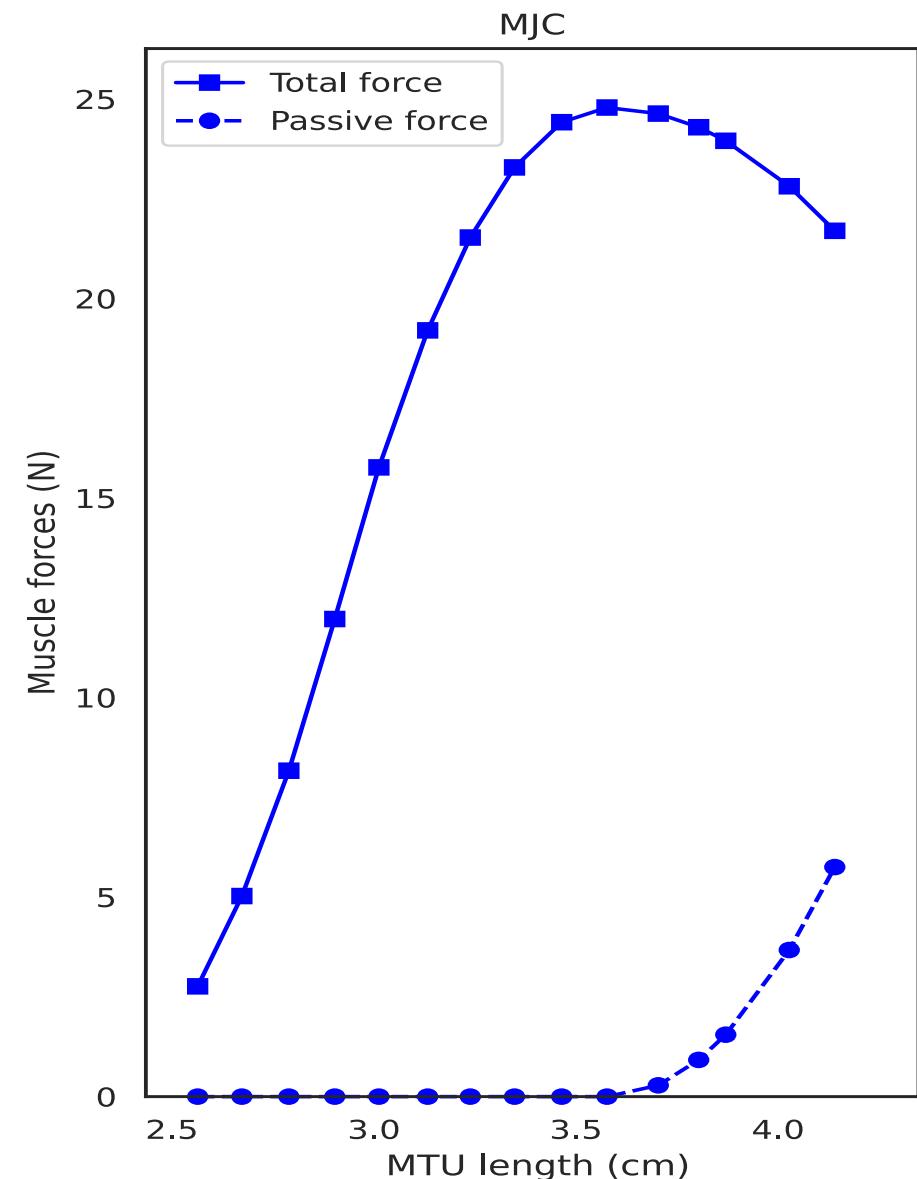
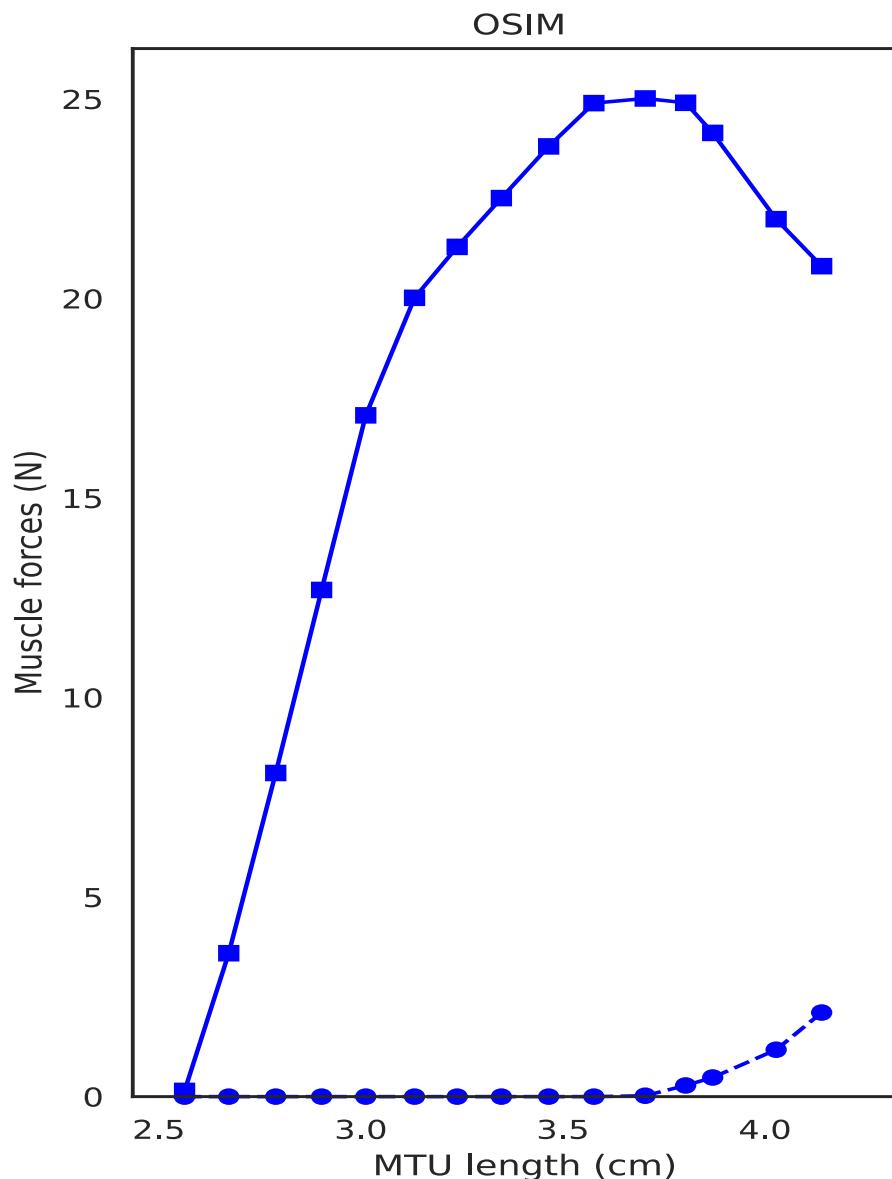
Muscle specific force comparison before/after optimization

longissi_cap_sklc6_L



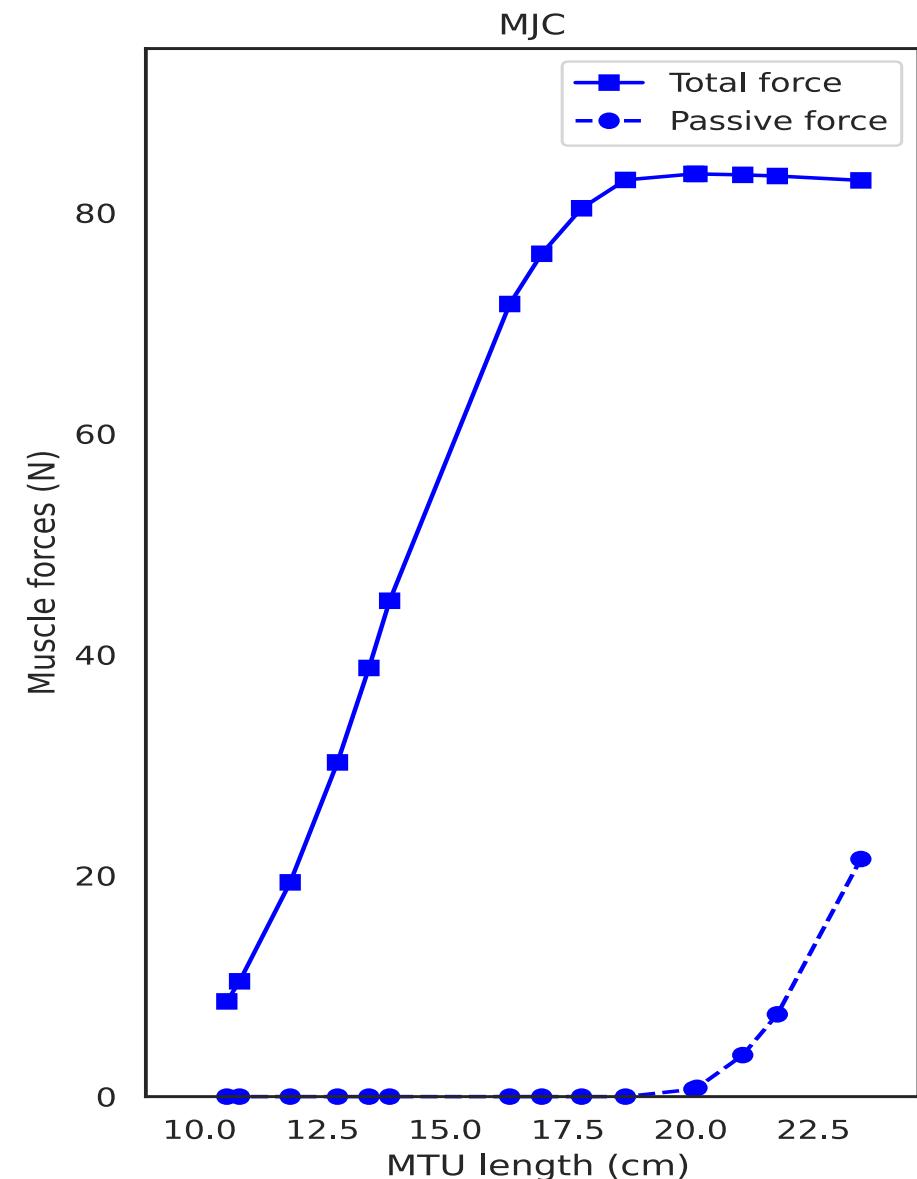
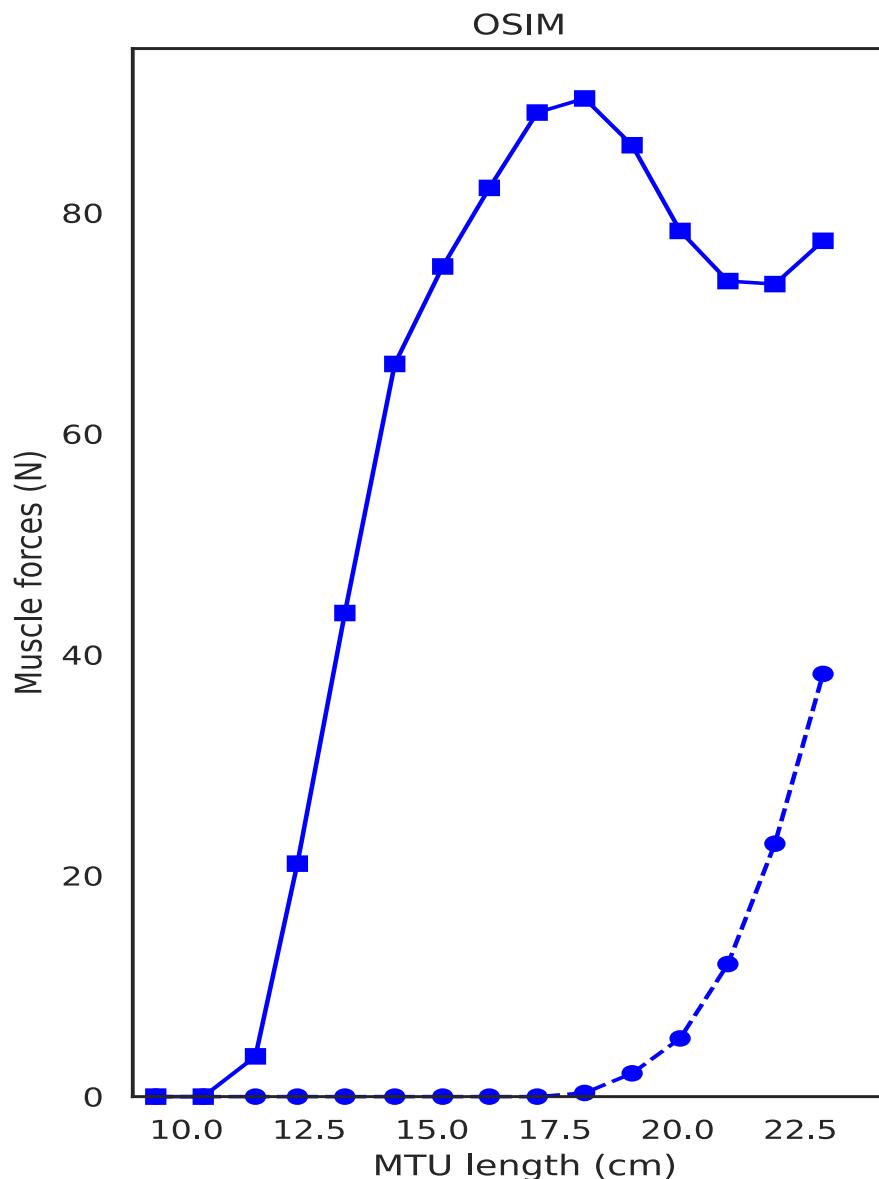
Muscle specific force comparison before/after optimization

rectcap_post_min_L



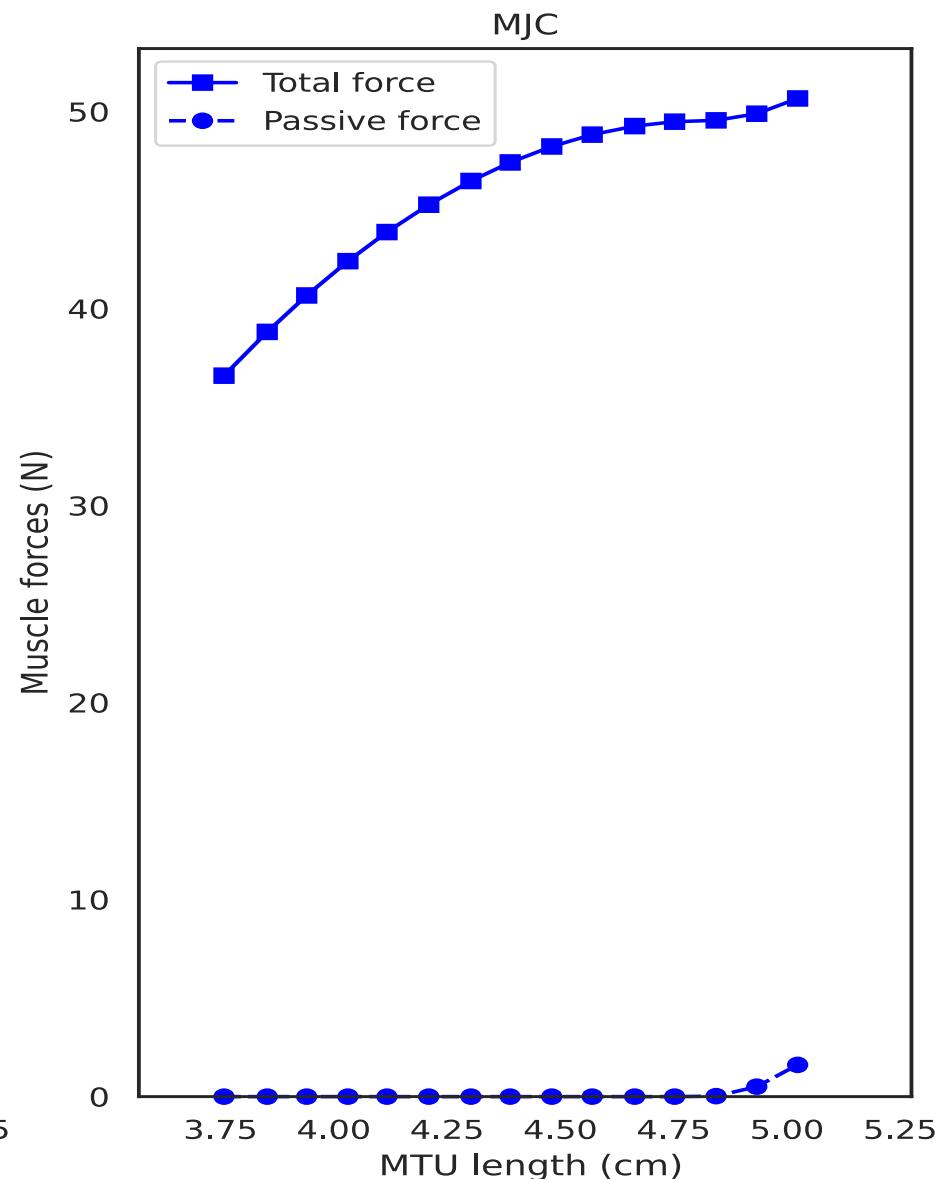
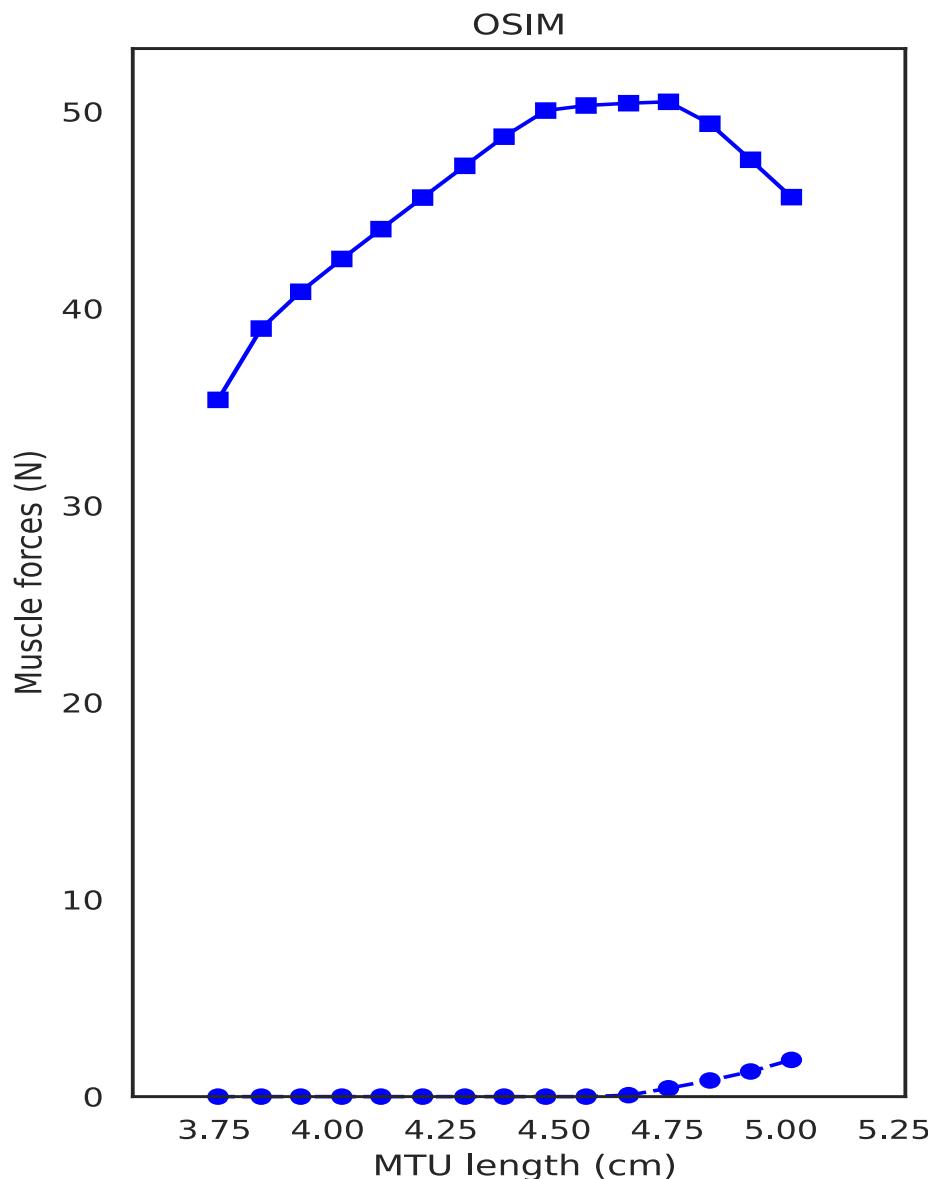
Muscle specific force comparison before/after optimization

cleid_occ



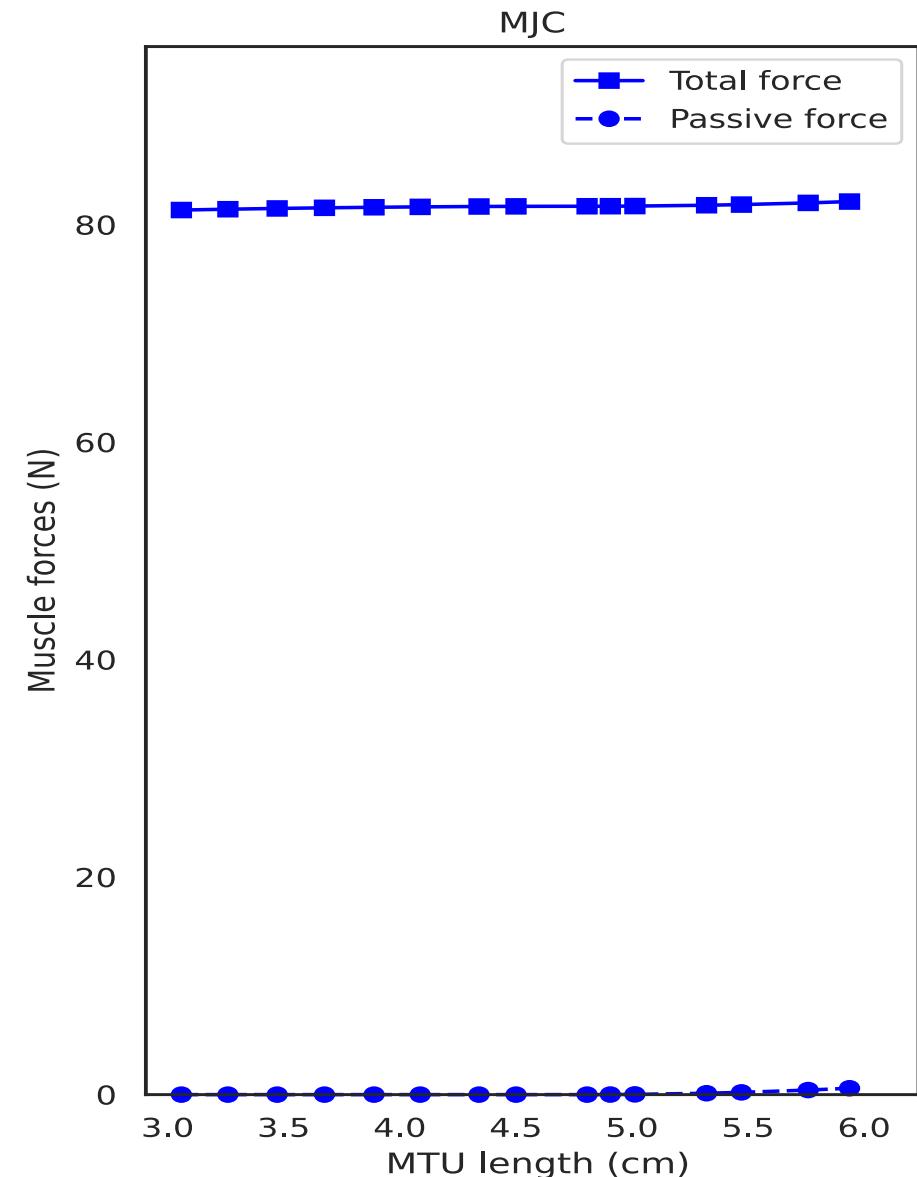
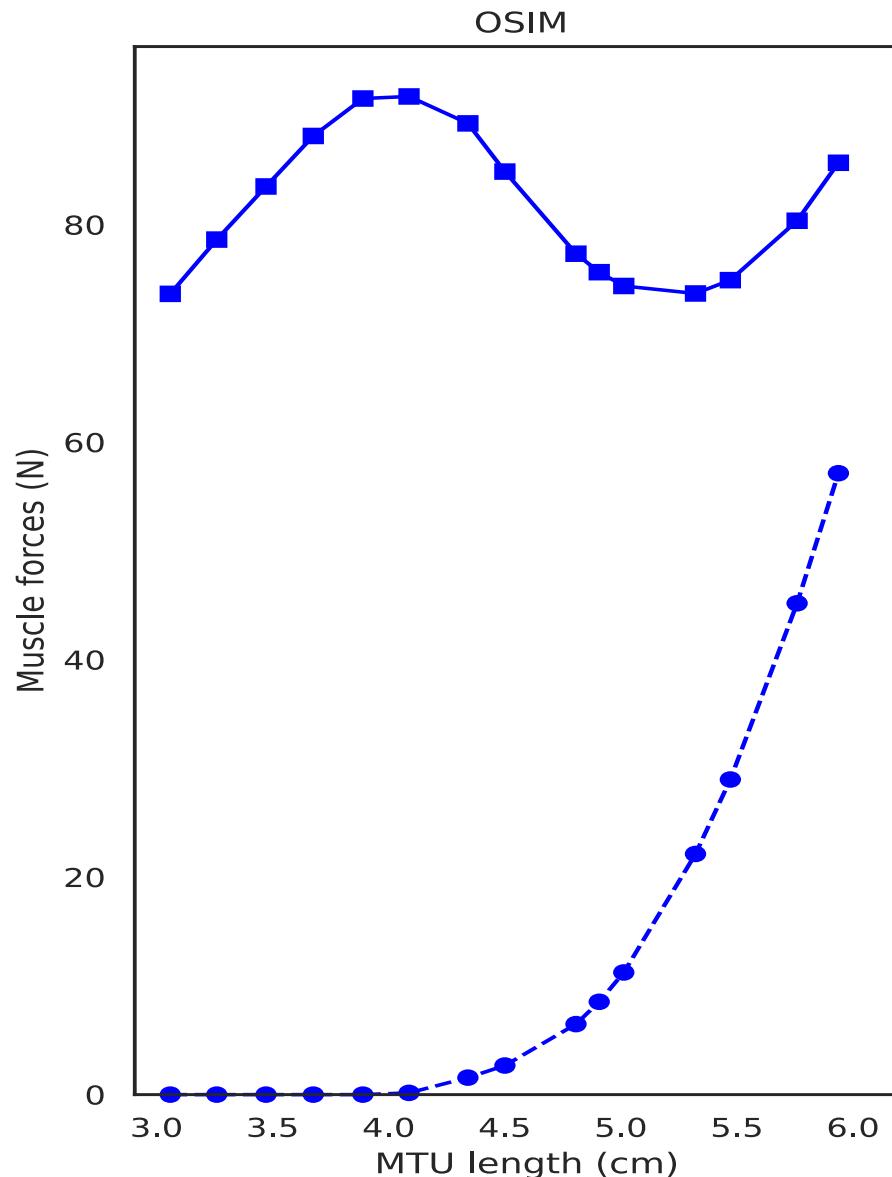
Muscle specific force comparison before/after optimization

obl_cap_sup



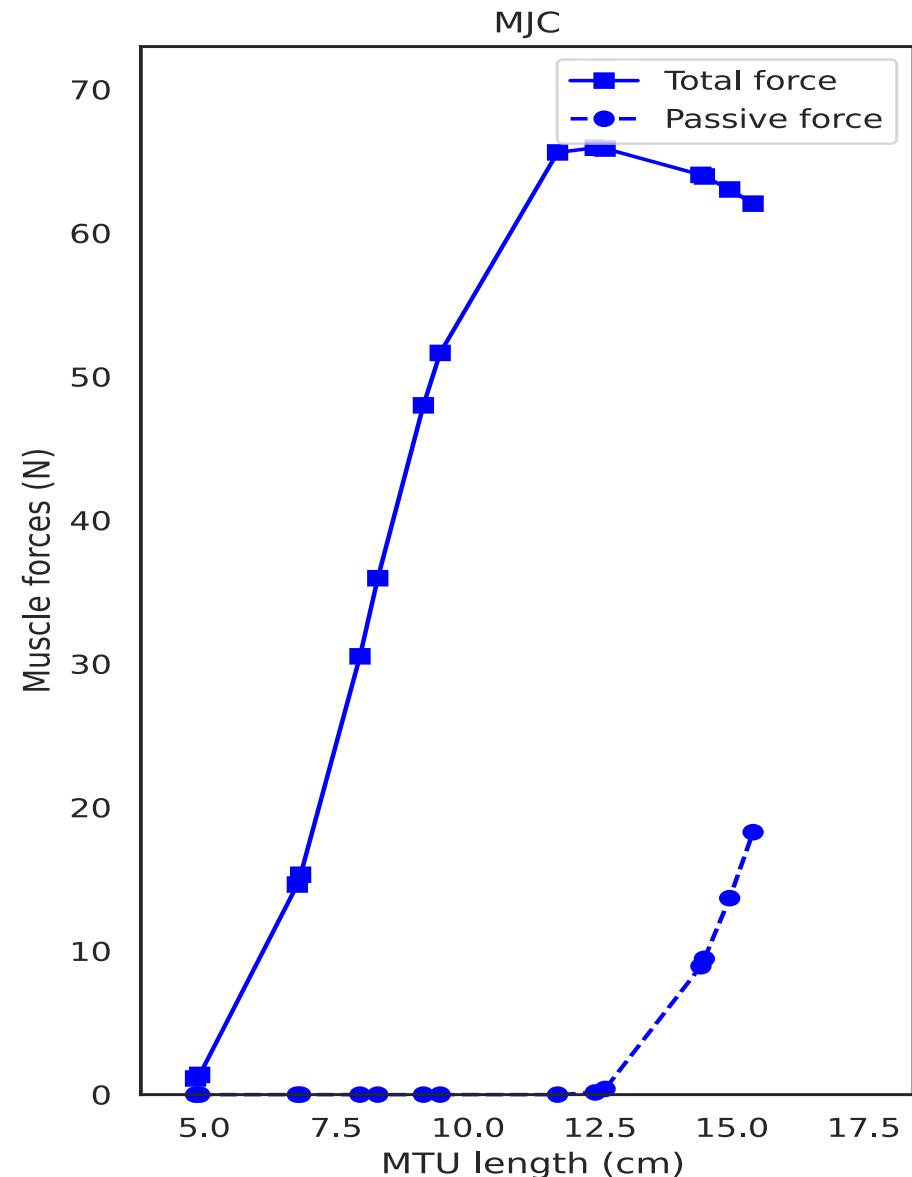
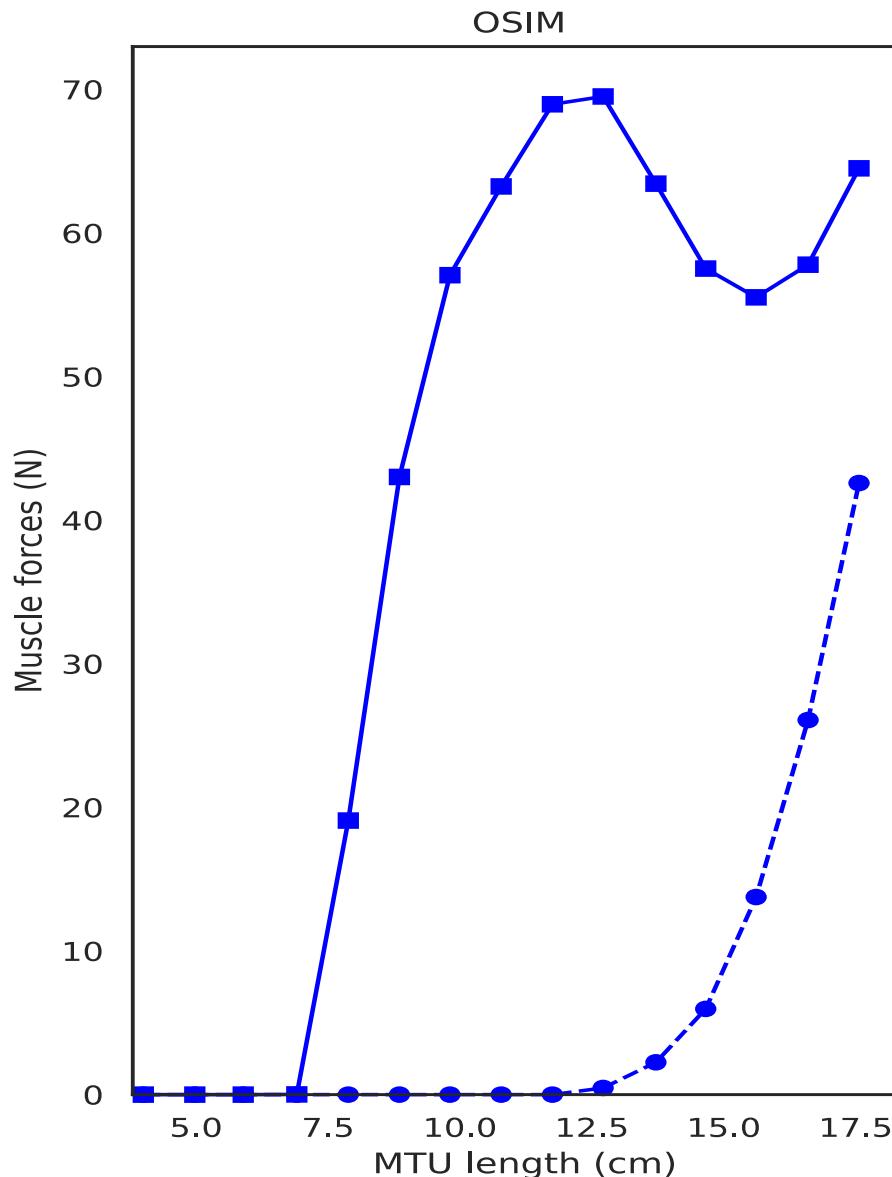
Muscle specific force comparison before/after optimization

Geniohyoid_L



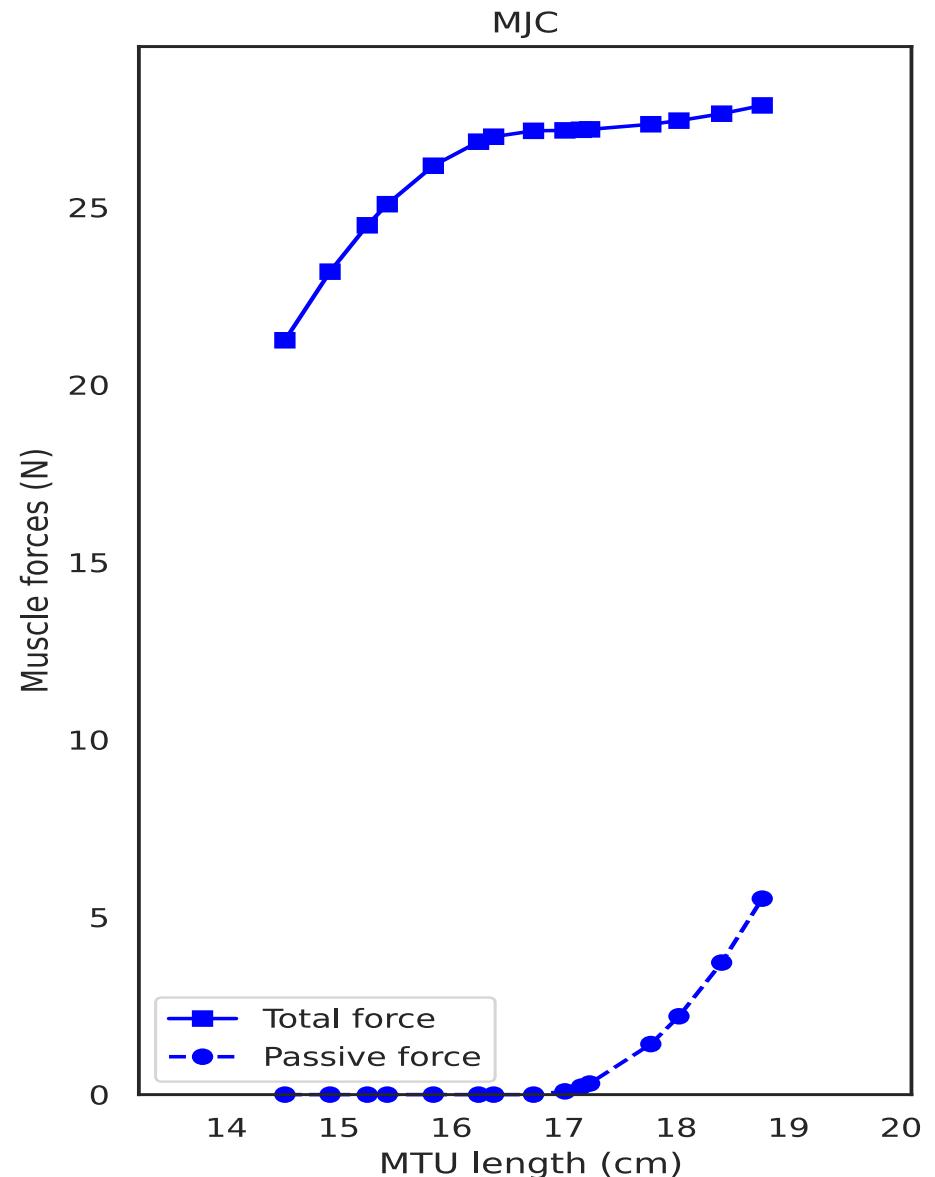
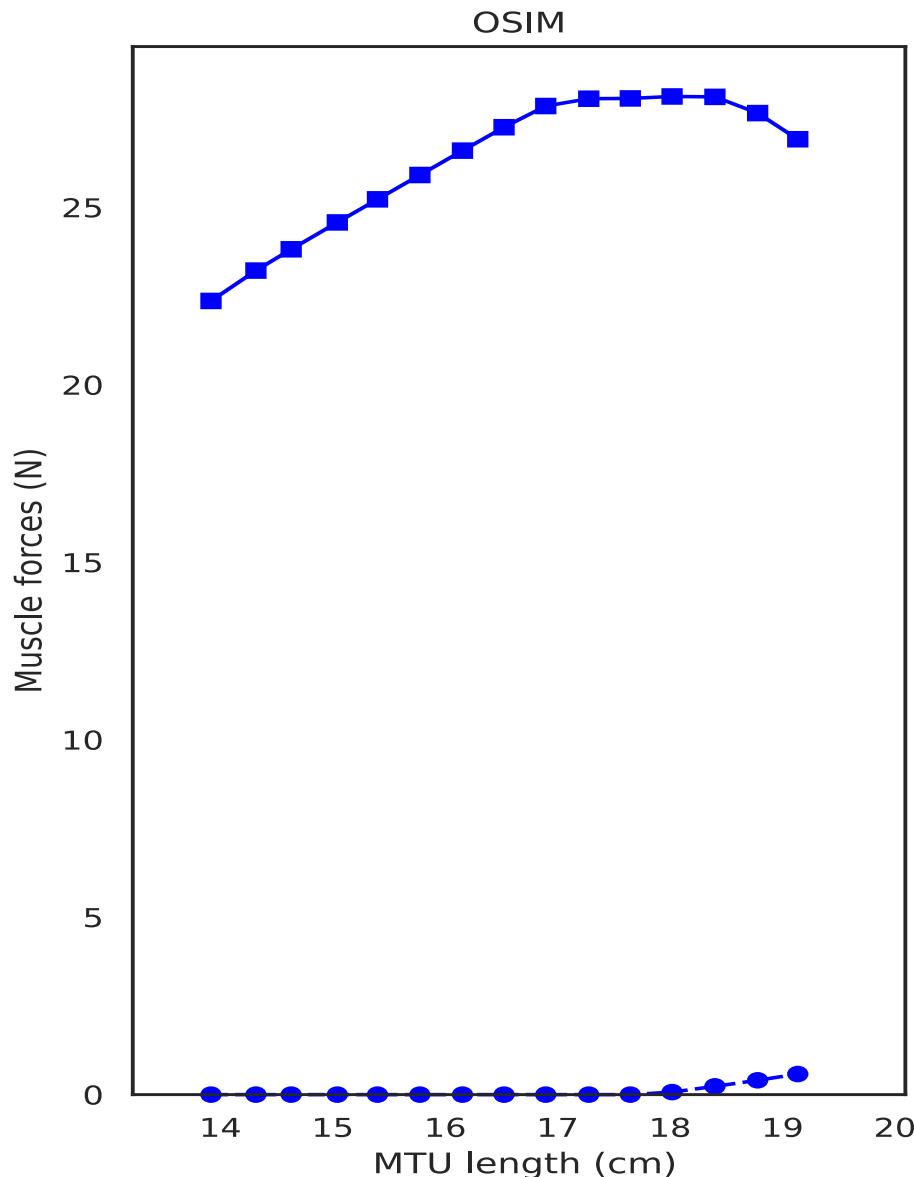
Muscle specific force comparison before/after optimization

splen_cap_sklc6_L



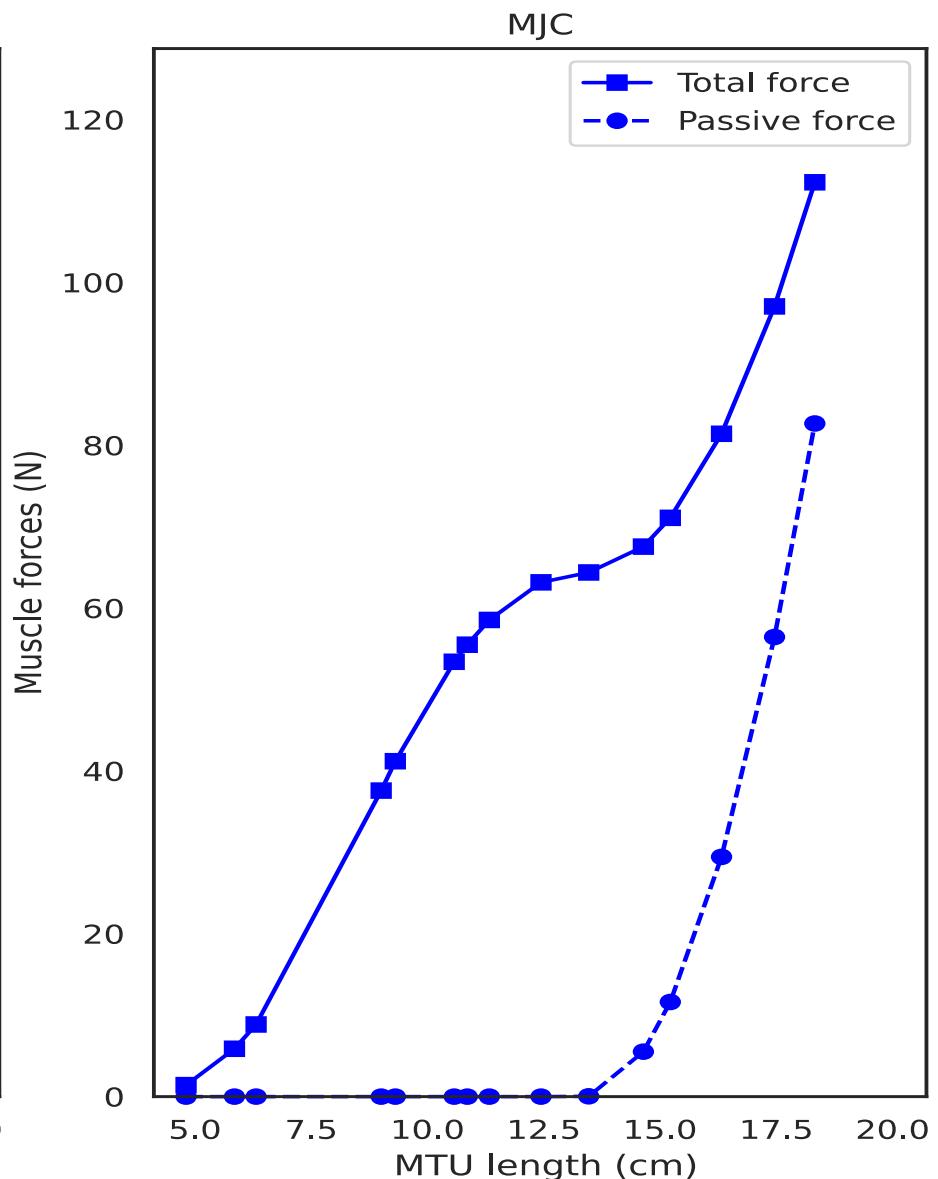
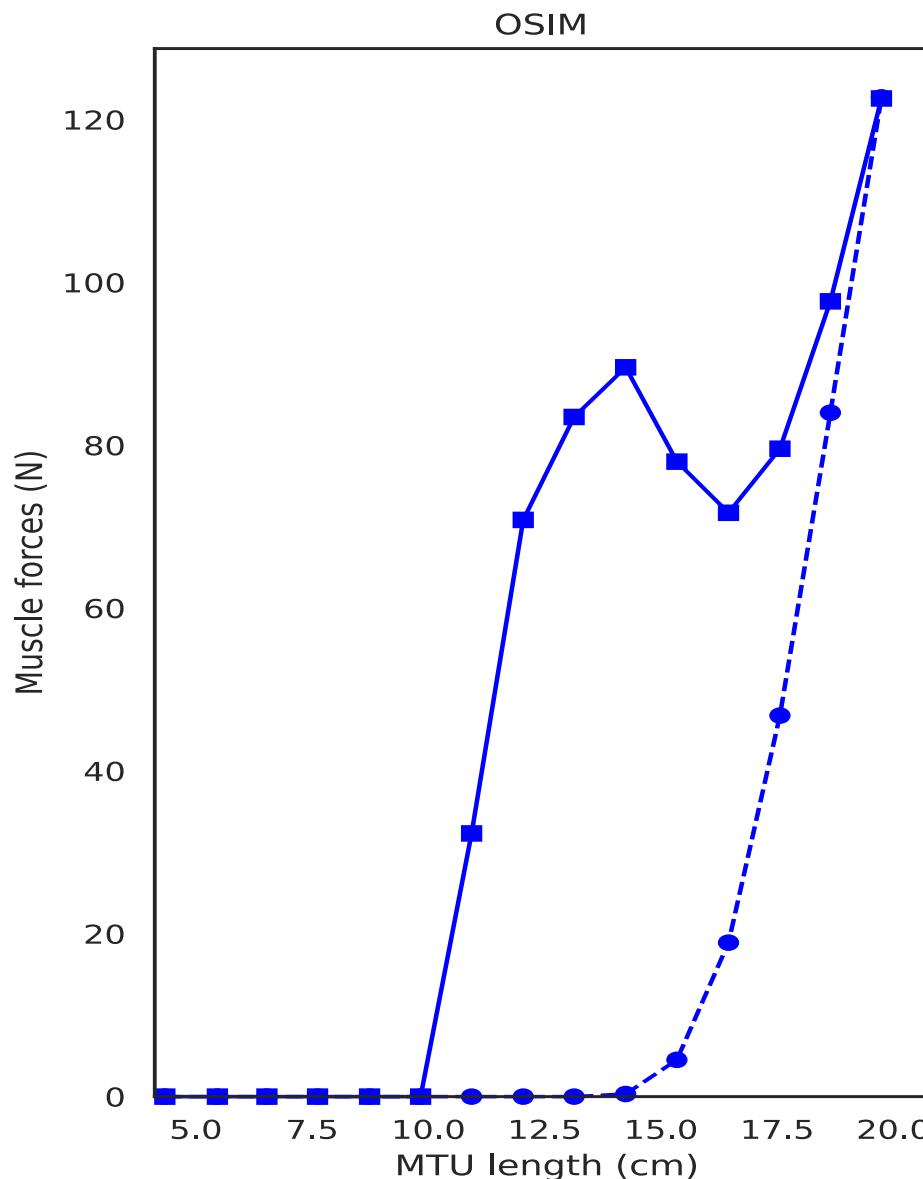
Muscle specific force comparison before/after optimization

longissi_cerv_c4thx_L



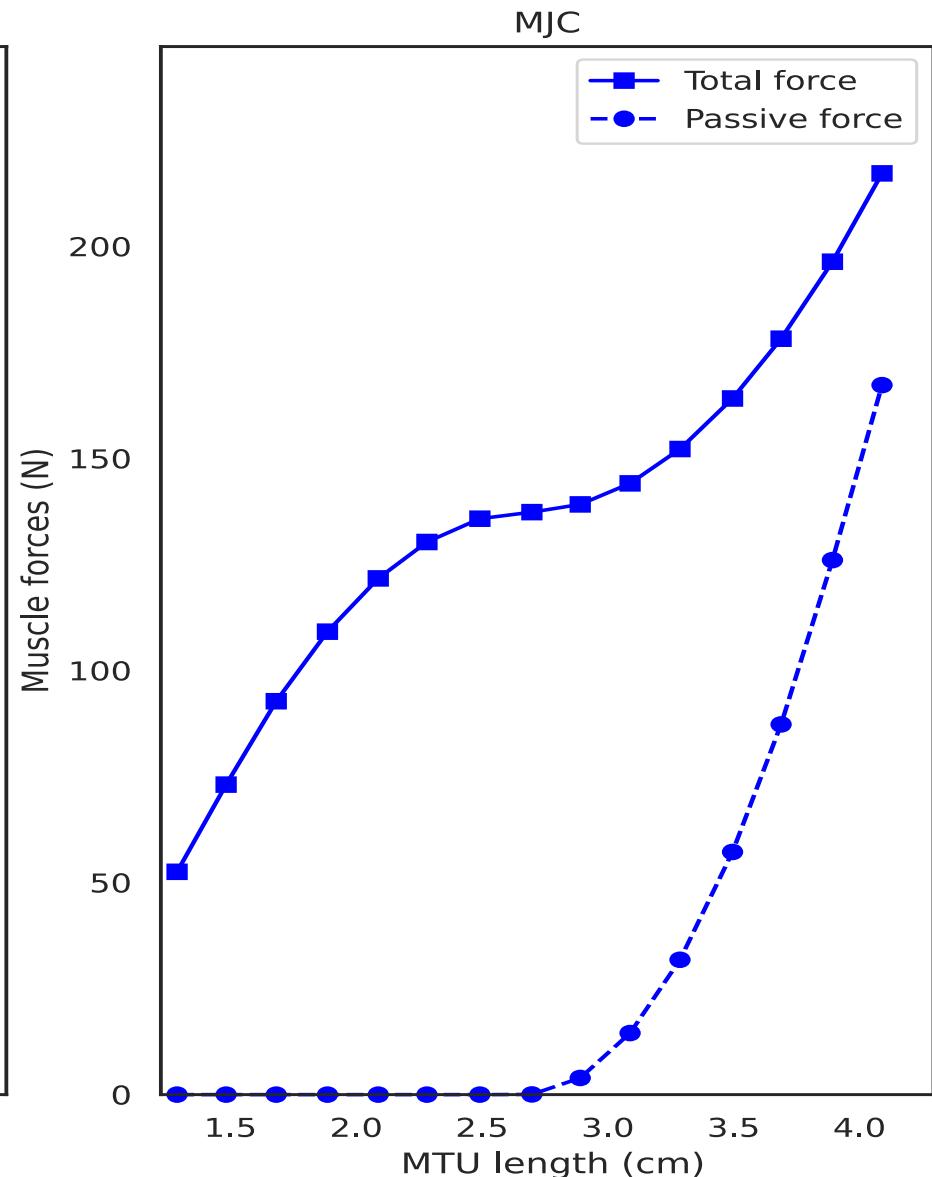
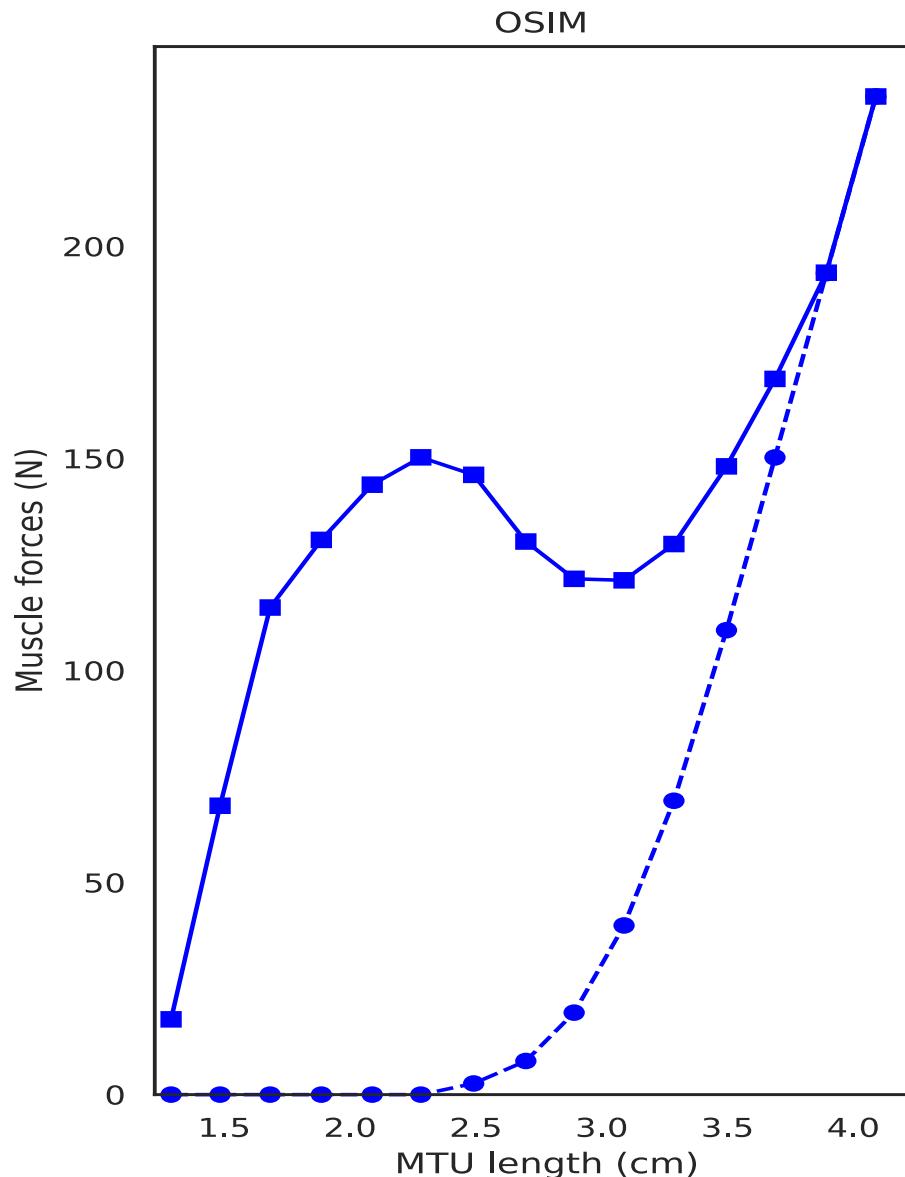
Muscle specific force comparison before/after optimization

semi_cap_sklthx



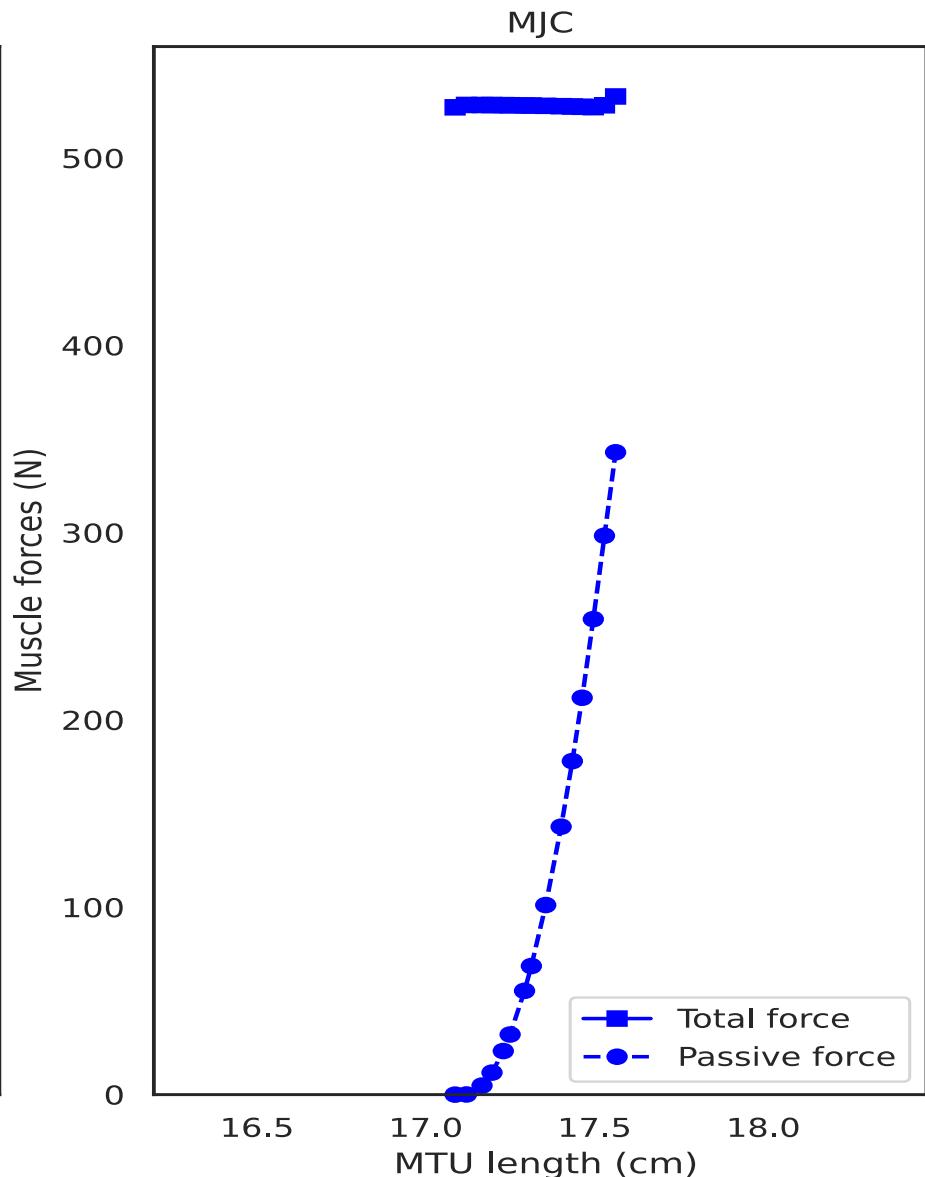
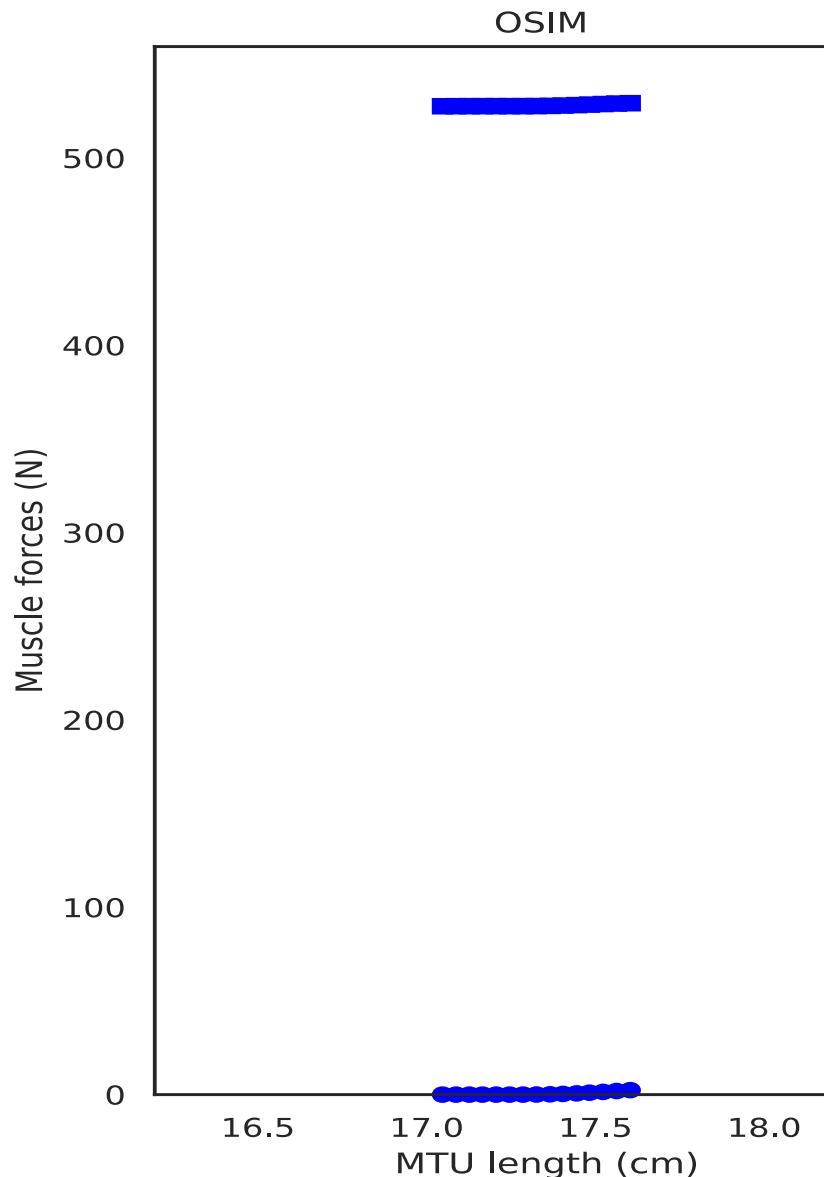
Muscle specific force comparison before/after optimization

Mylohyoid_Ant_L



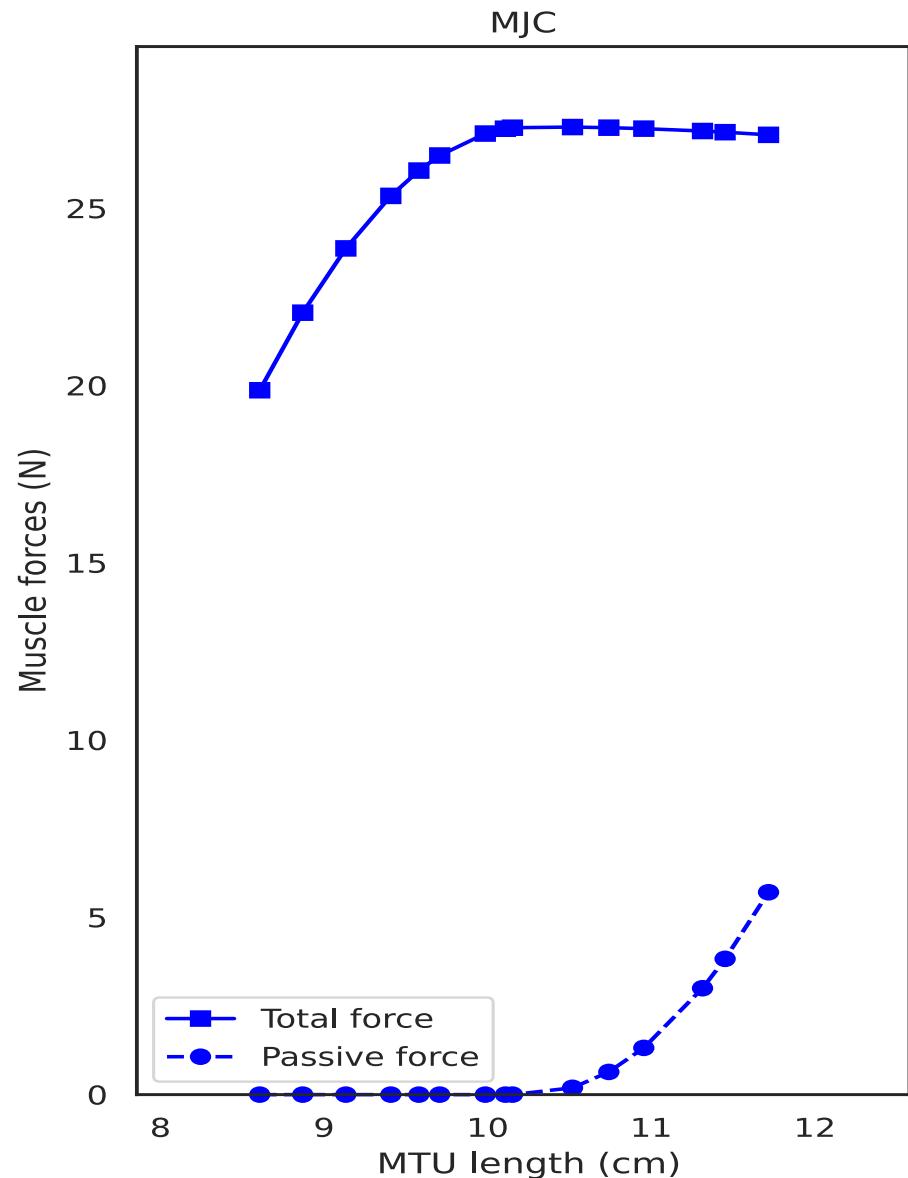
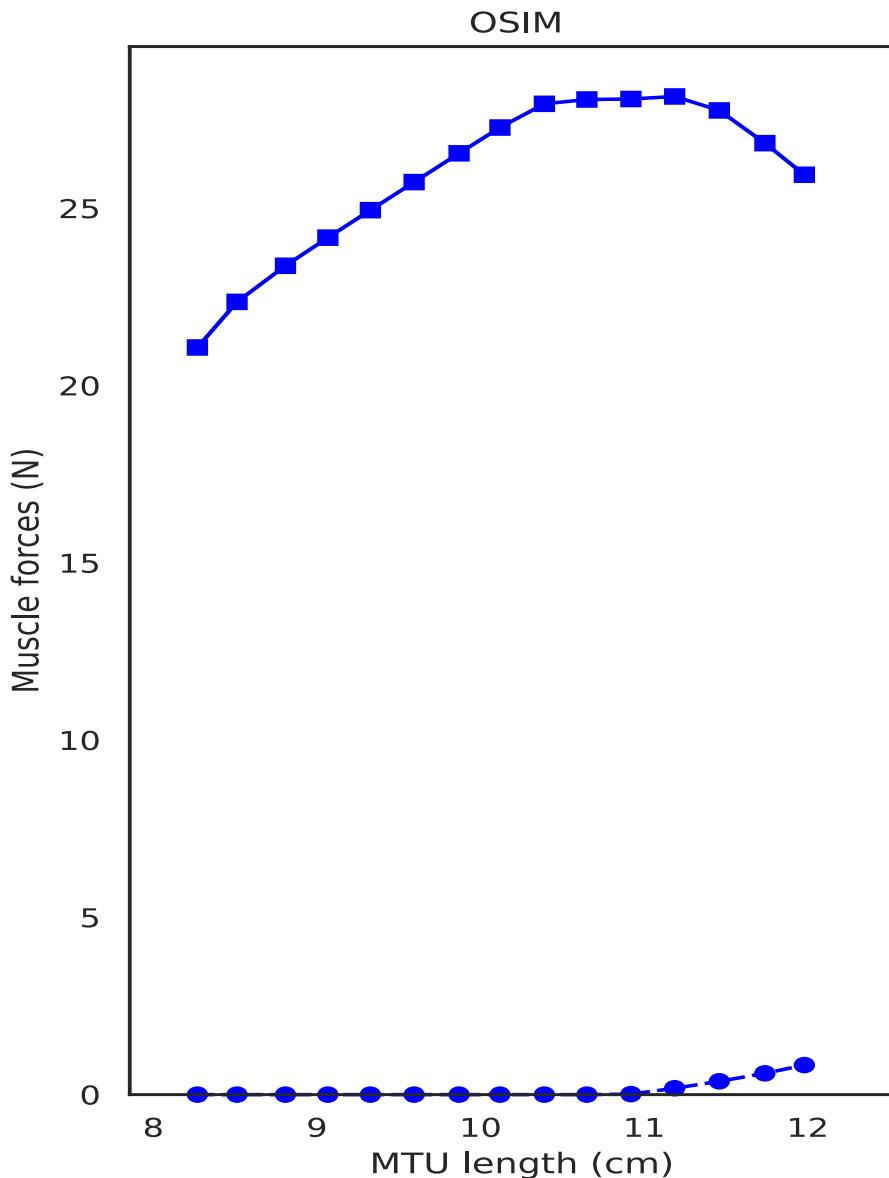
Muscle specific force comparison before/after optimization

trap_acr_L



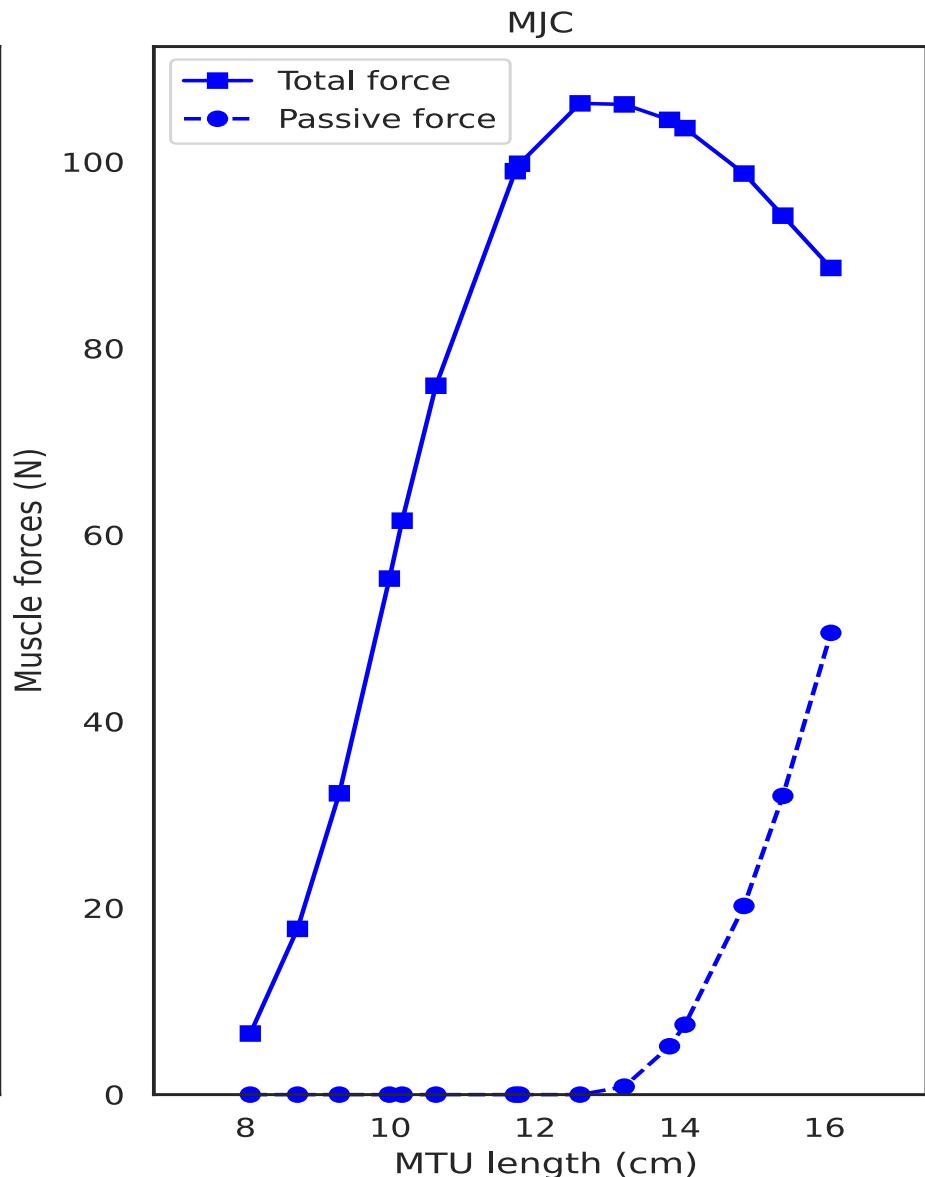
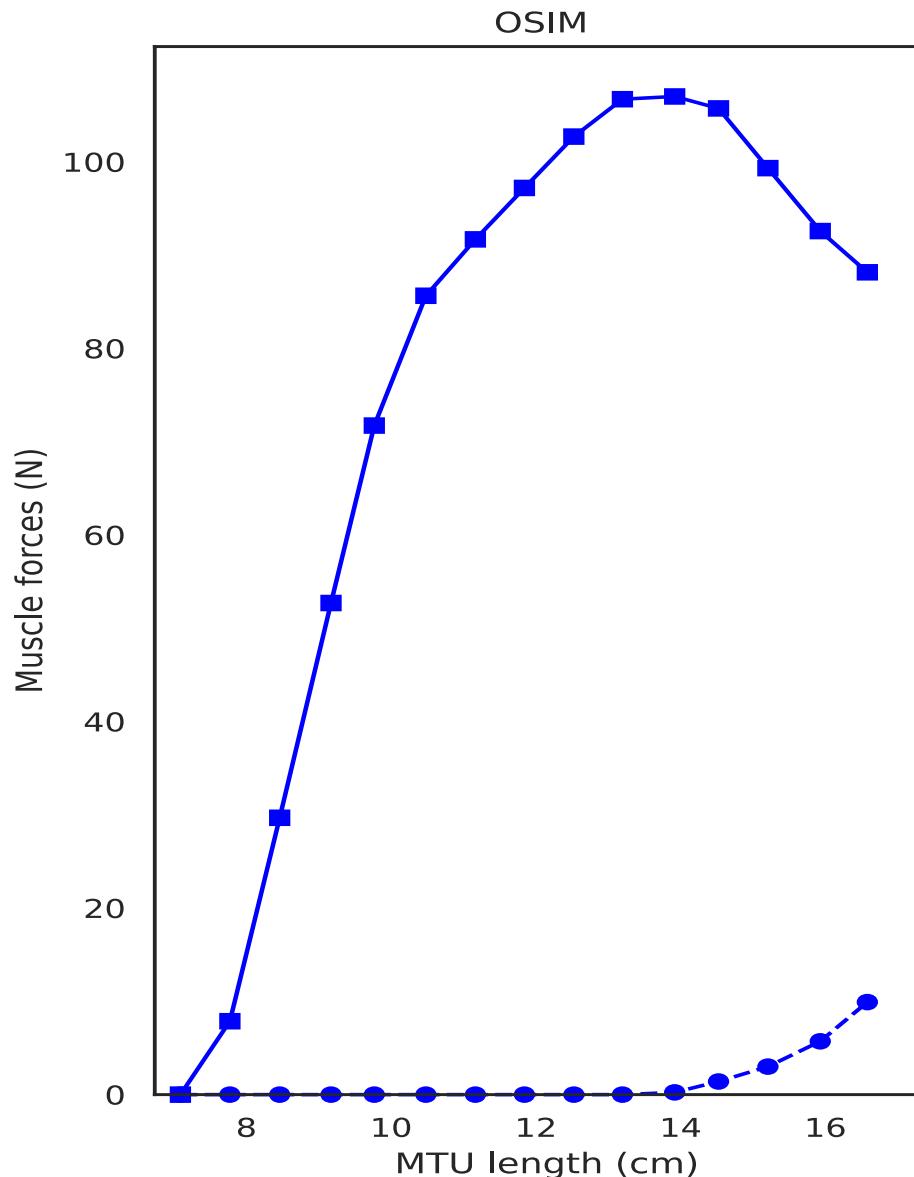
Muscle specific force comparison before/after optimization

iliocost_cerv_c5rib_L



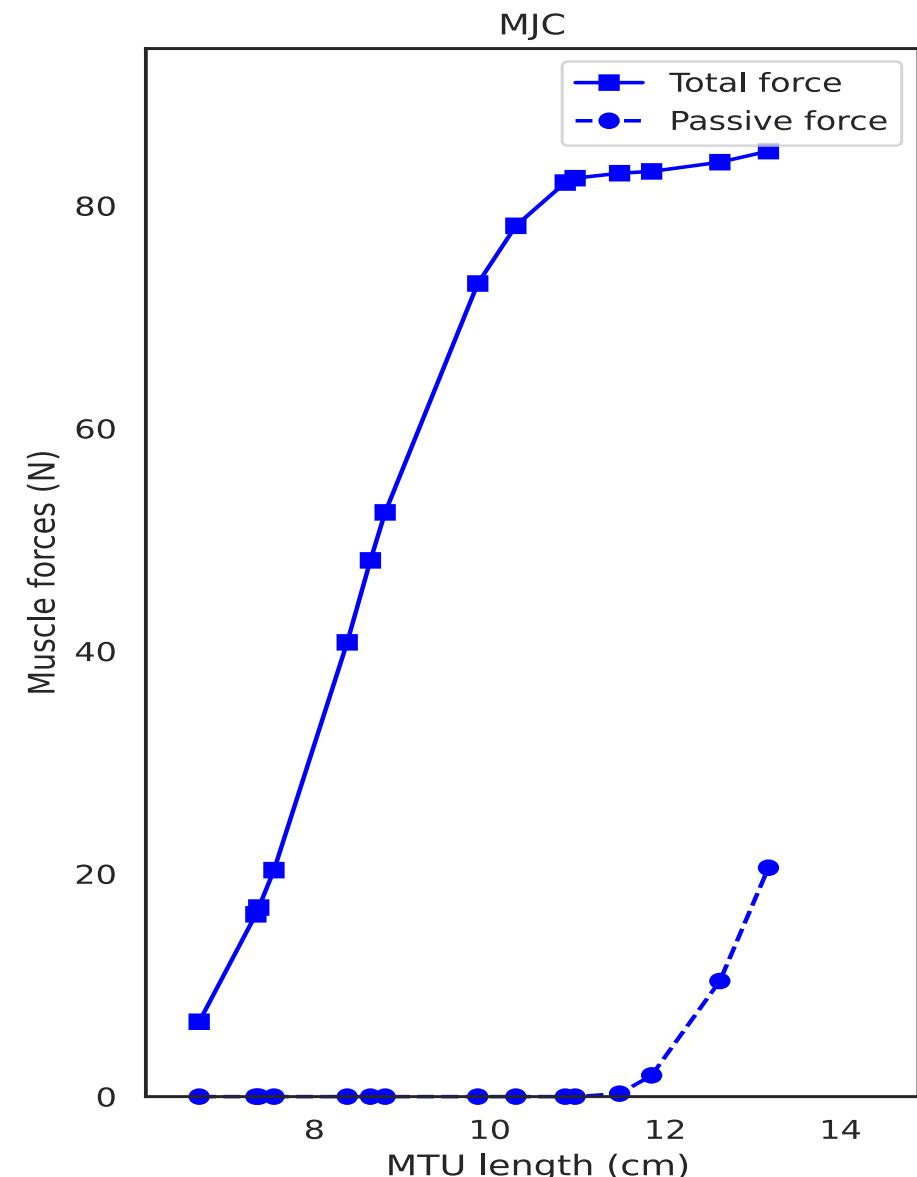
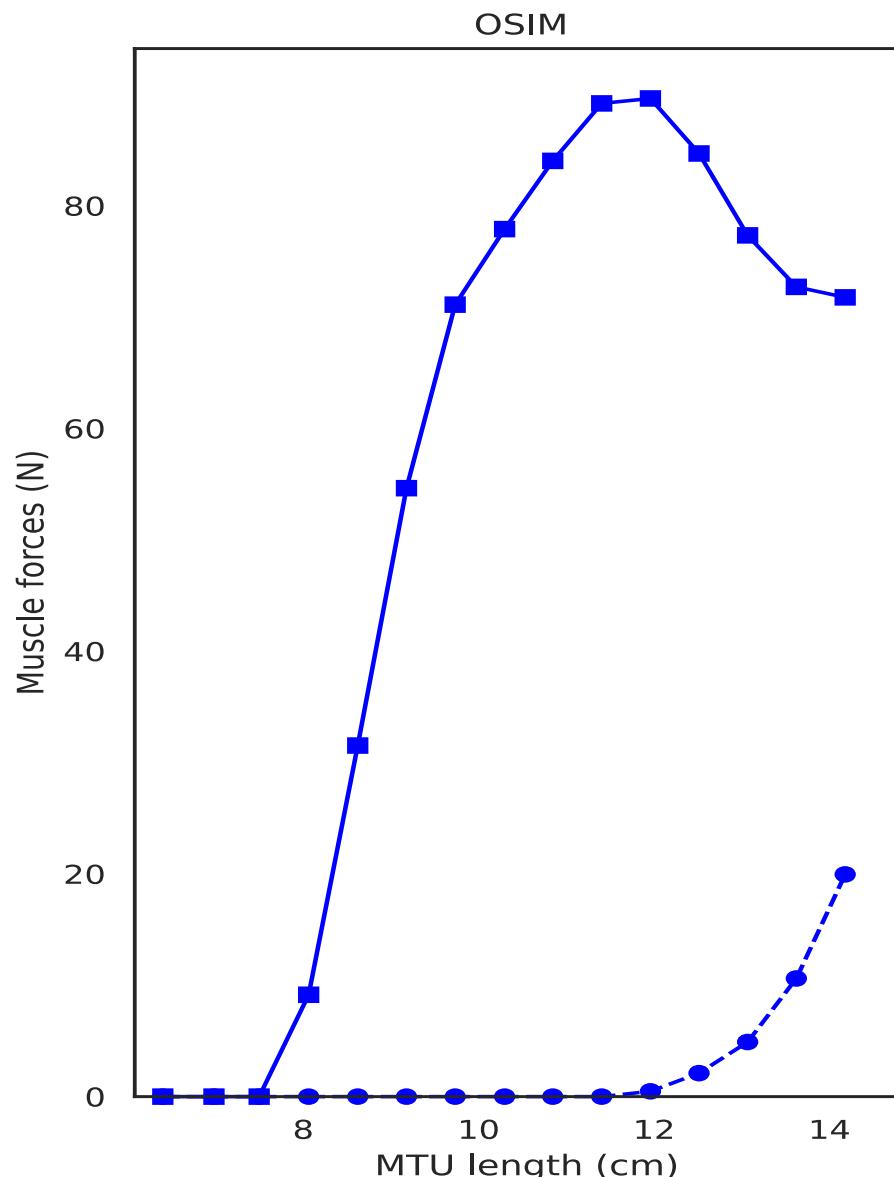
Muscle specific force comparison before/after optimization

levator_scap_L



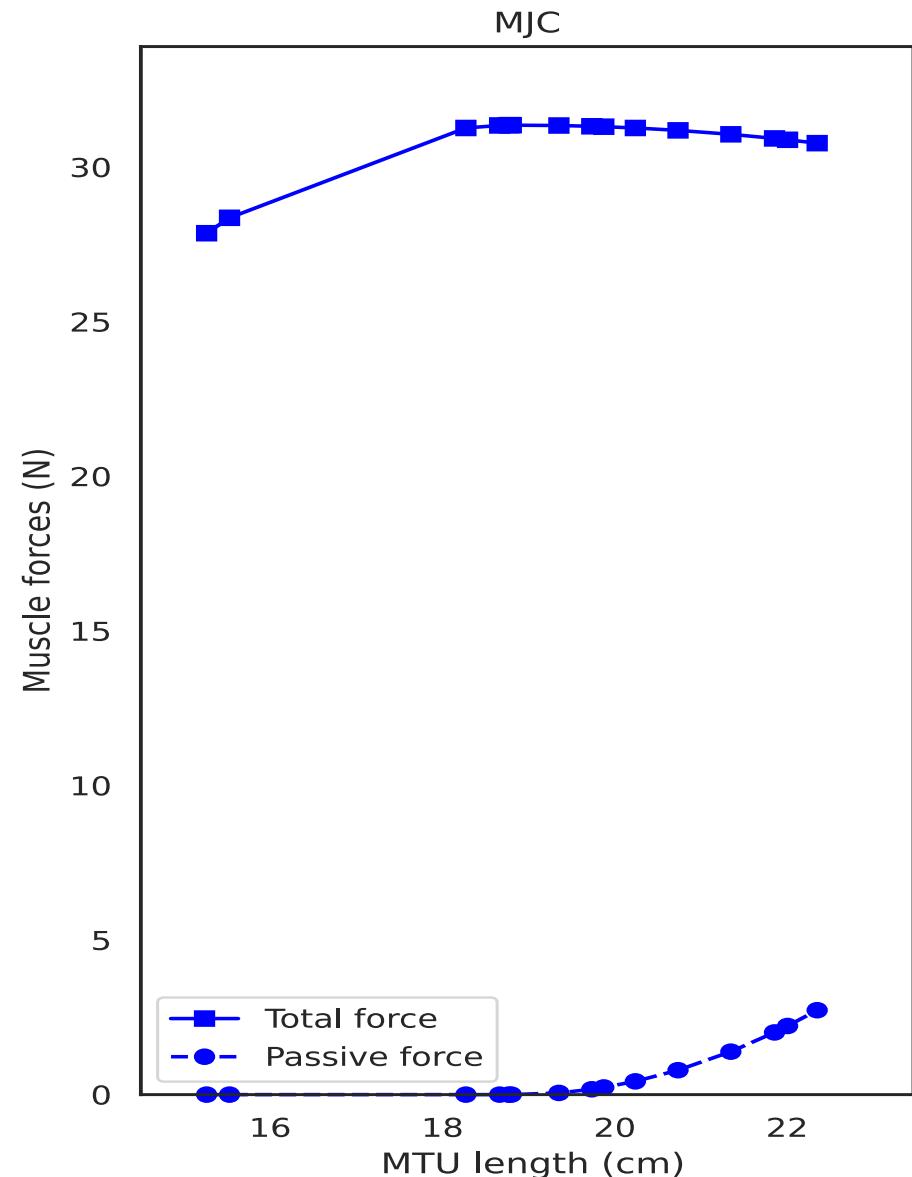
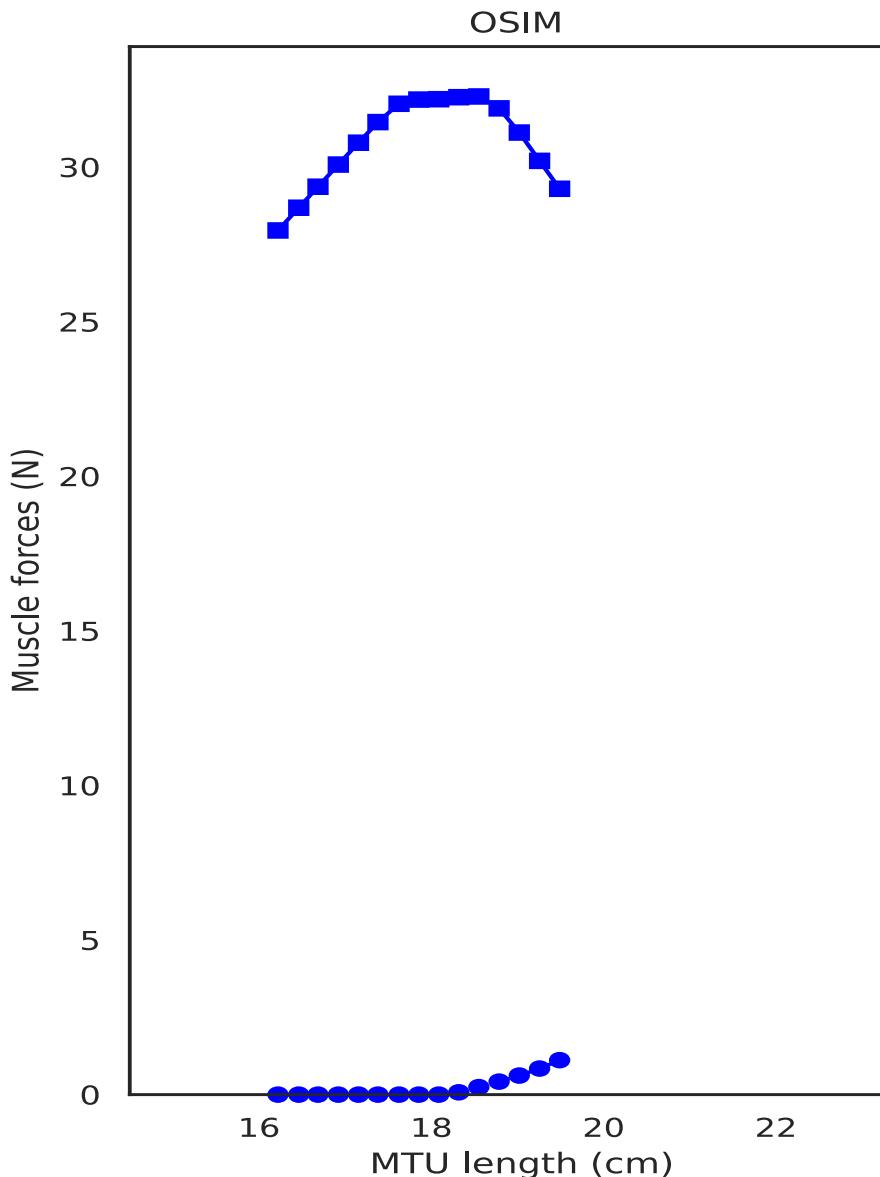
Muscle specific force comparison before/after optimization

semi_cap_sklc5_L



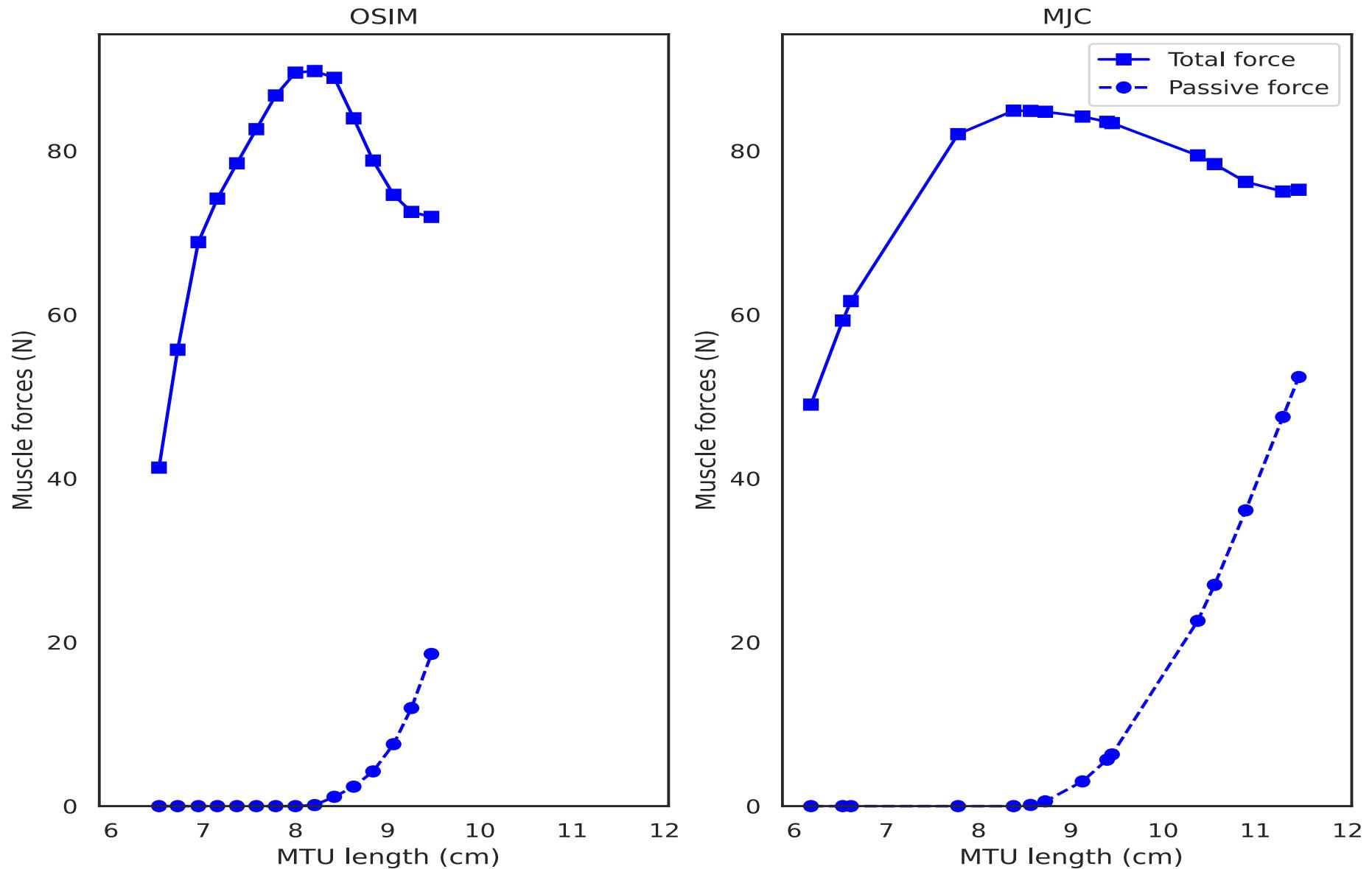
Muscle specific force comparison before/after optimization

long_col_c1thx



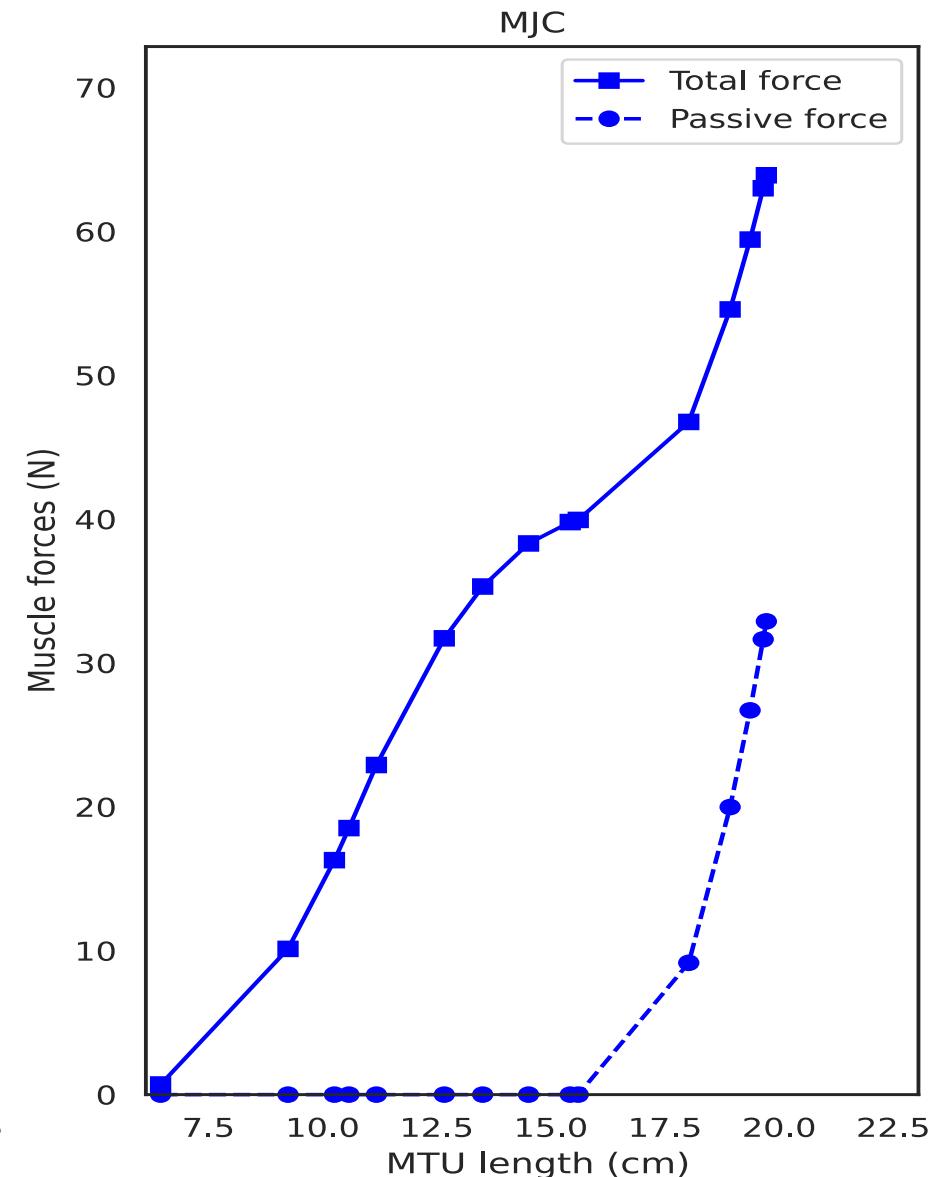
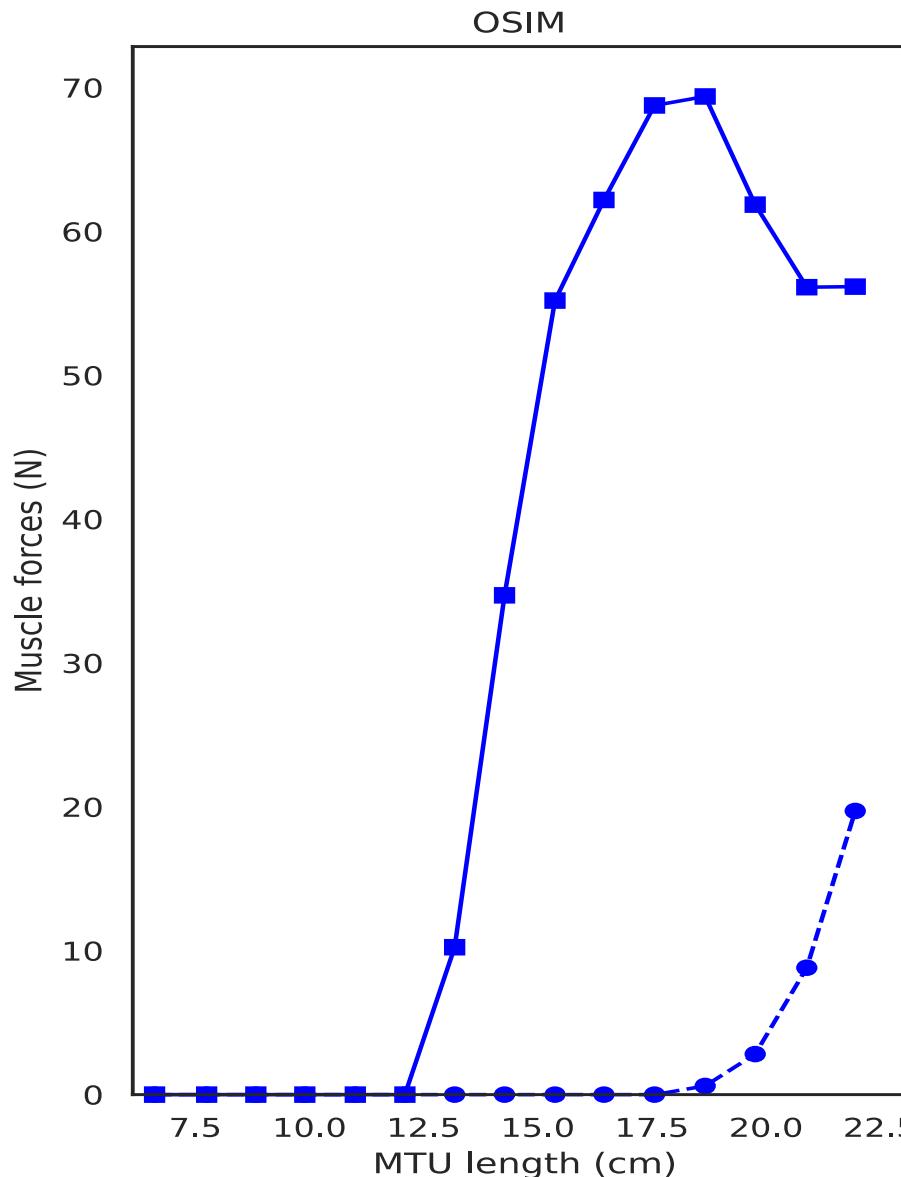
Muscle specific force comparison before/after optimization

long_cap_sklc4_L



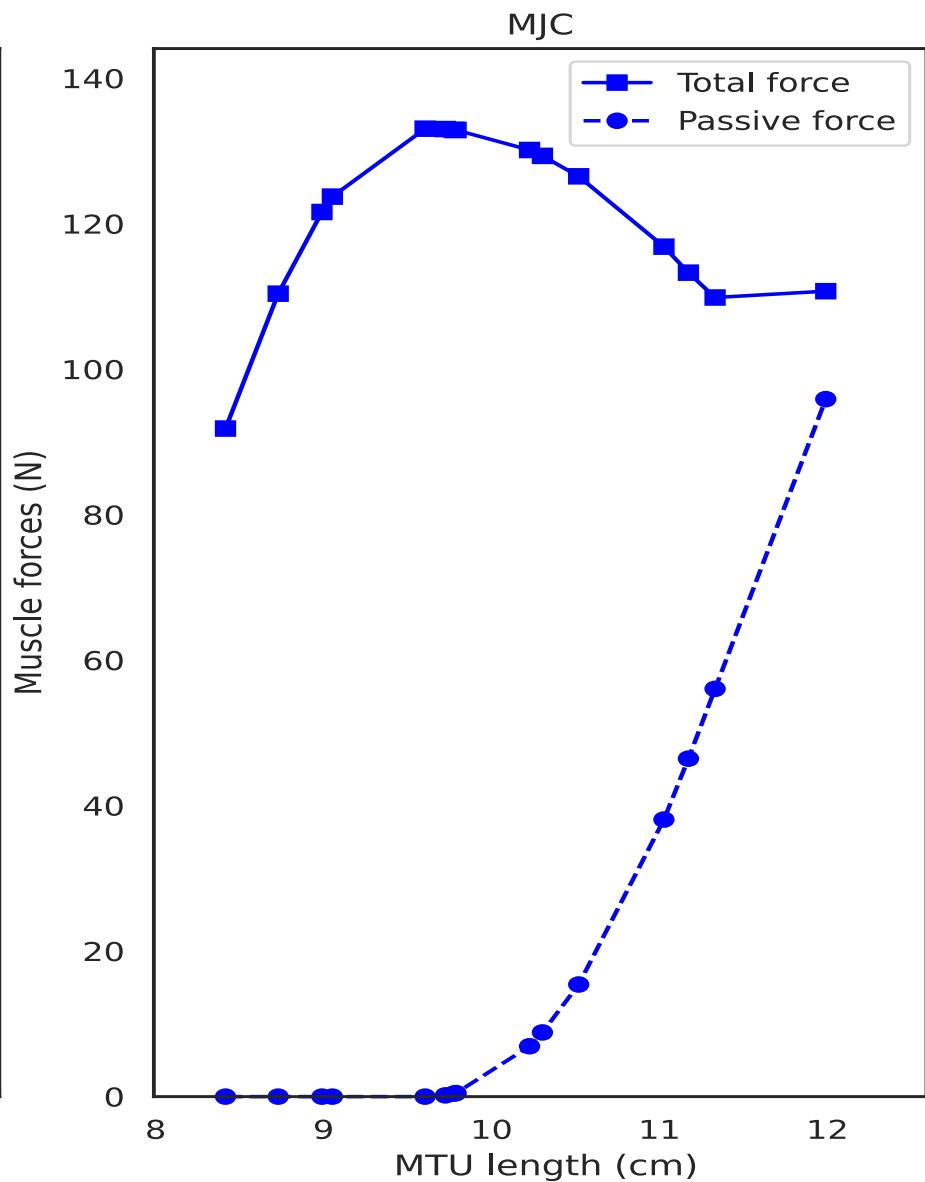
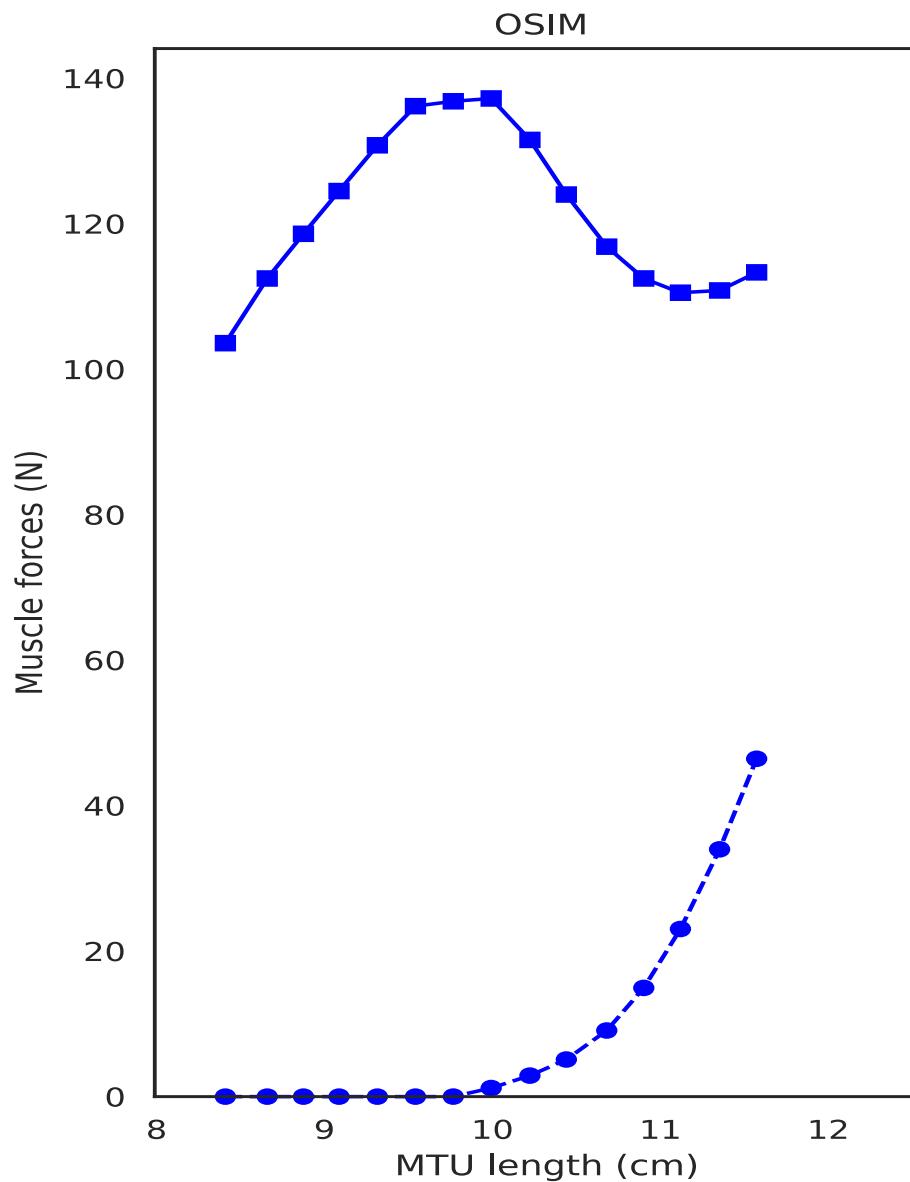
Muscle specific force comparison before/after optimization

splen_cap_sklthx



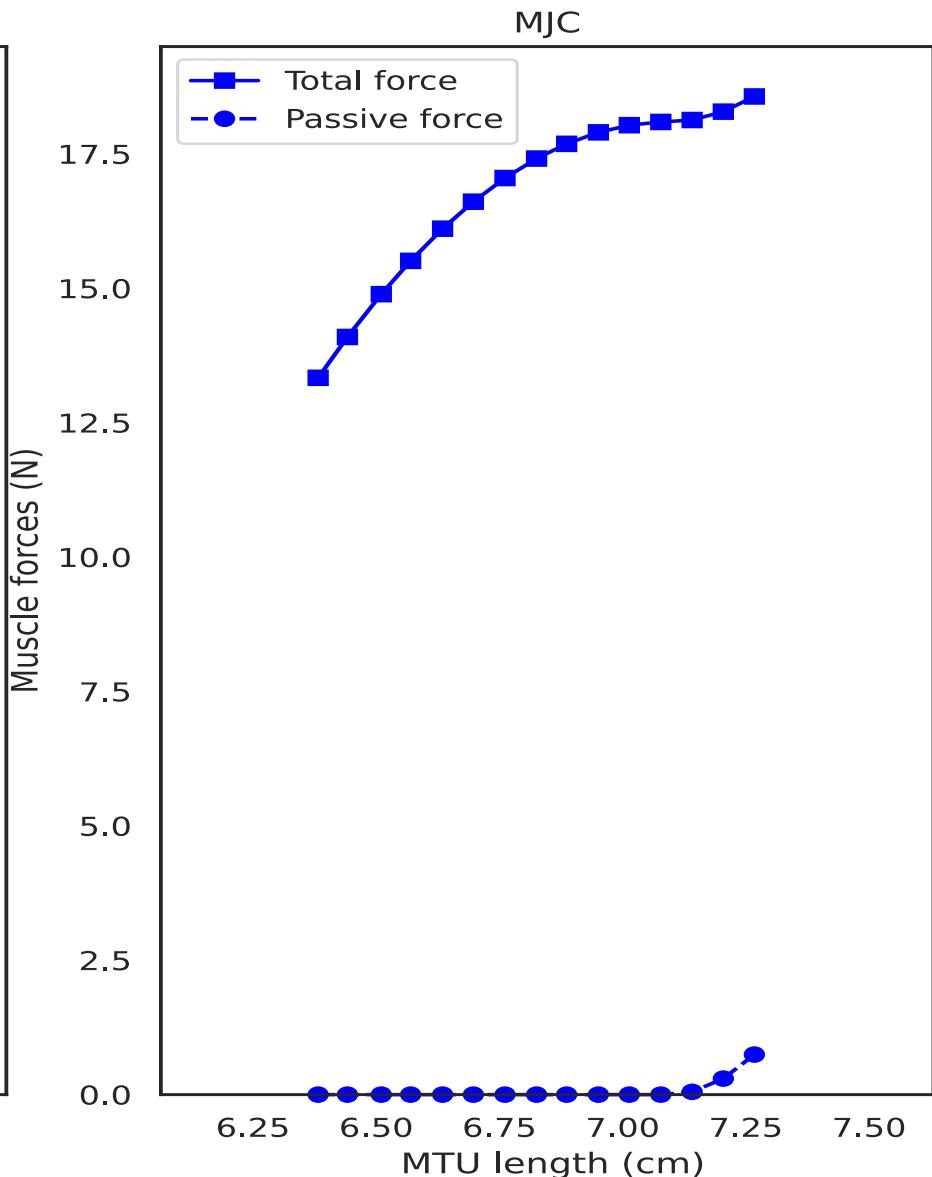
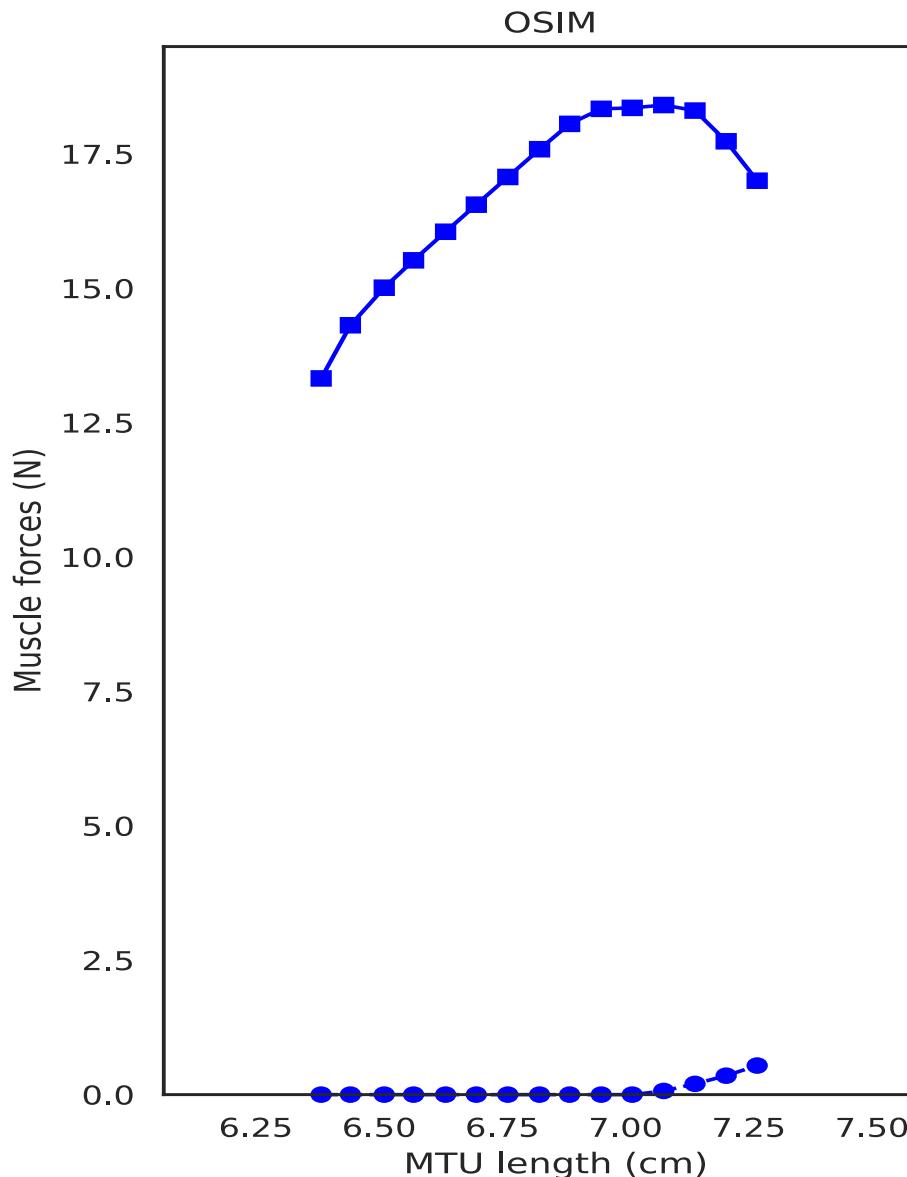
Muscle specific force comparison before/after optimization

scalenus_ant_L



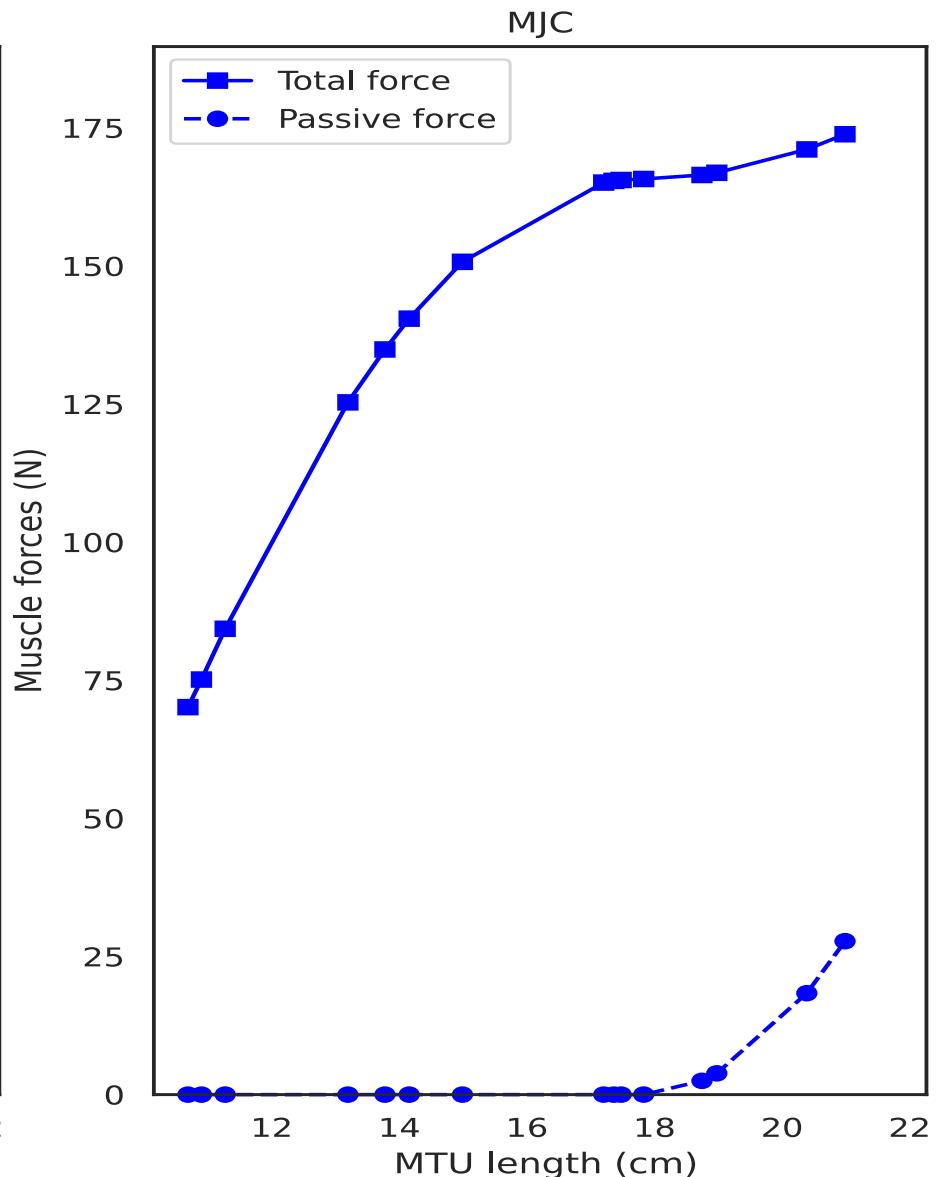
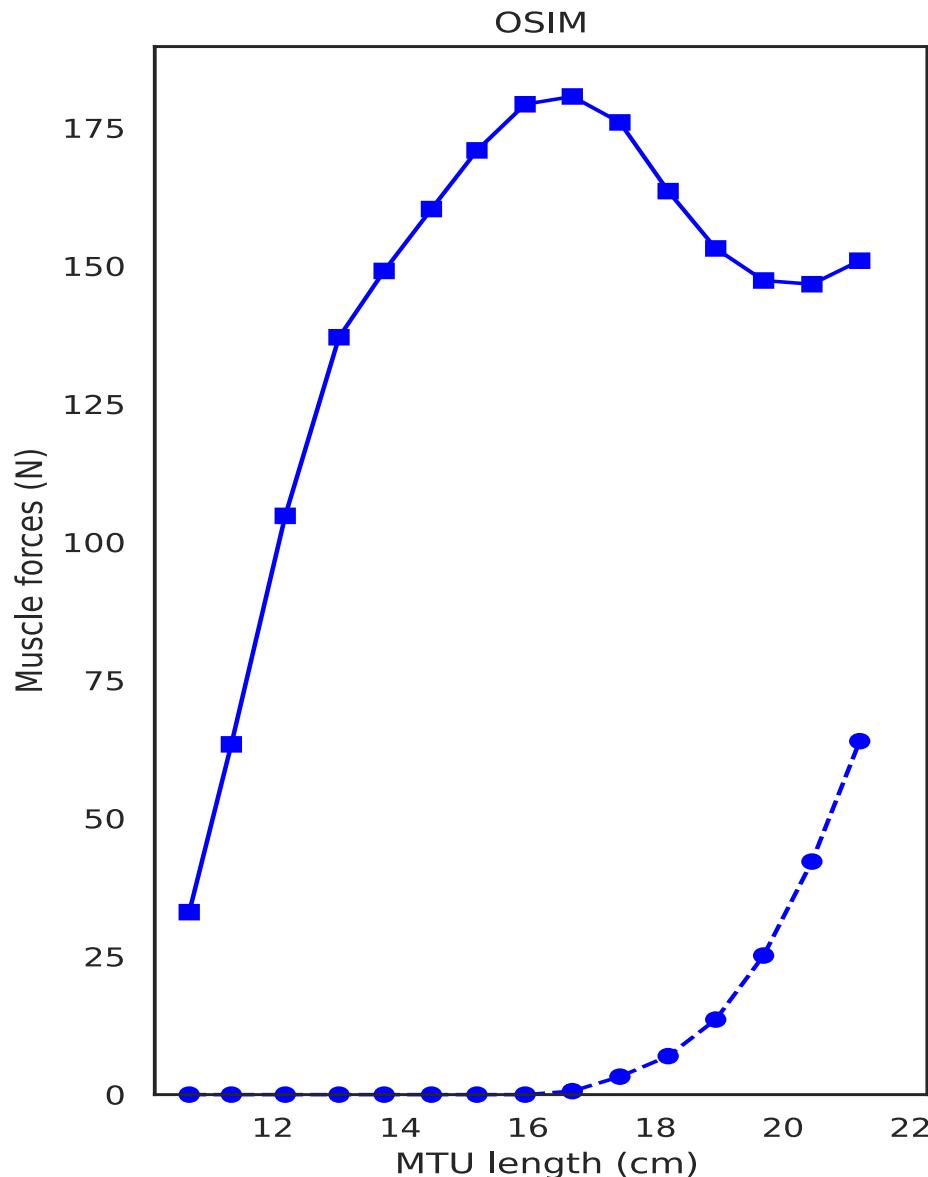
Muscle specific force comparison before/after optimization

Stylohyoid_Lat



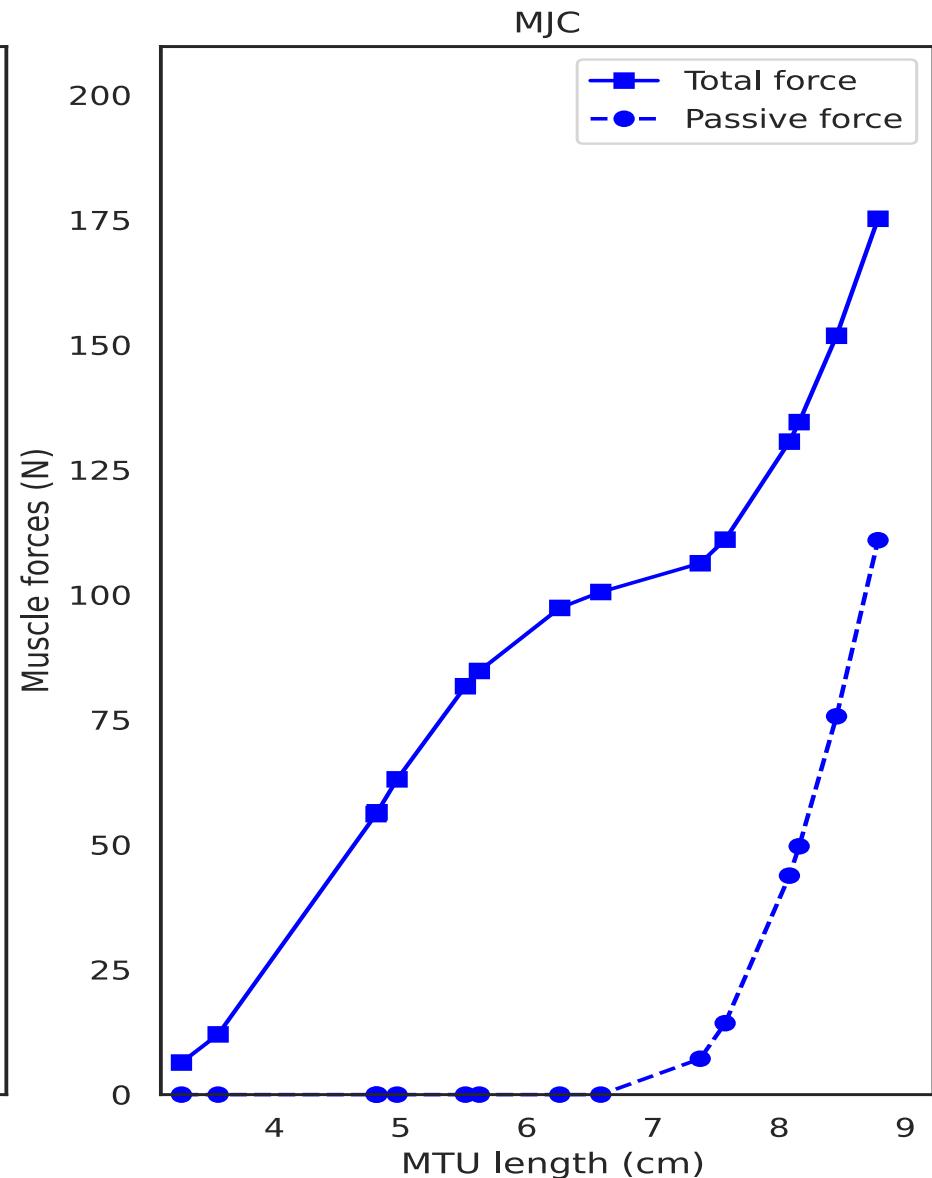
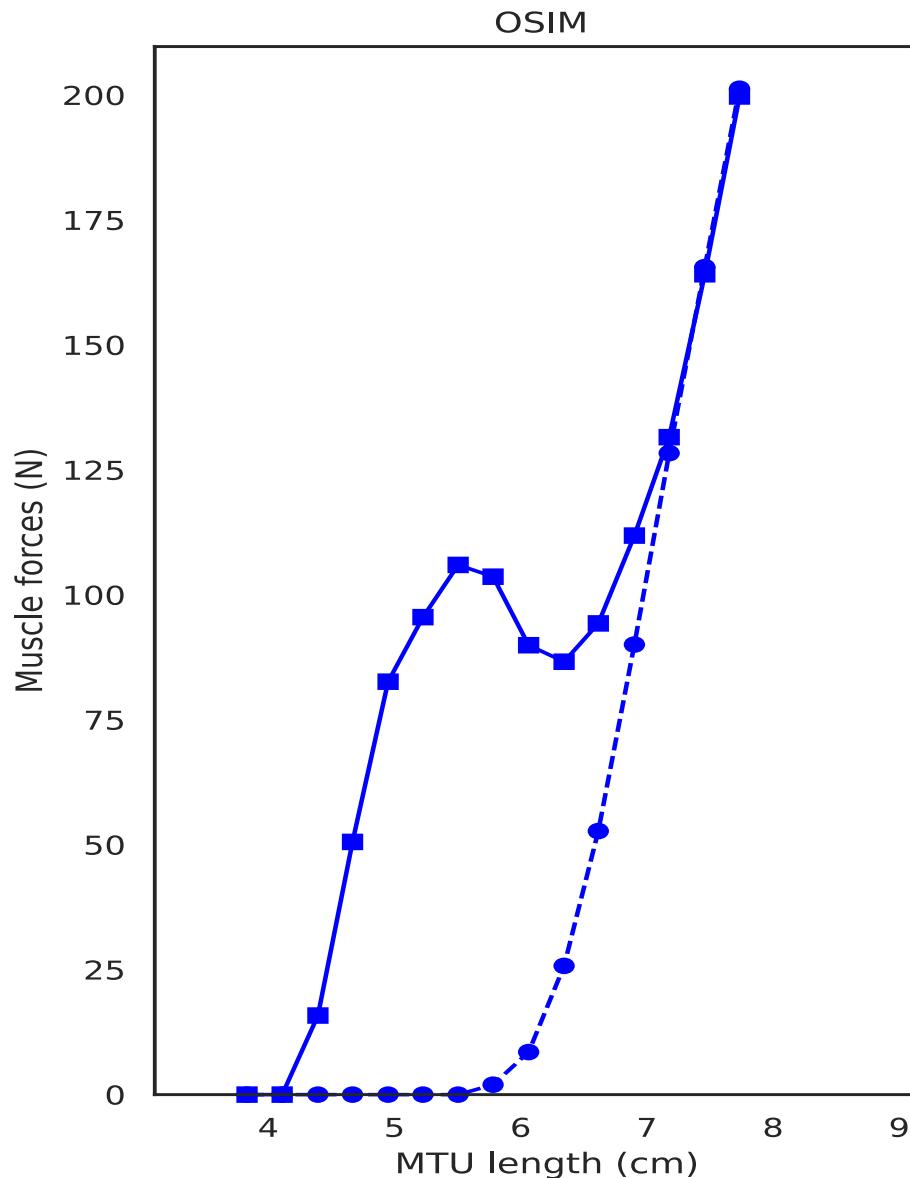
Muscle specific force comparison before/after optimization

stern_mast_L



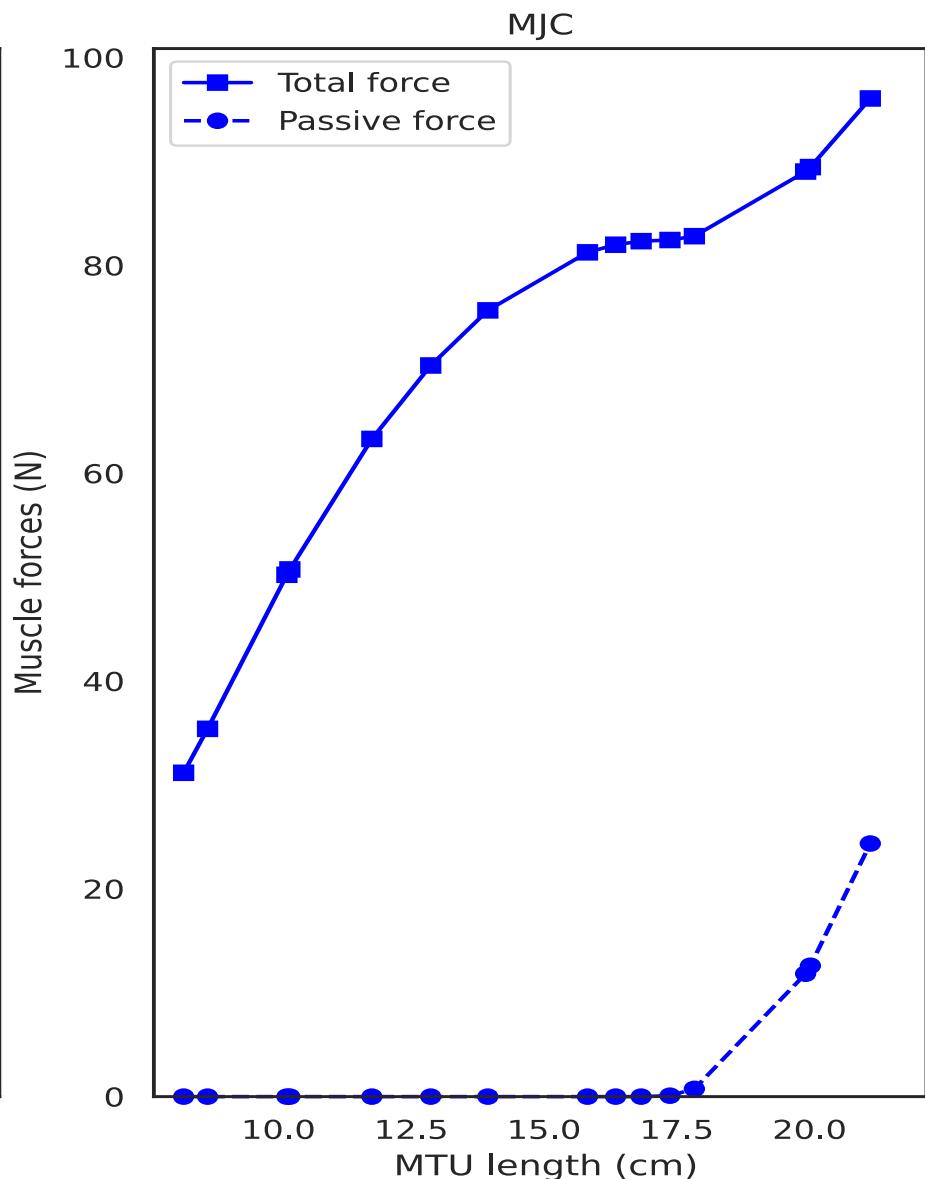
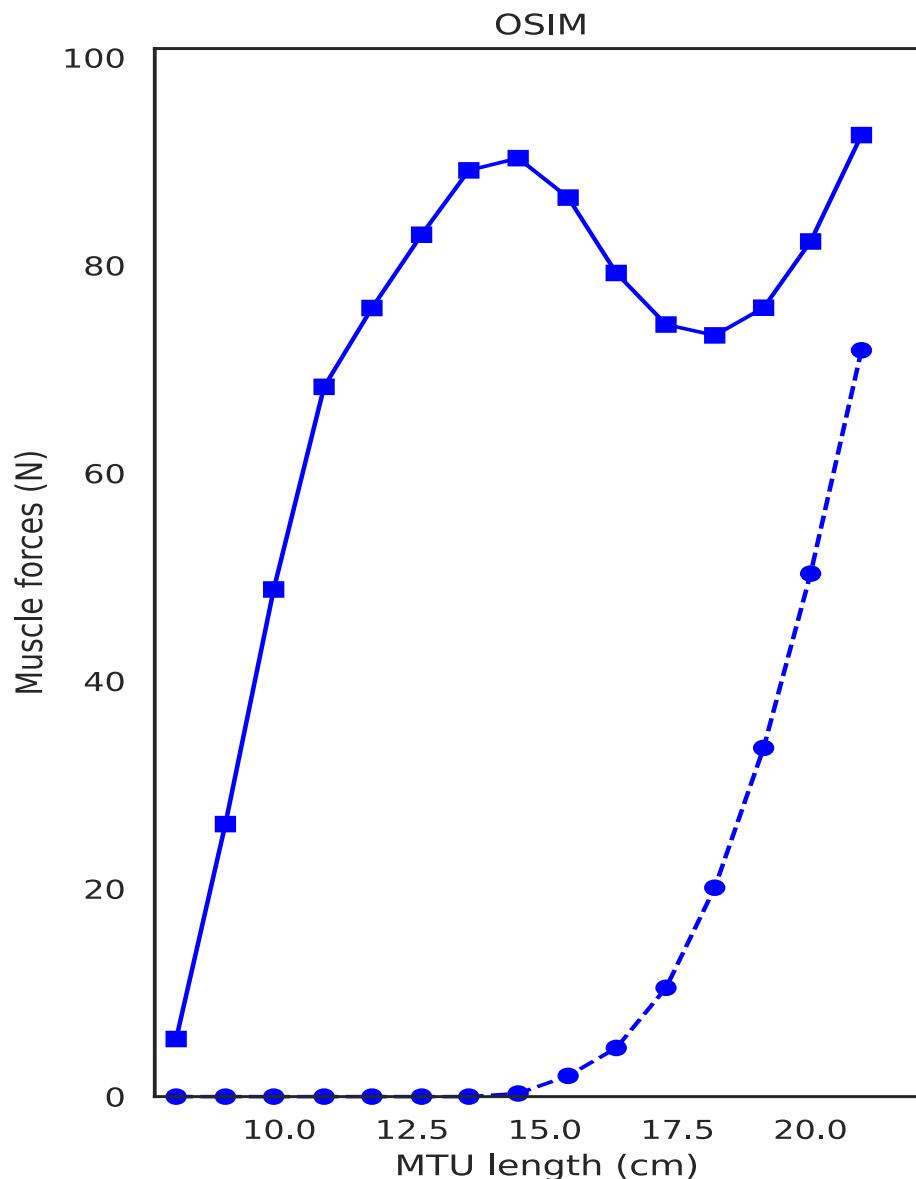
Muscle specific force comparison before/after optimization

digastric_post_L

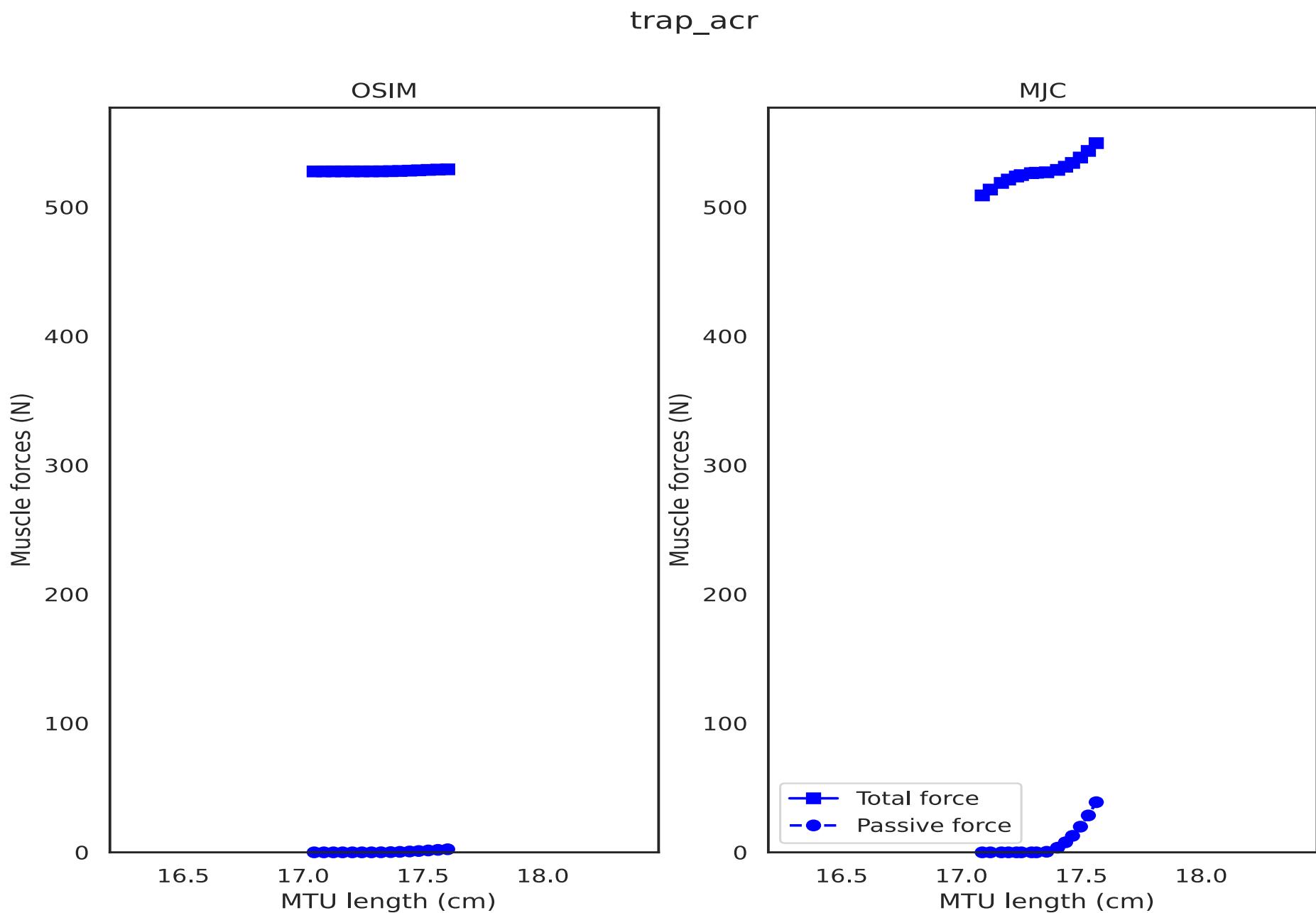


Muscle specific force comparison before/after optimization

cleid_mast

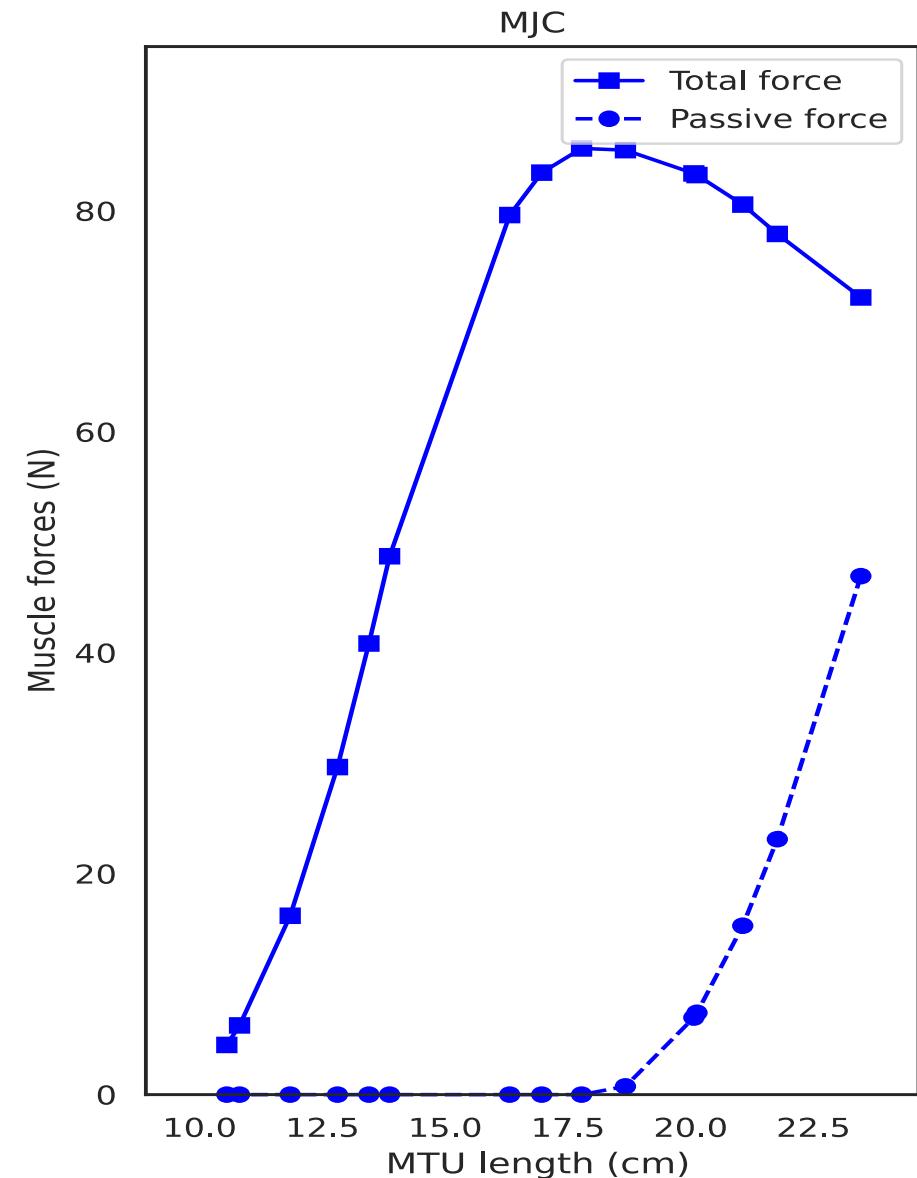
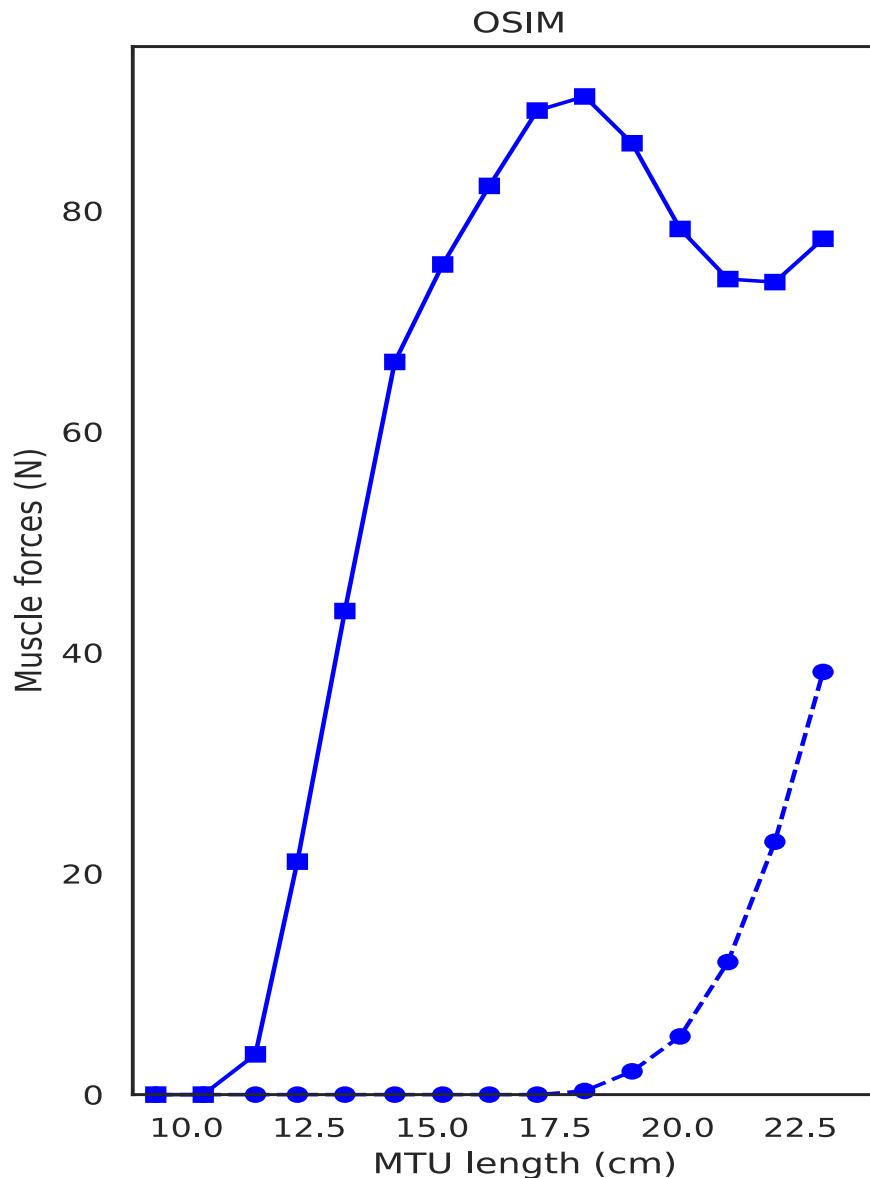


Muscle specific force comparison before/after optimization



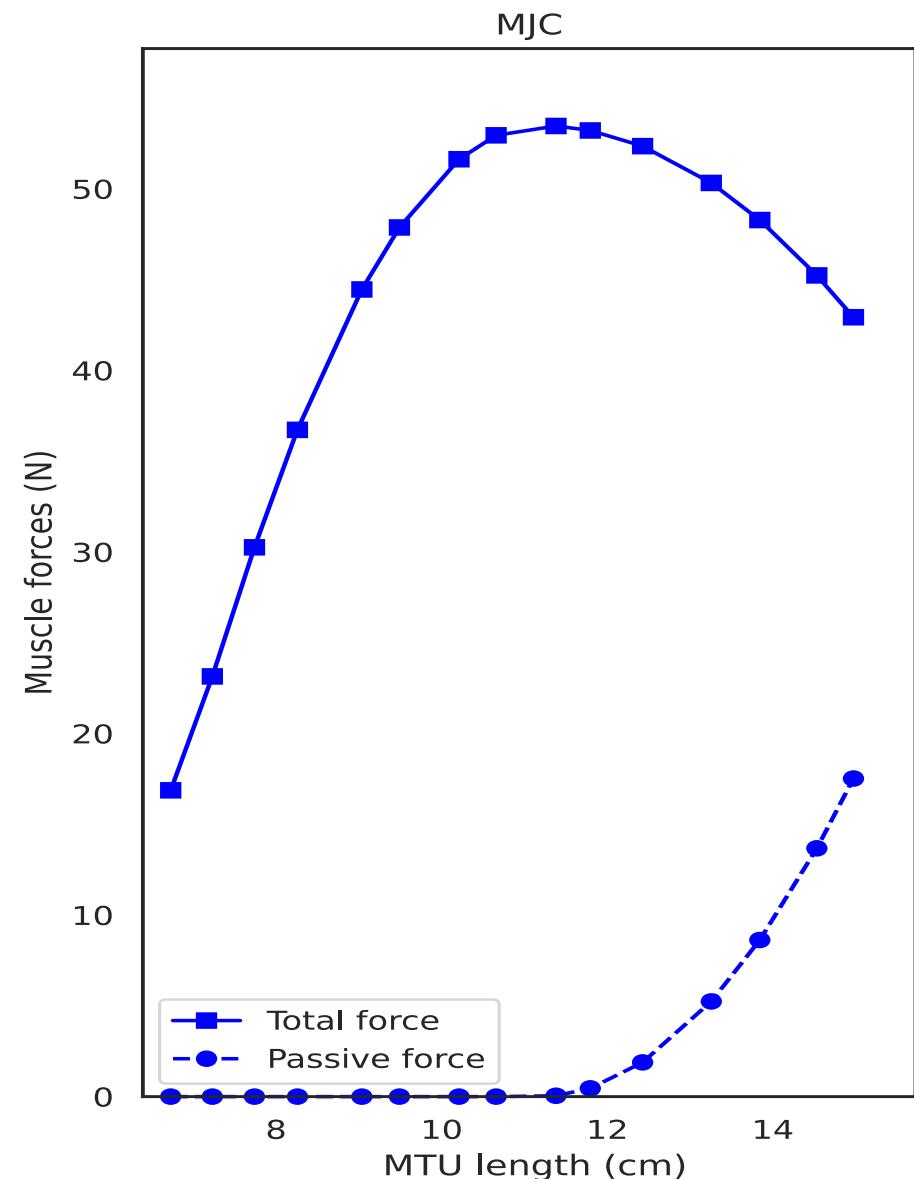
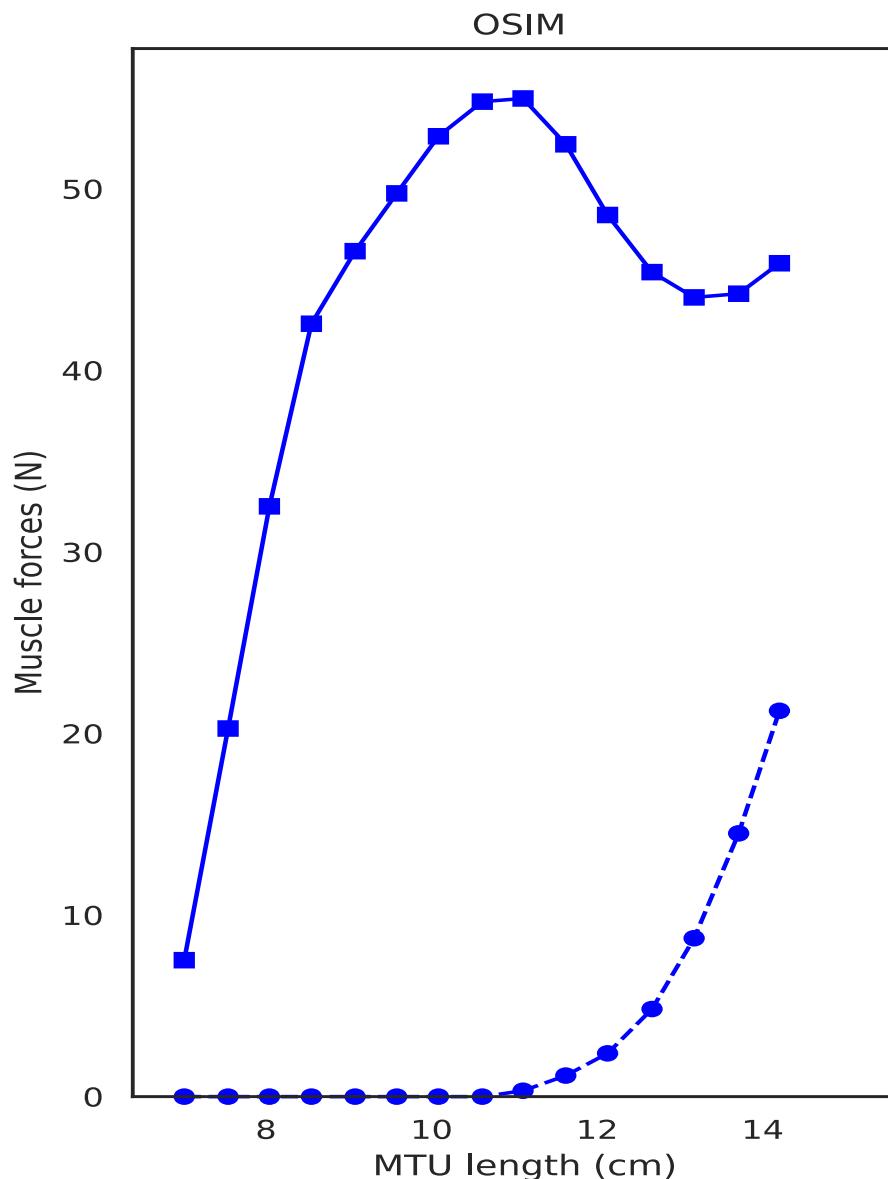
Muscle specific force comparison before/after optimization

cleid_occ_L

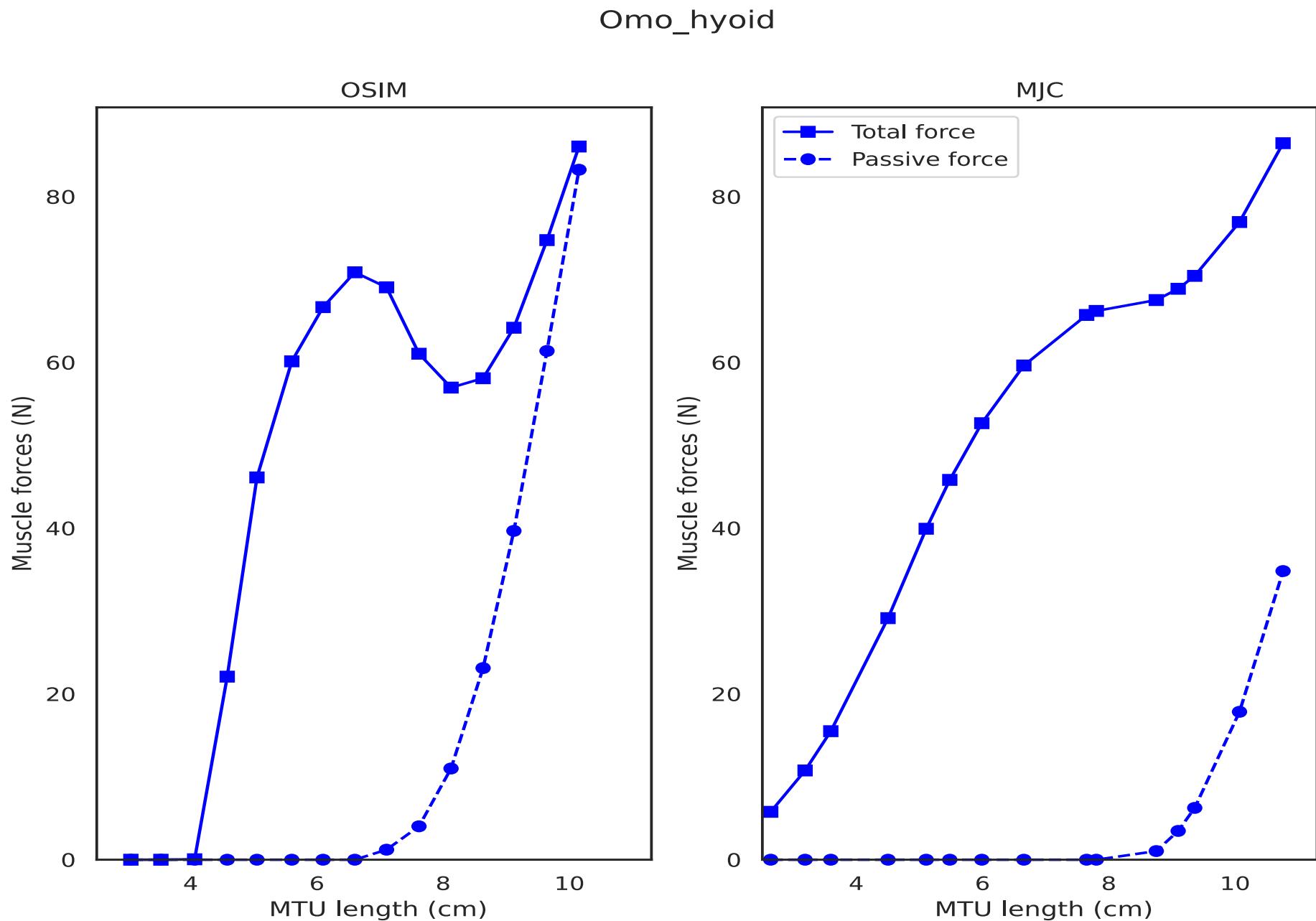


Muscle specific force comparison before/after optimization

Sterno_hyoid_L

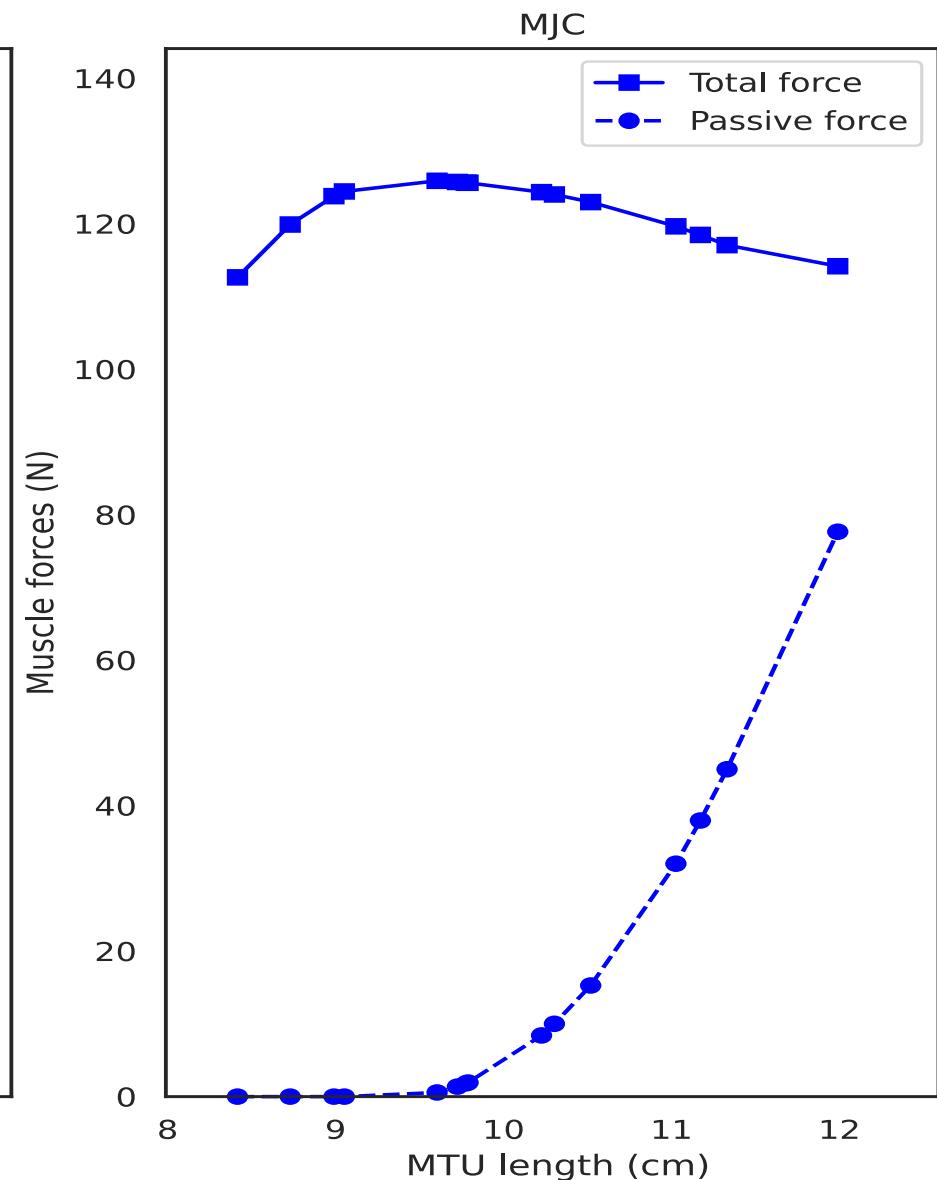
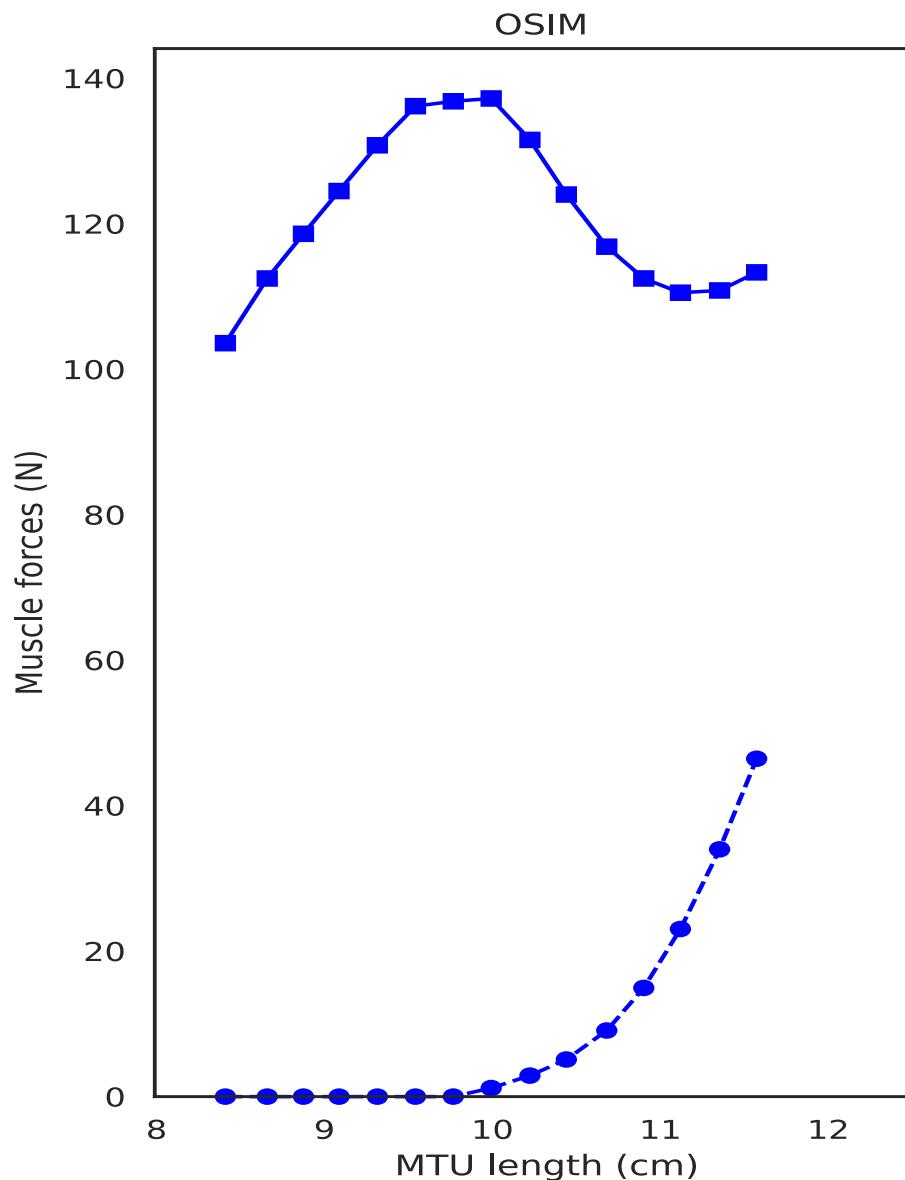


Muscle specific force comparison before/after optimization



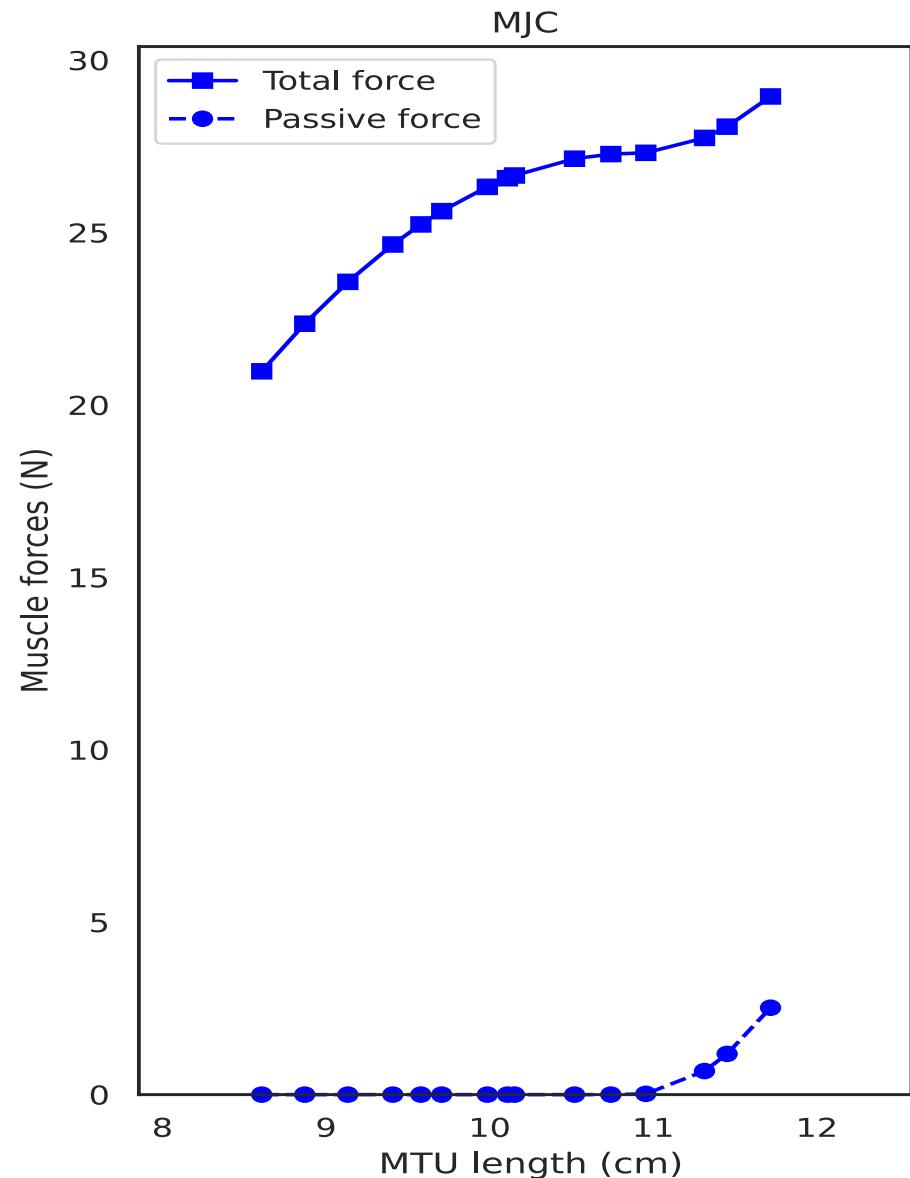
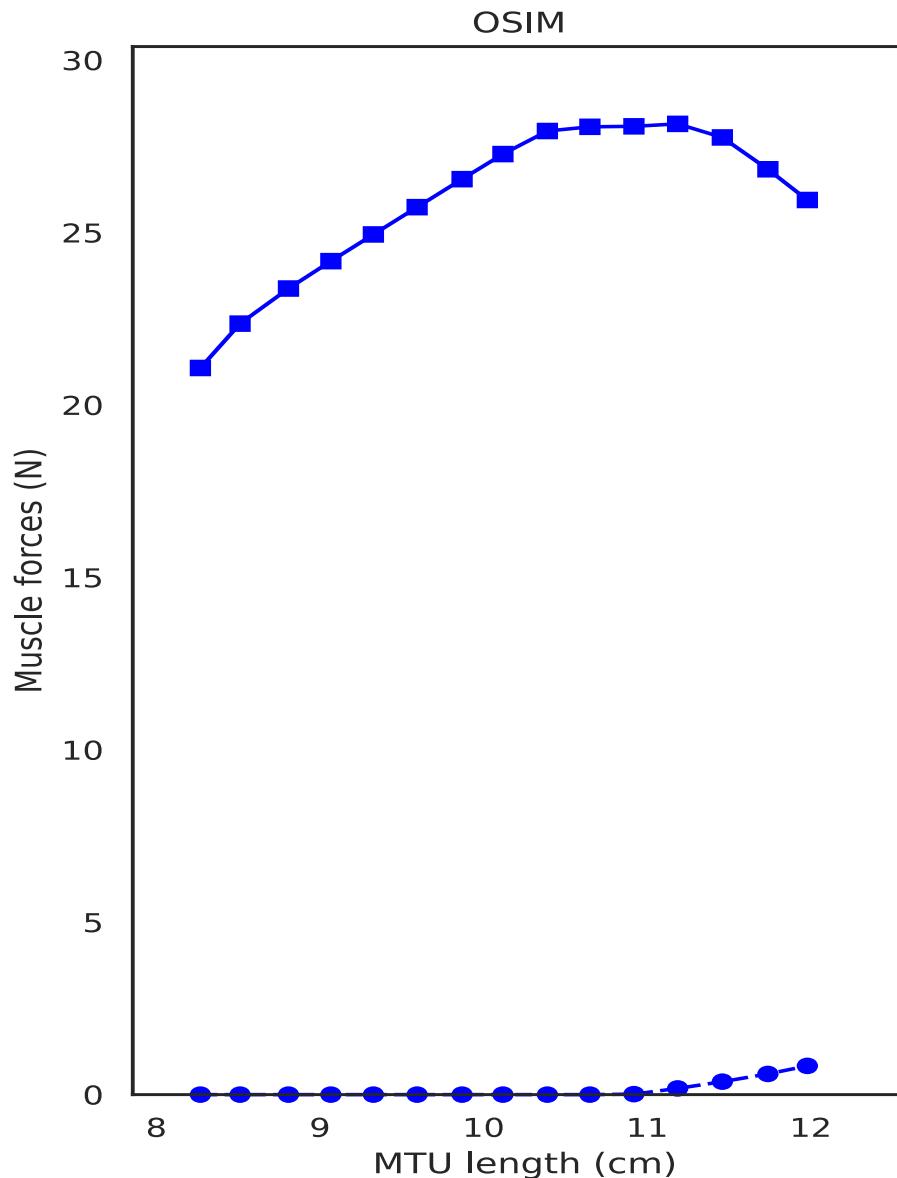
Muscle specific force comparison before/after optimization

scalenus_ant



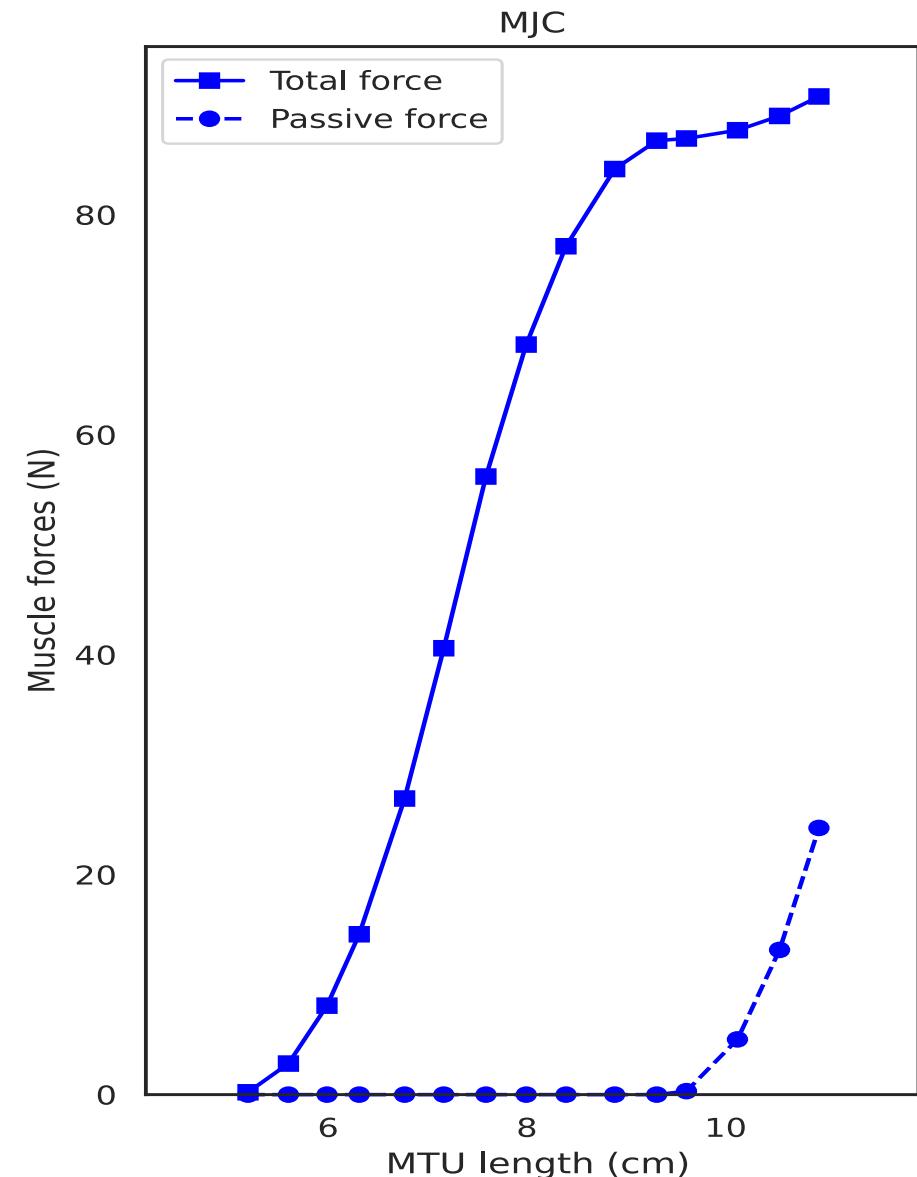
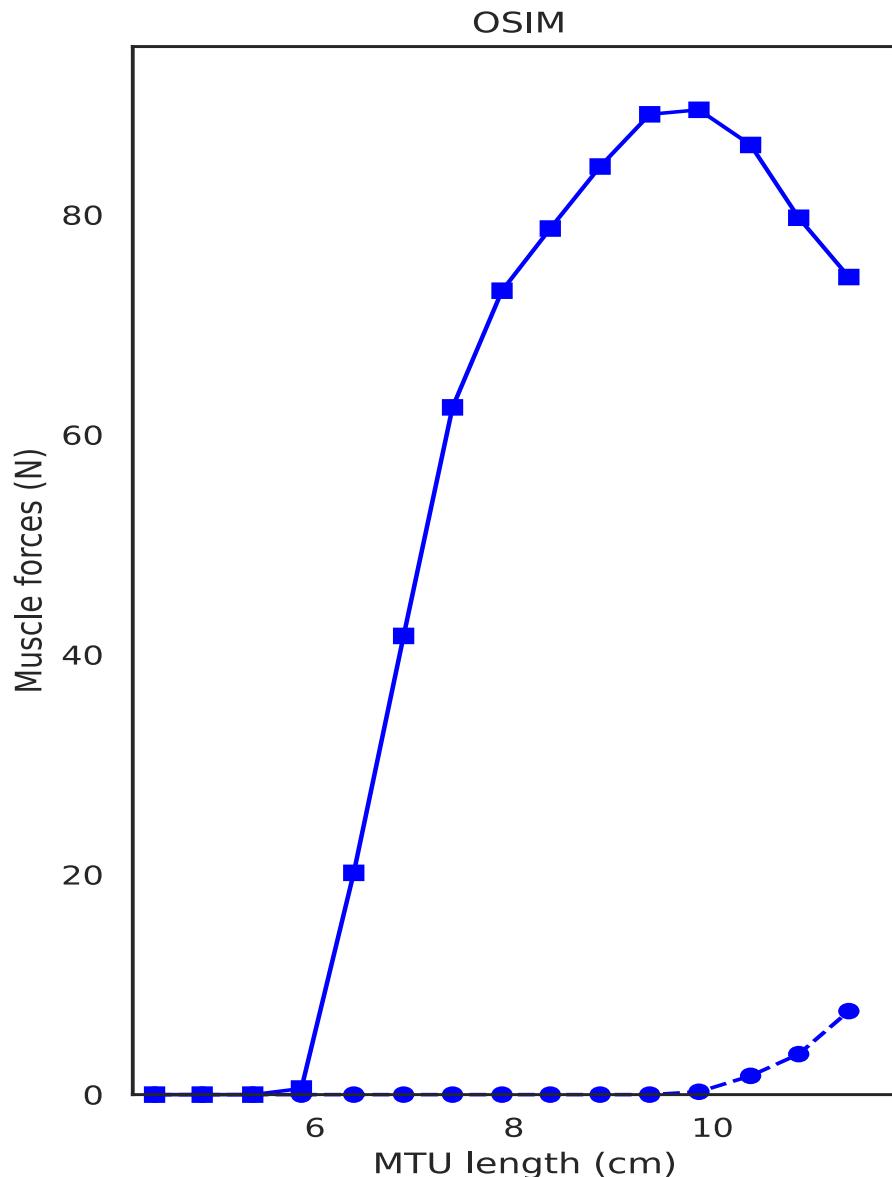
Muscle specific force comparison before/after optimization

iliocost_cerv_c5rib



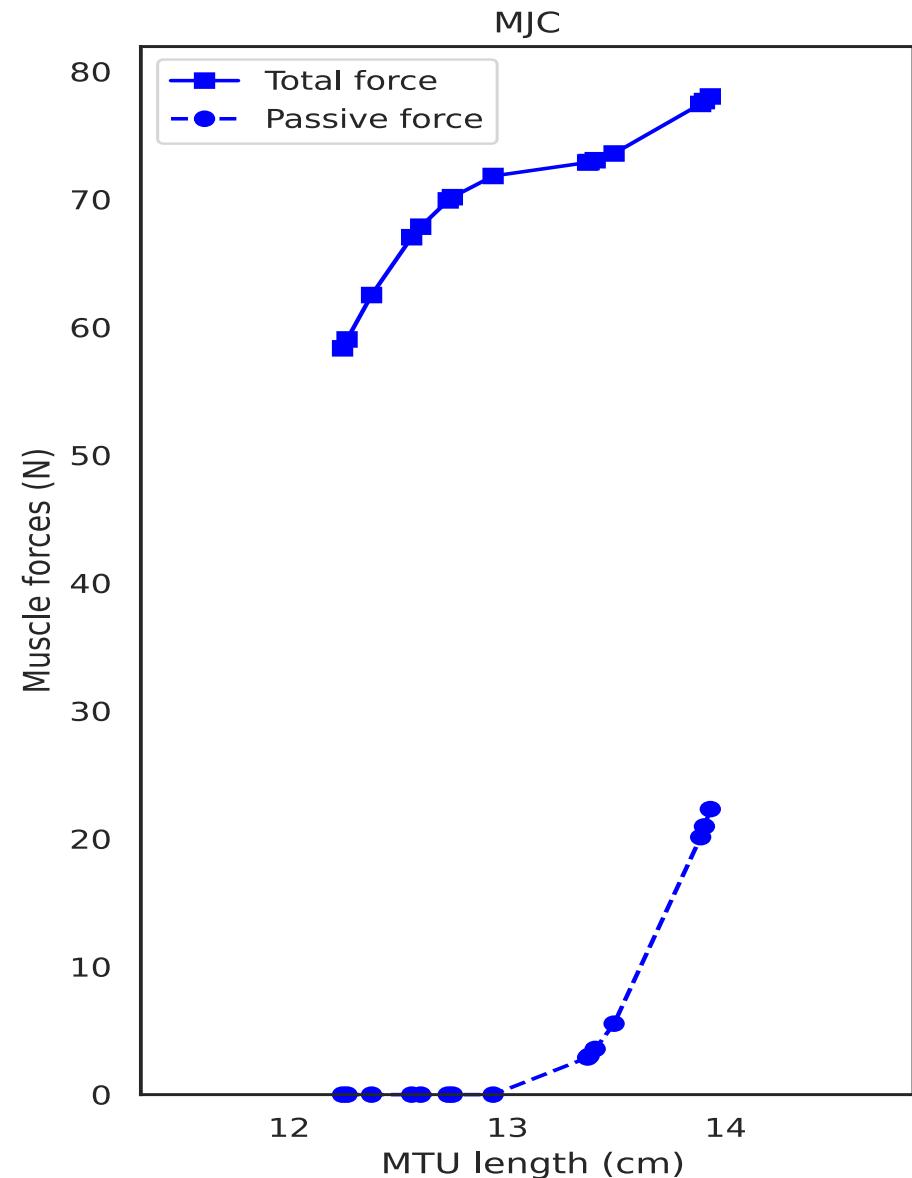
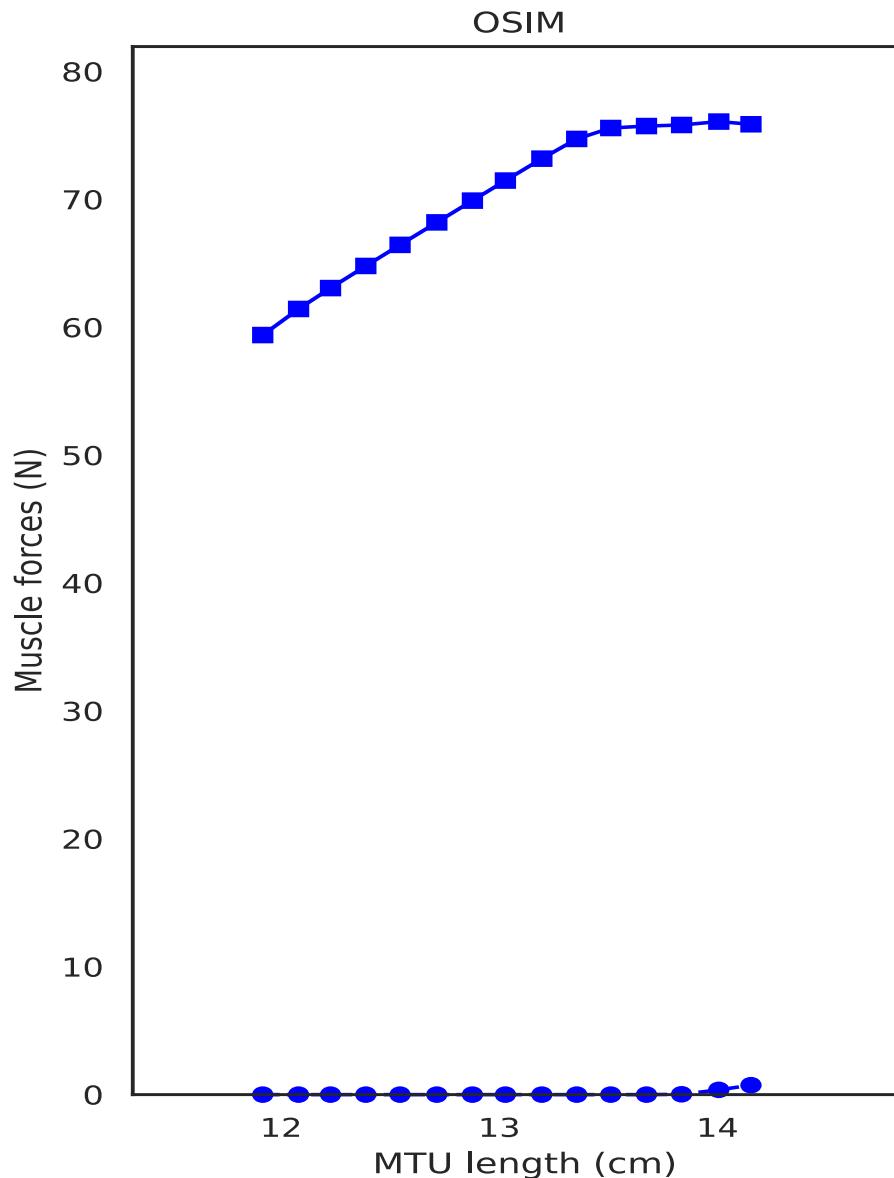
Muscle specific force comparison before/after optimization

semi_cerv_c3thx



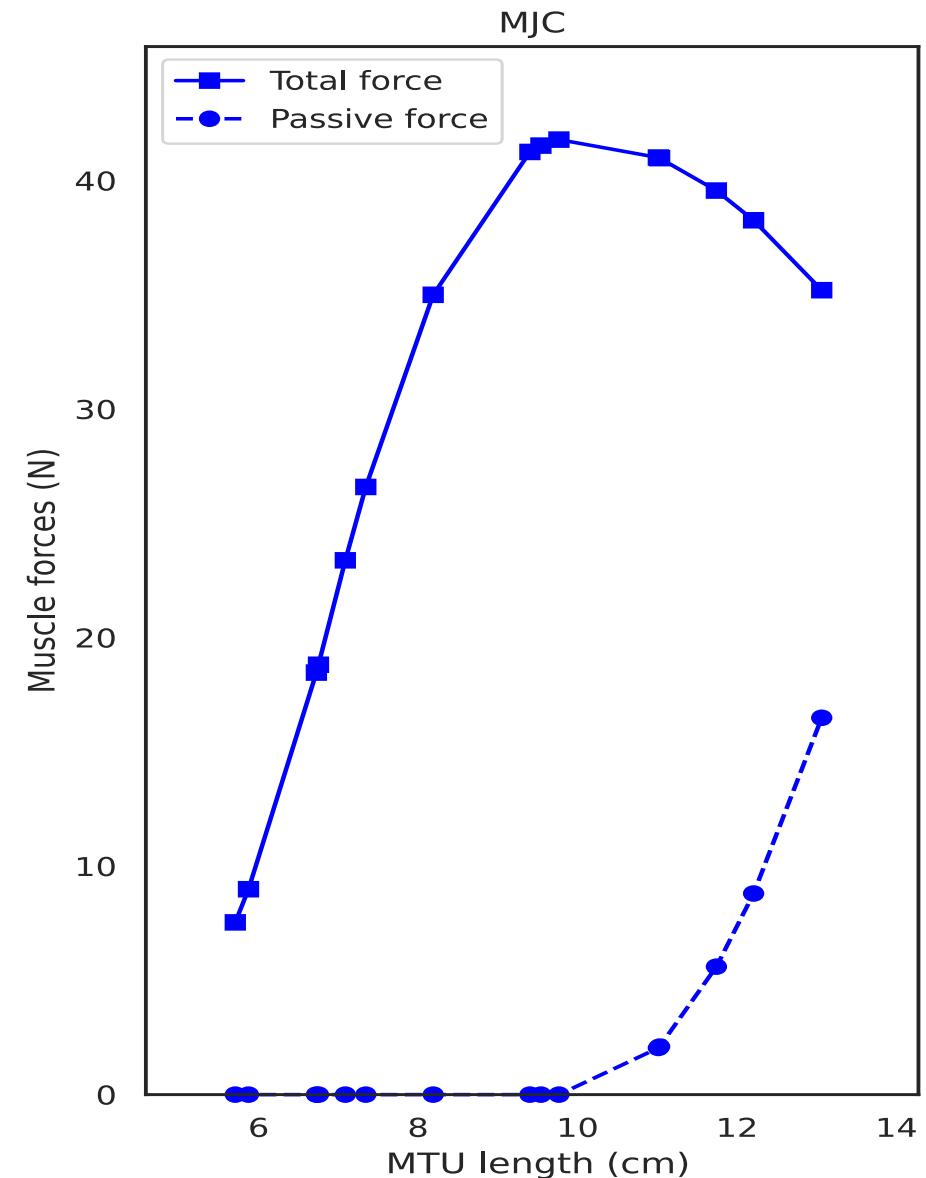
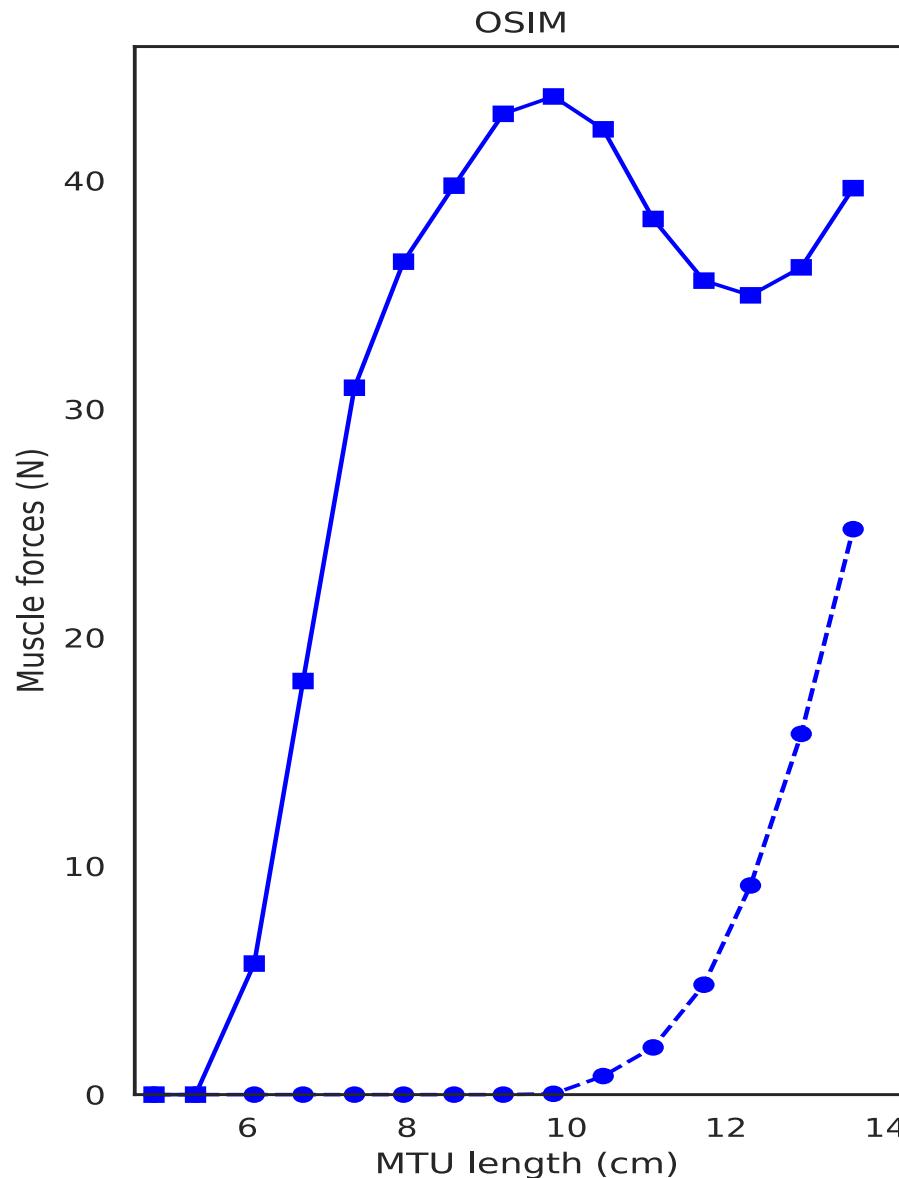
Muscle specific force comparison before/after optimization

scalenus_post



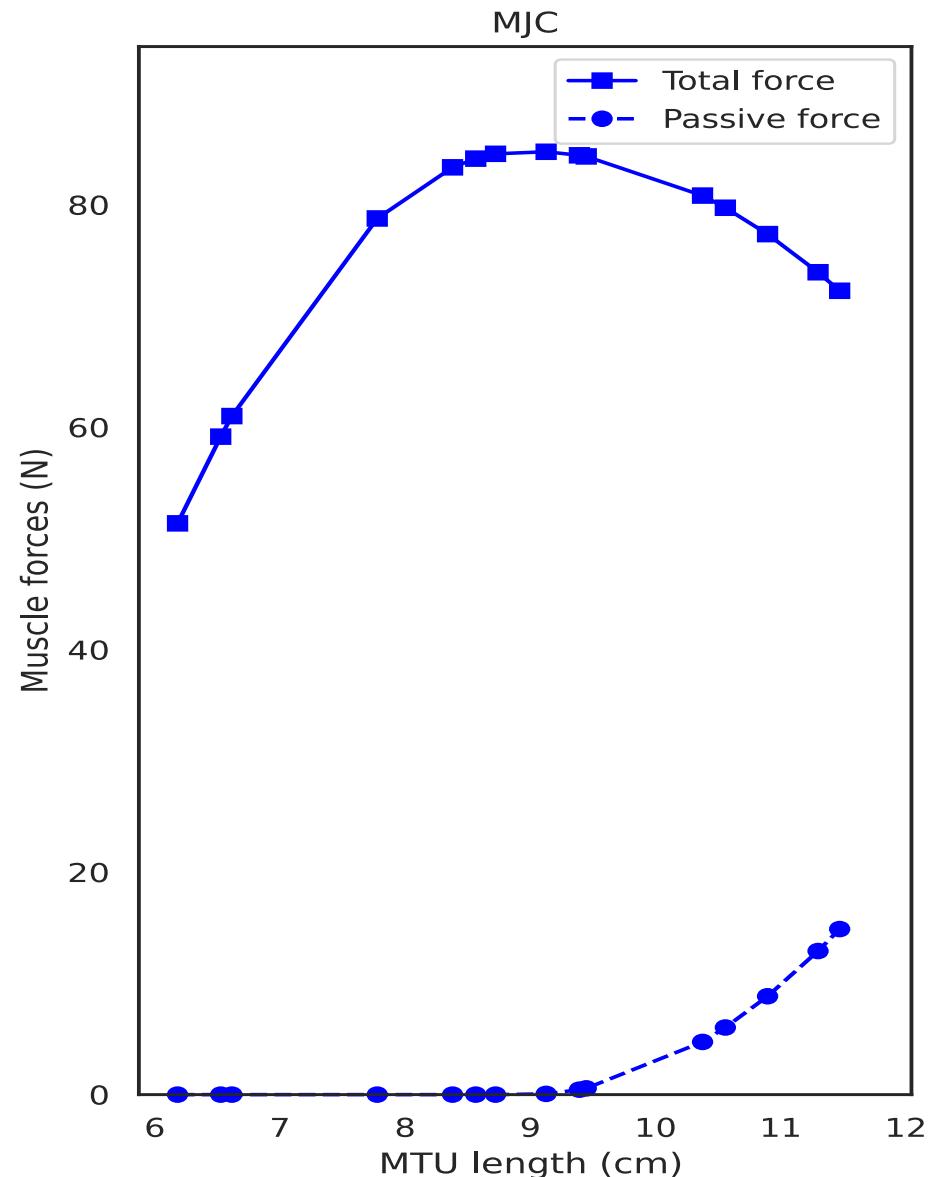
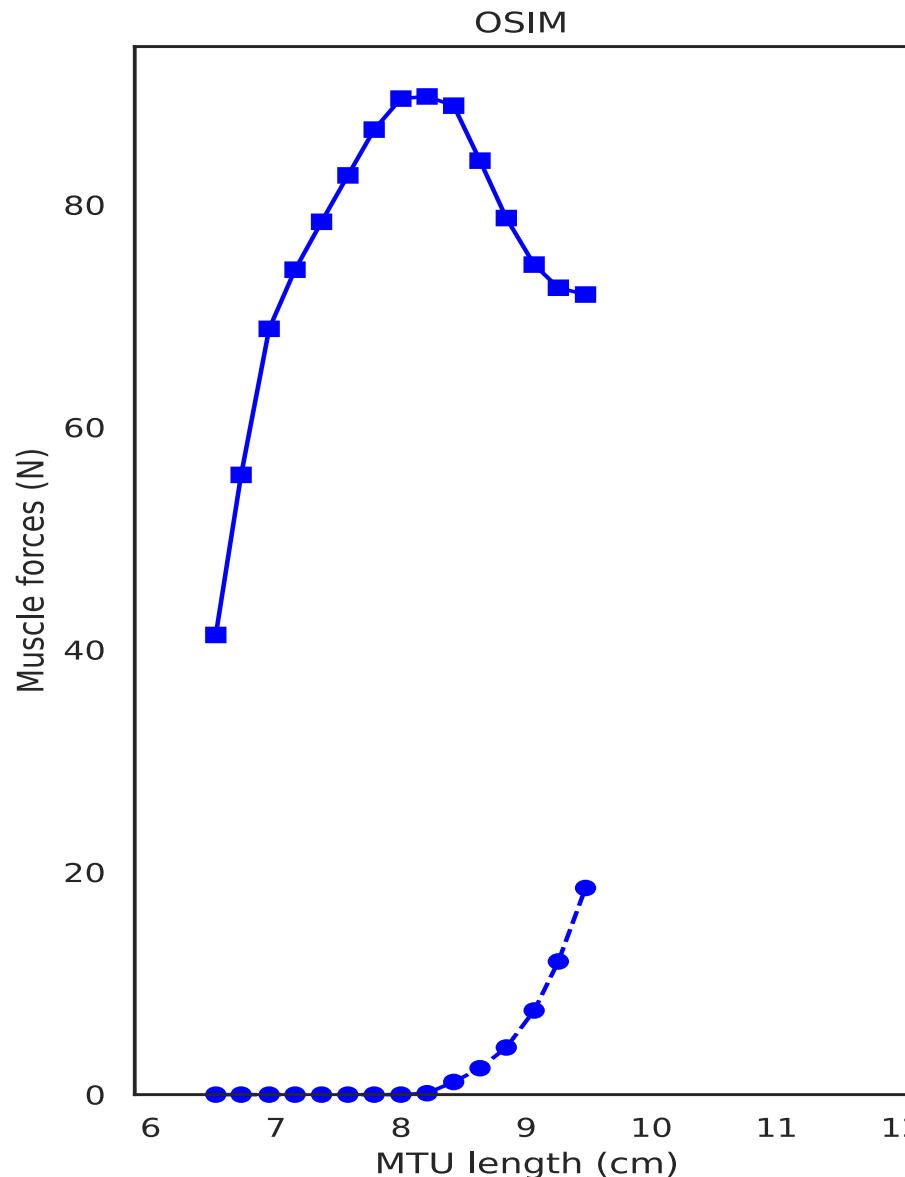
Muscle specific force comparison before/after optimization

longissi_cap_sklc6



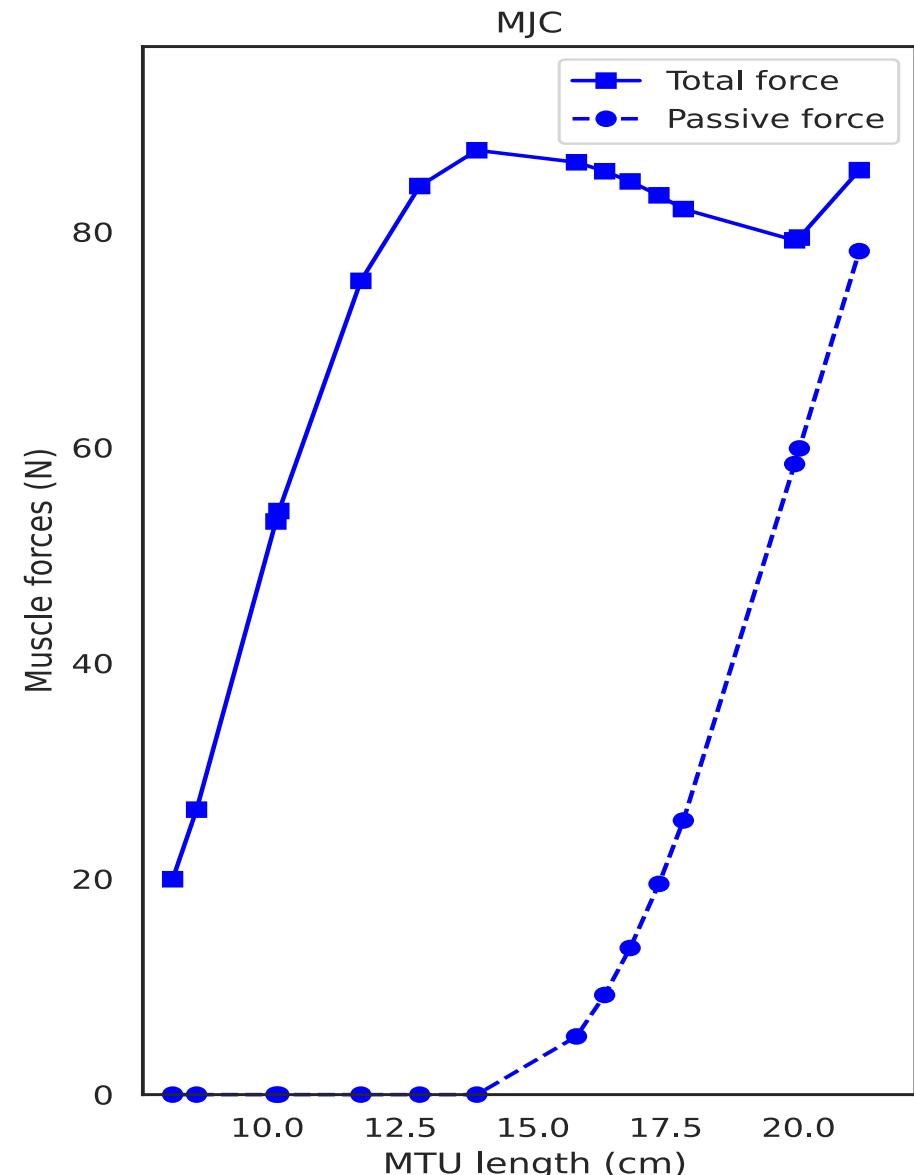
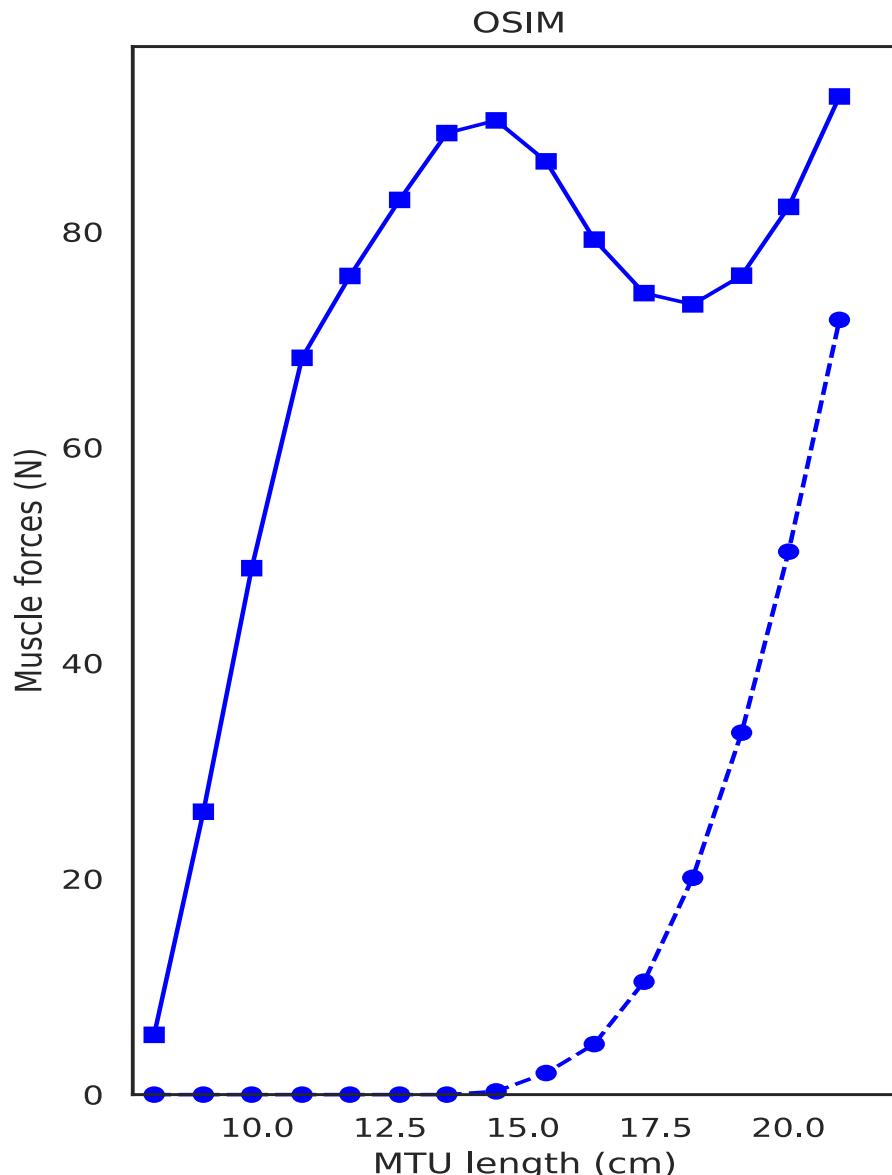
Muscle specific force comparison before/after optimization

long_cap_sklc4



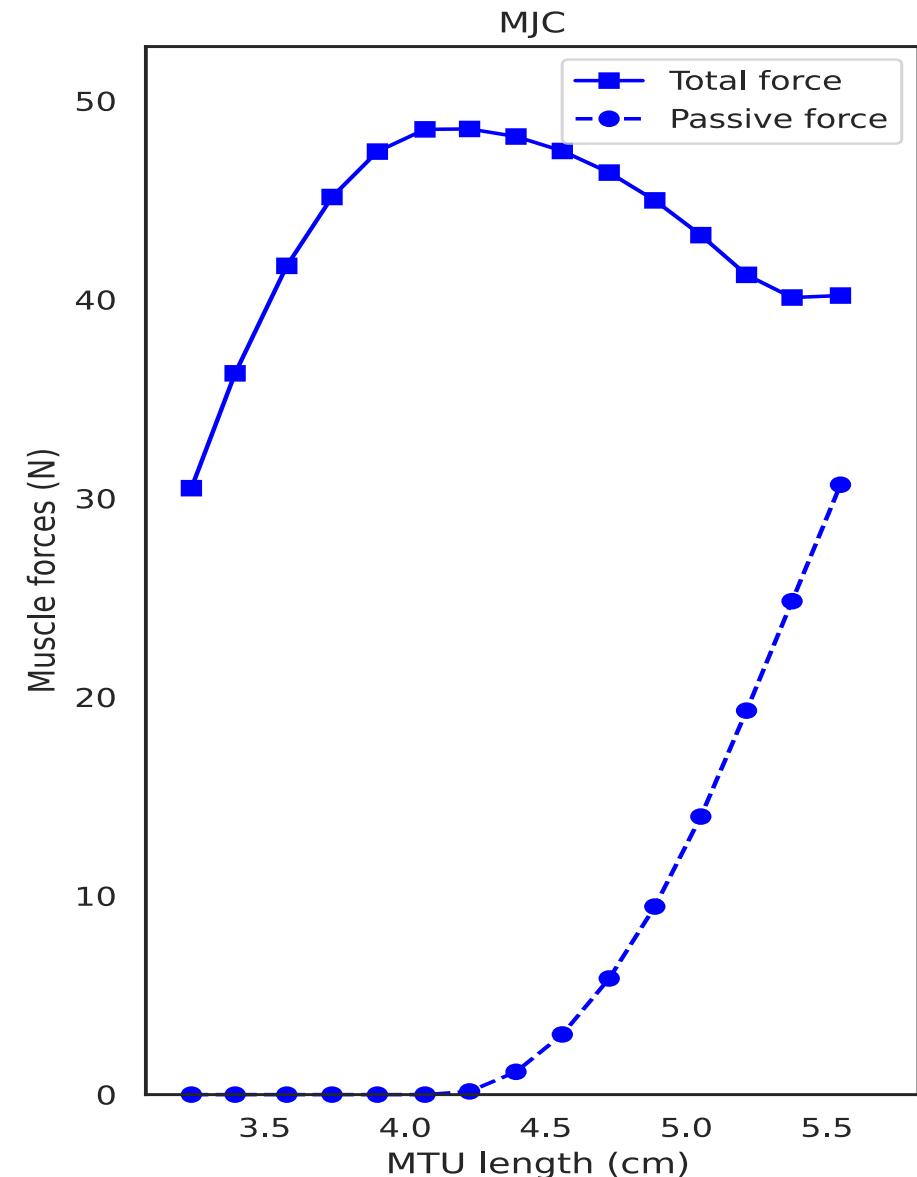
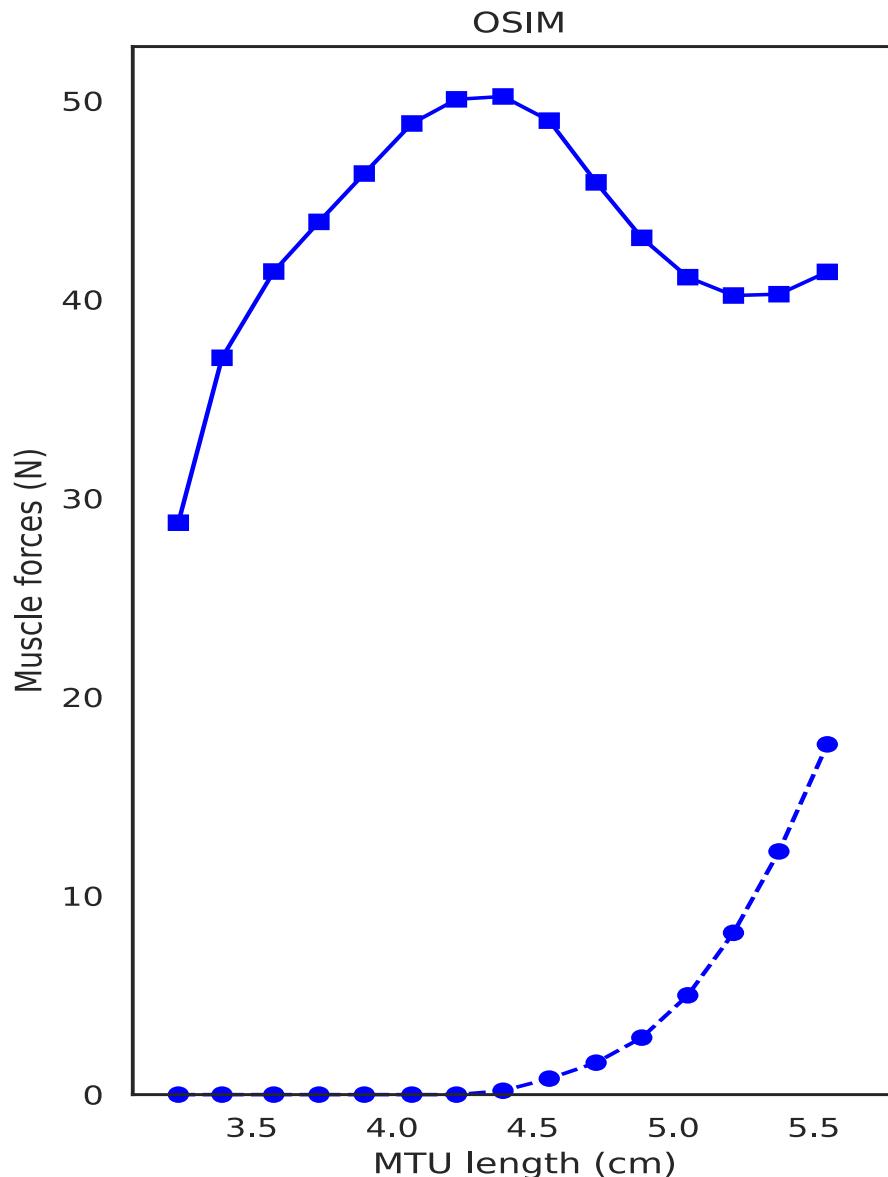
Muscle specific force comparison before/after optimization

cleid_mast_L



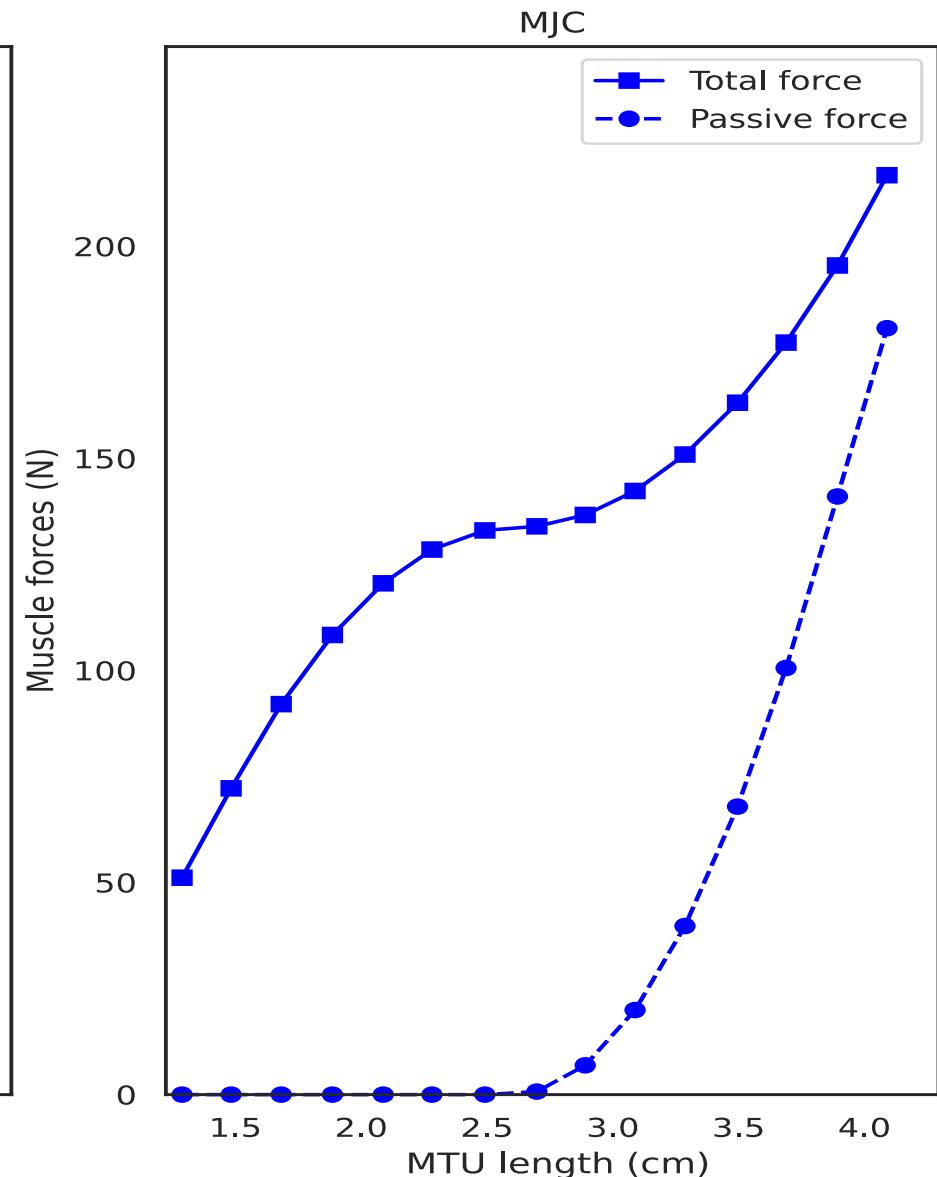
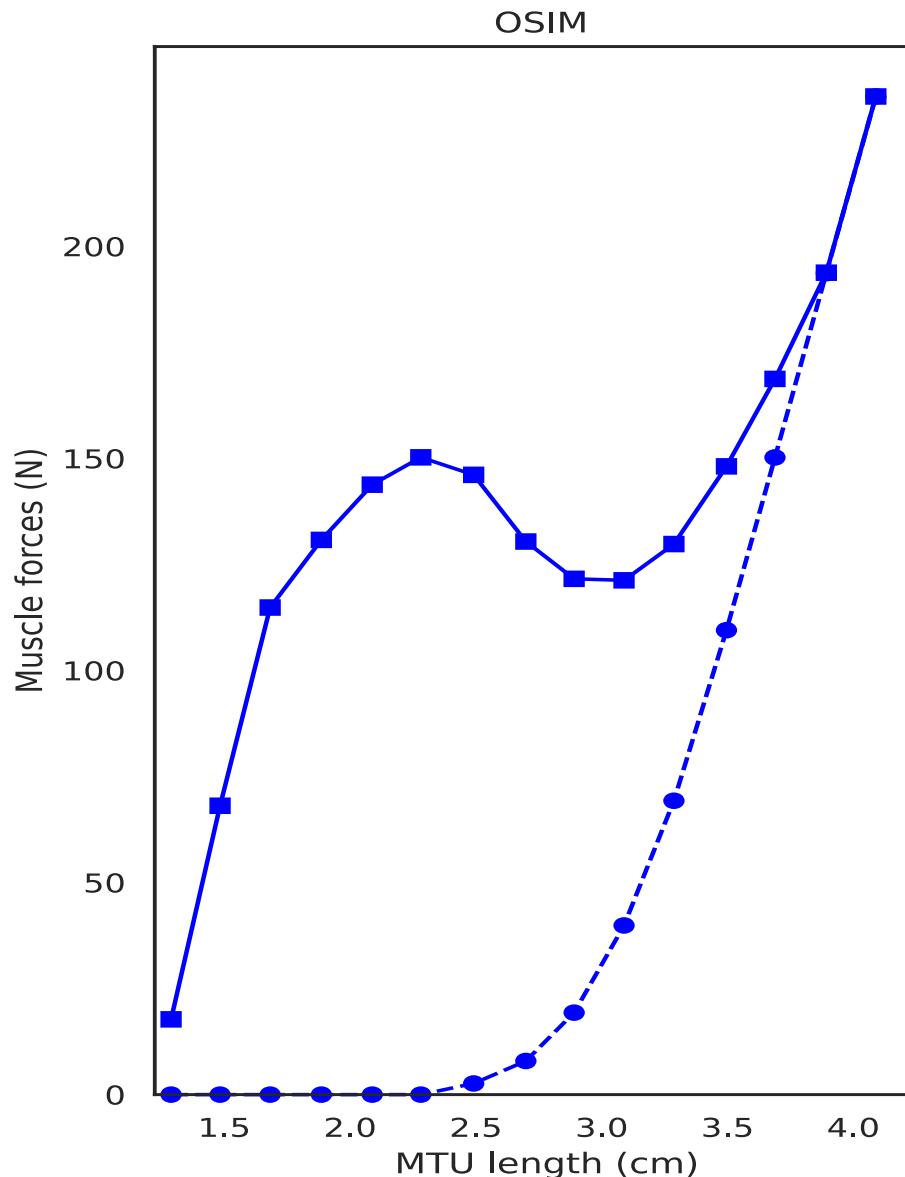
Muscle specific force comparison before/after optimization

Mylohyoid_Post



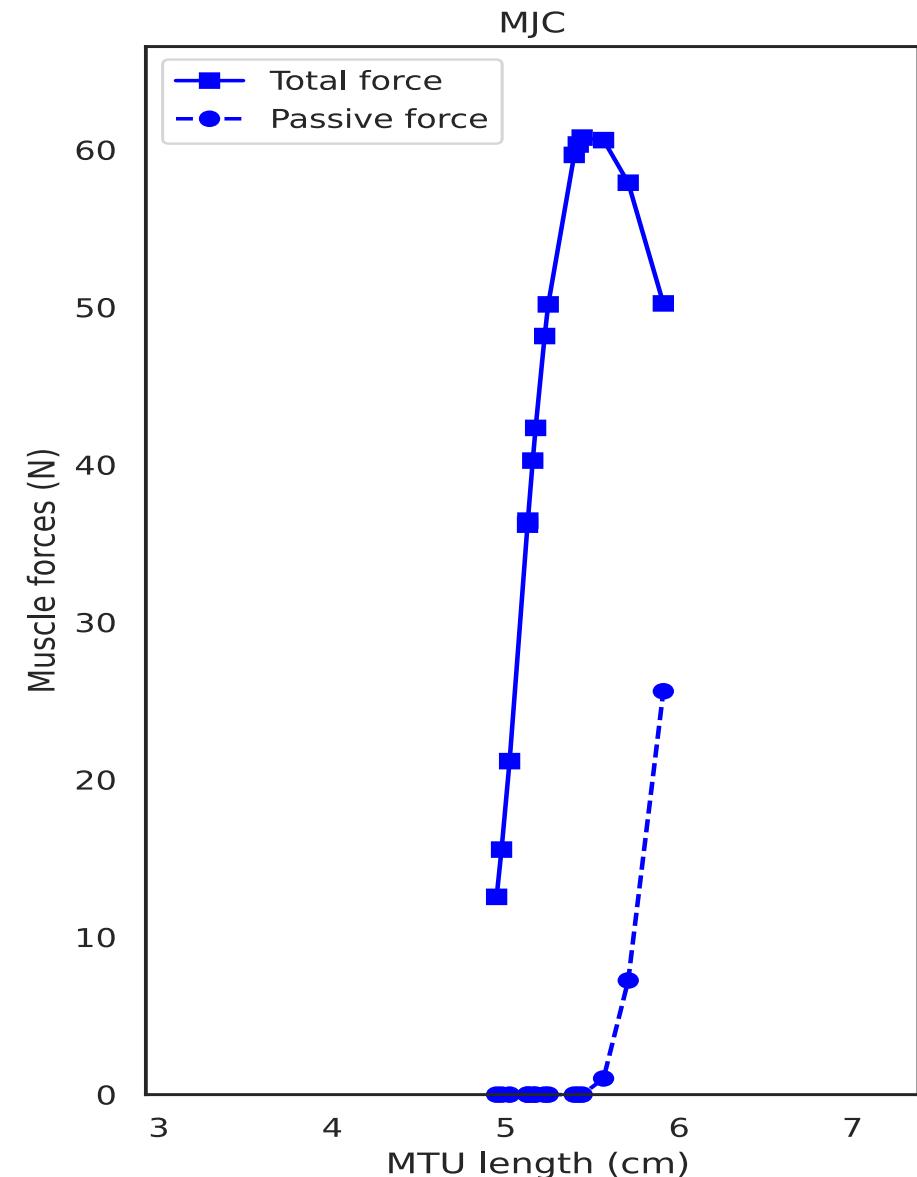
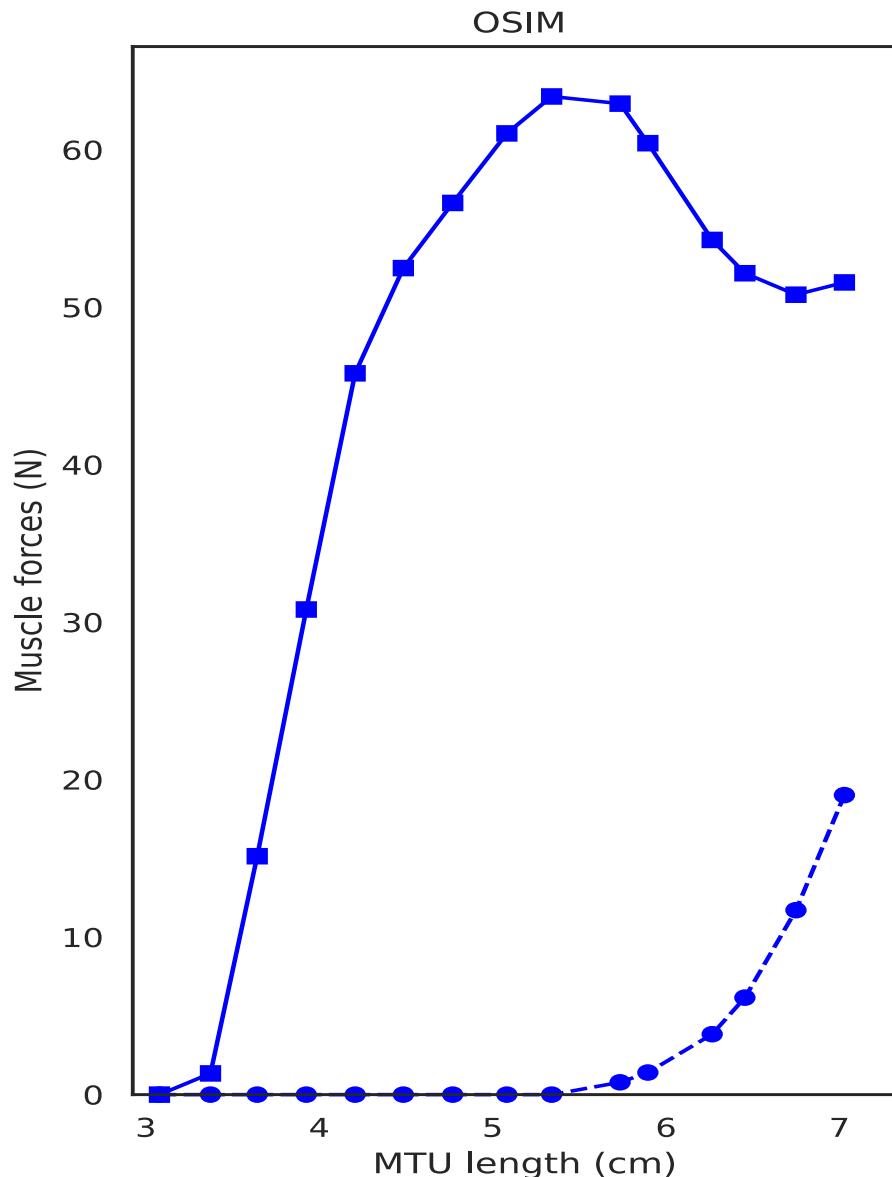
Muscle specific force comparison before/after optimization

Mylohyoid_Ant



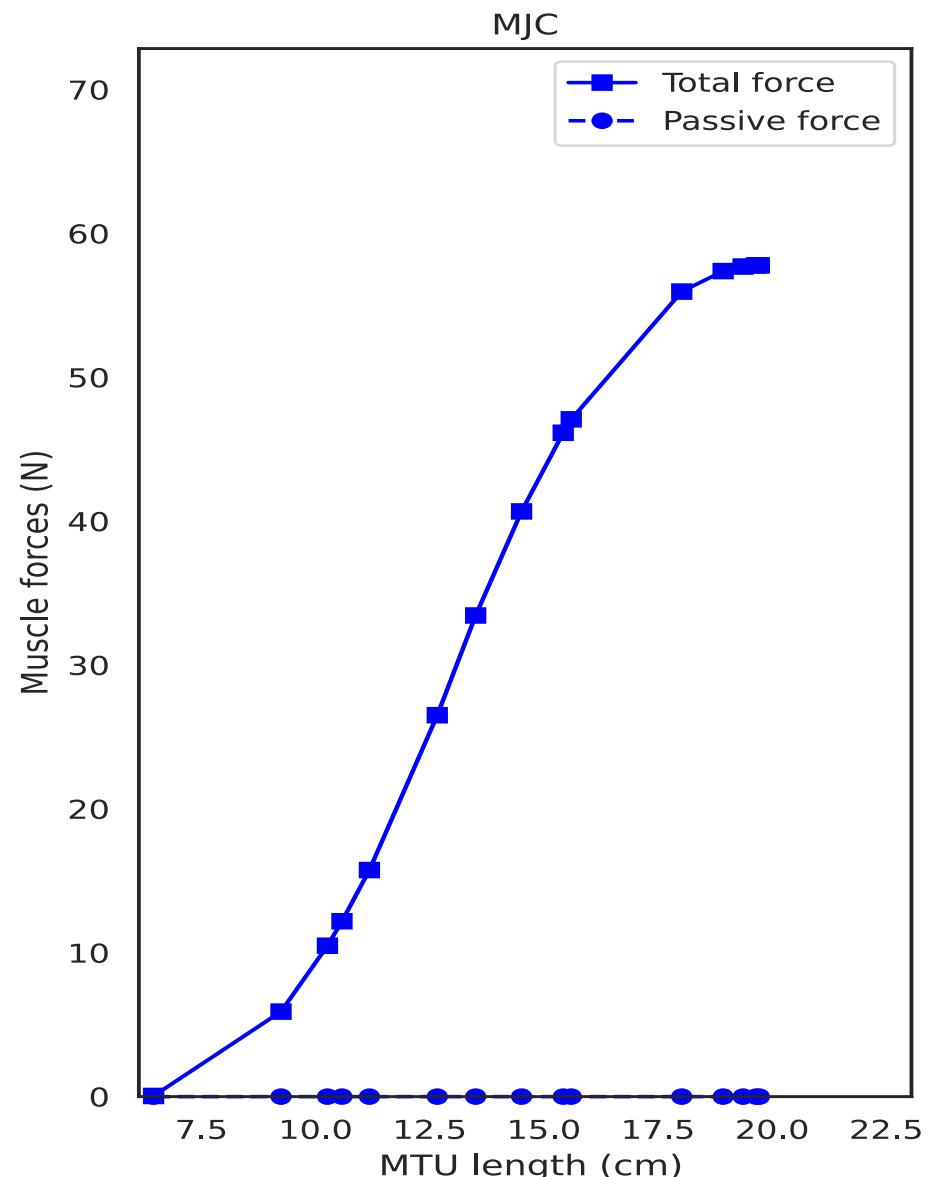
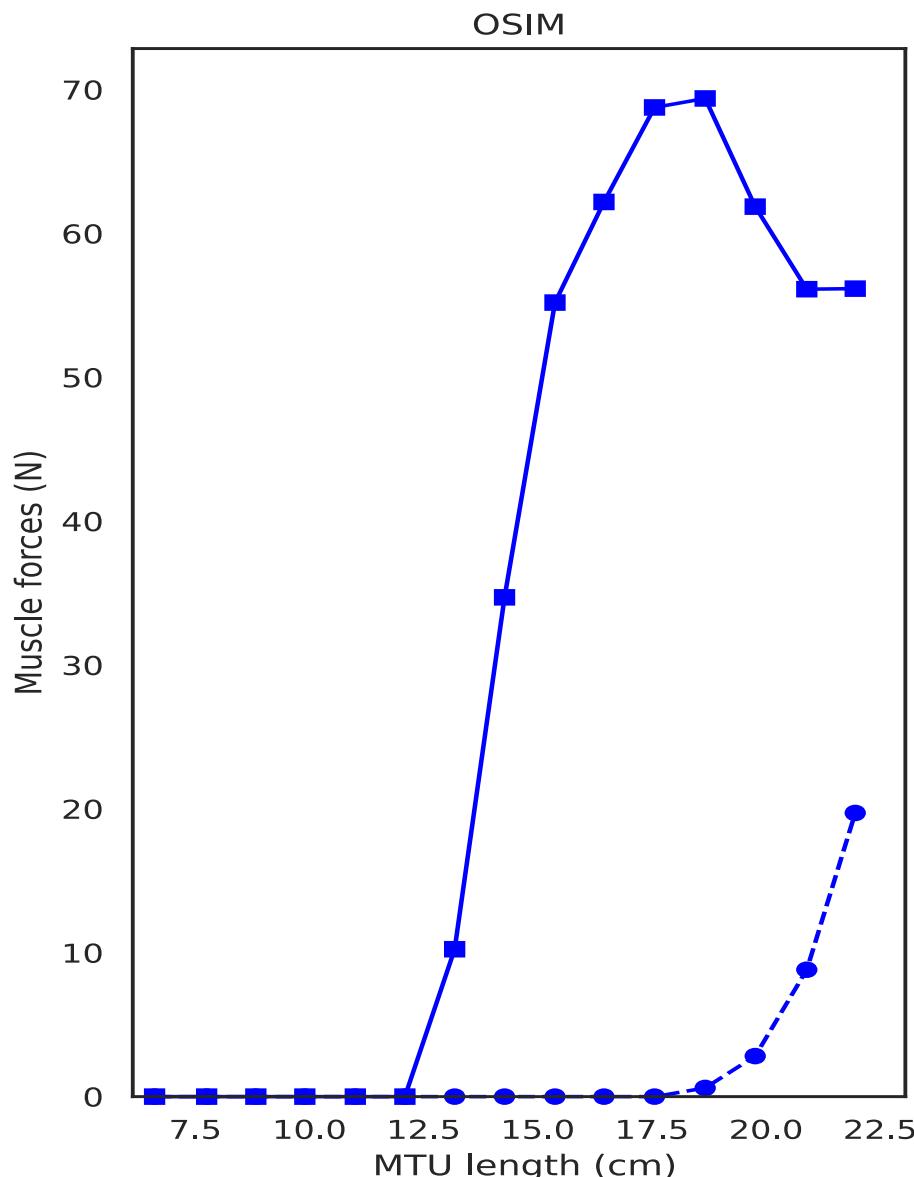
Muscle specific force comparison before/after optimization

obl_cap_inf_L



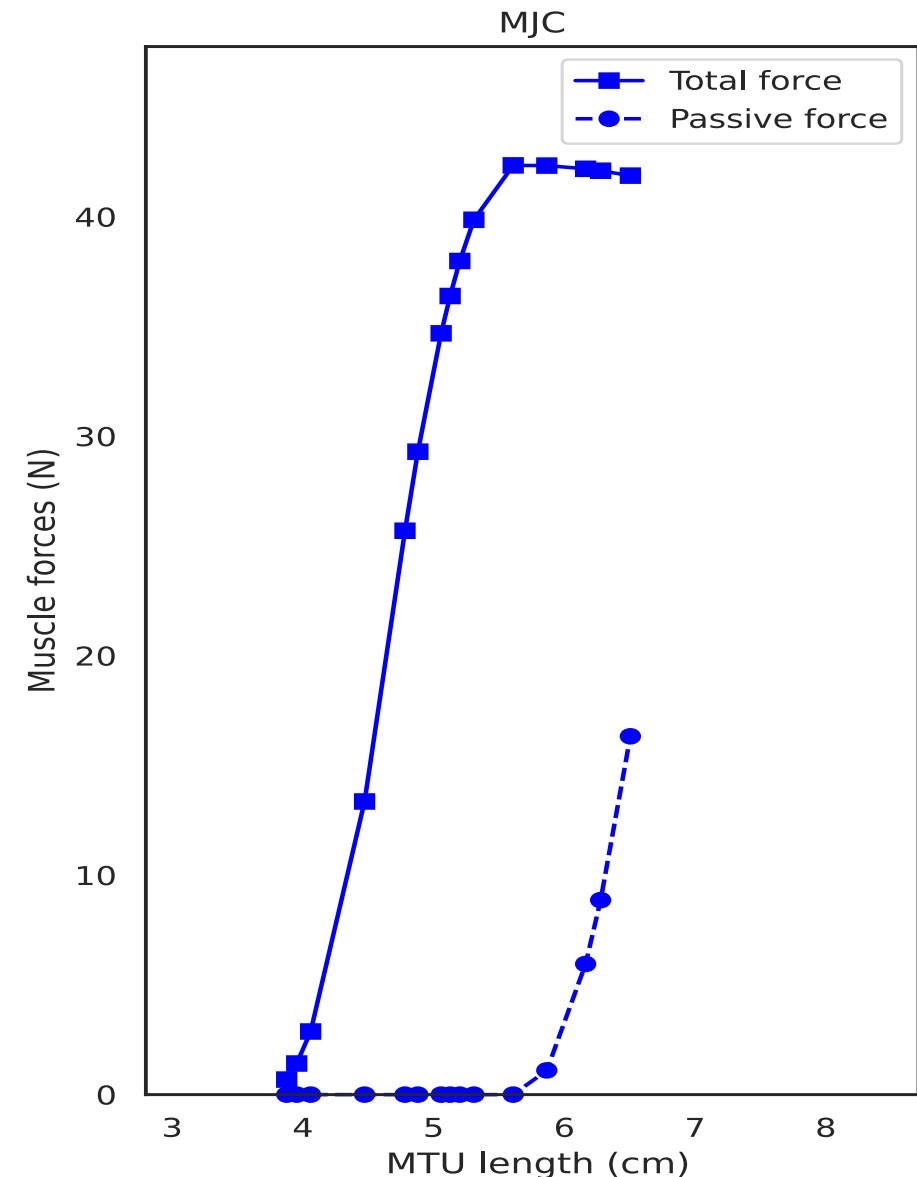
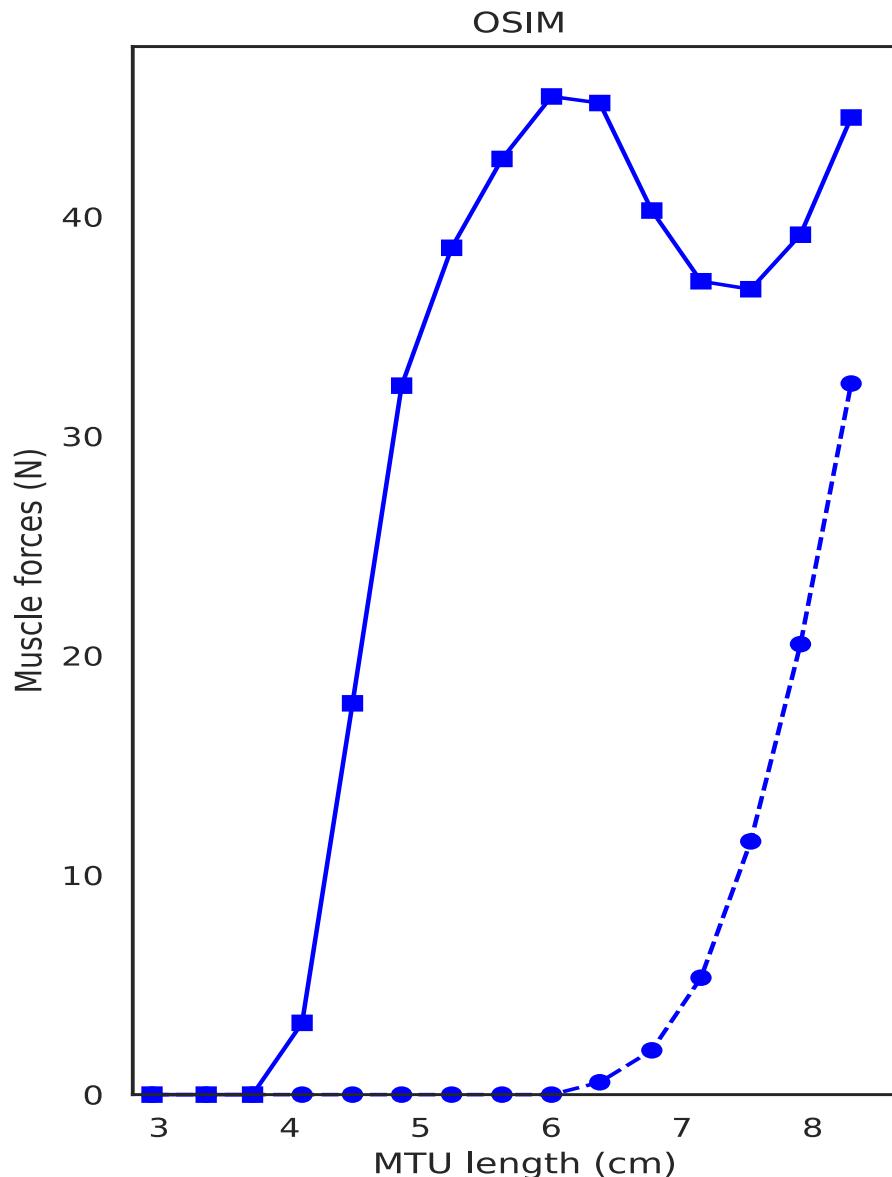
Muscle specific force comparison before/after optimization

splen_cap_sklthx_L



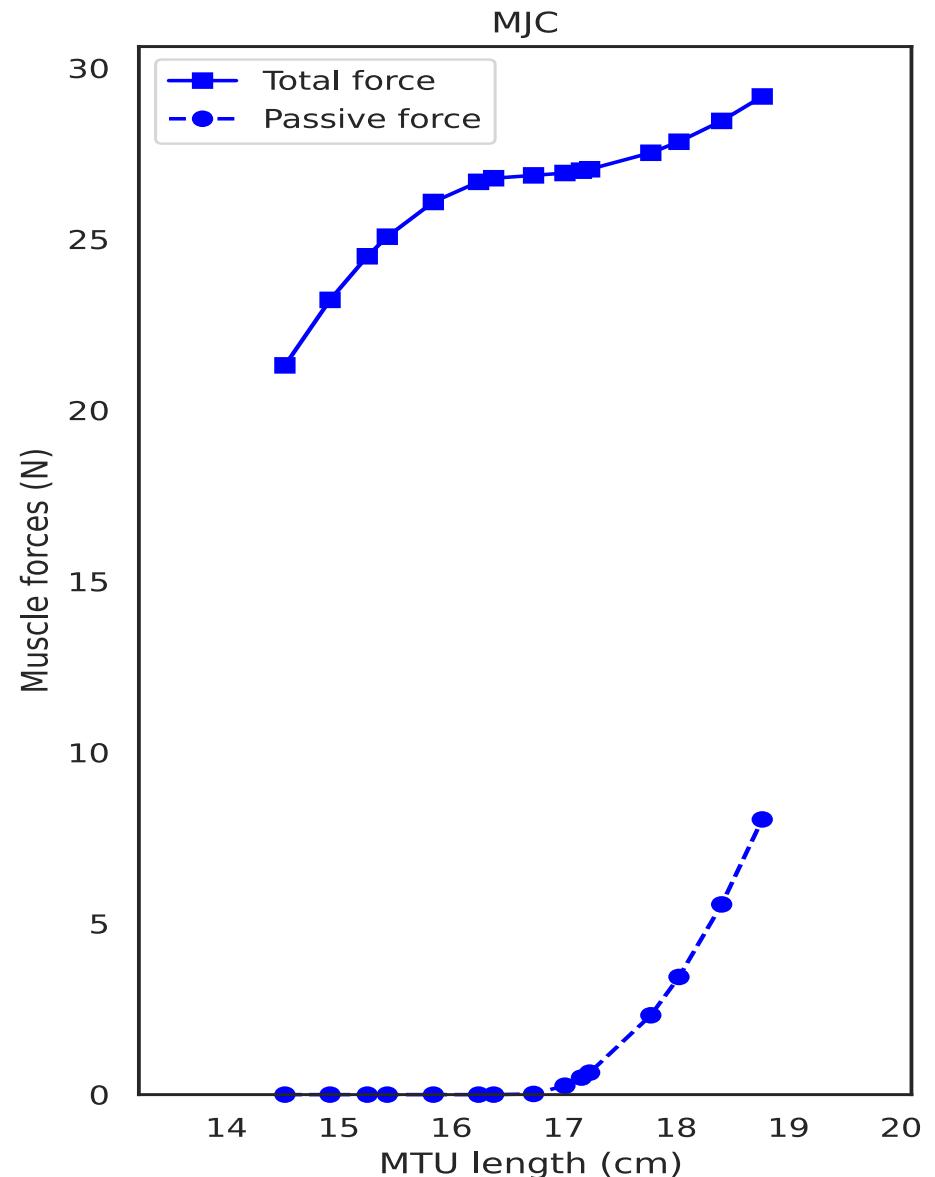
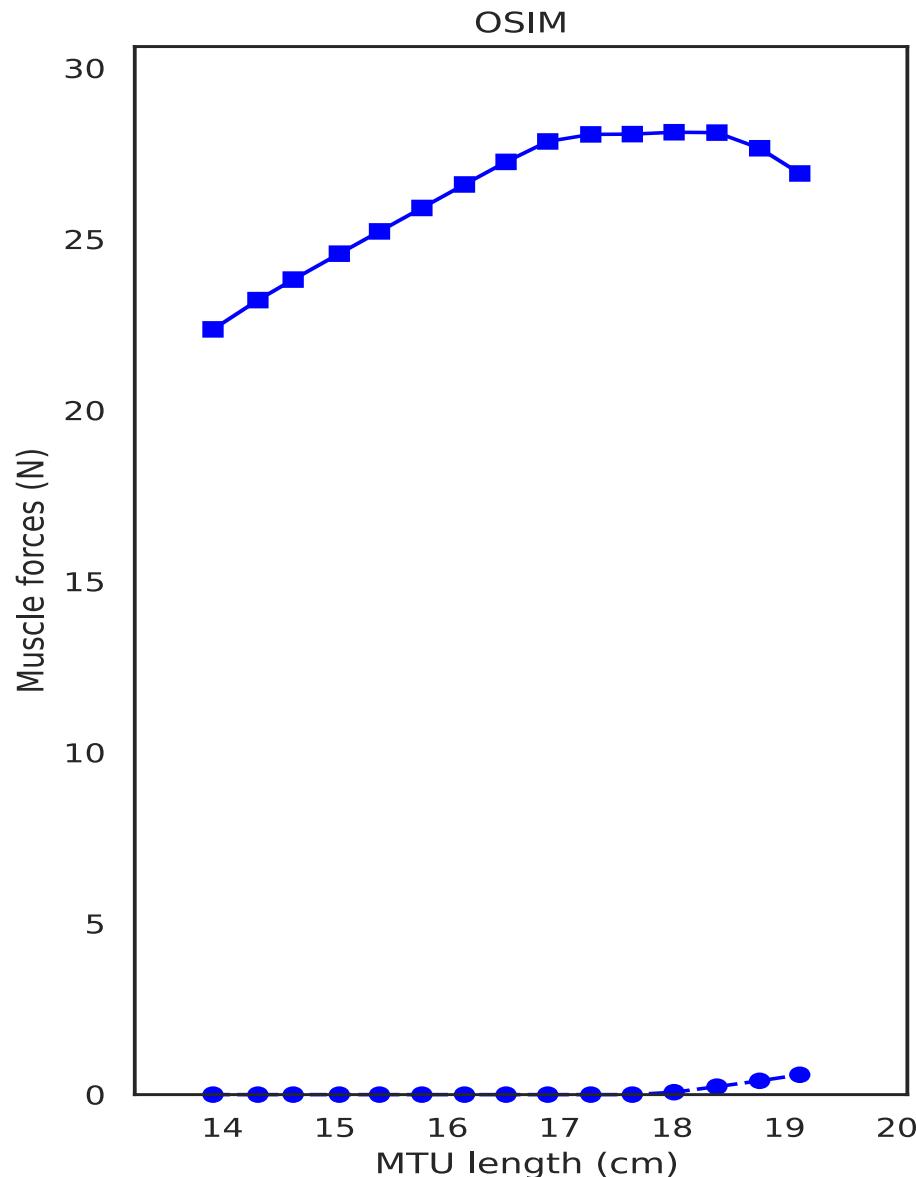
Muscle specific force comparison before/after optimization

rectcap_post_maj



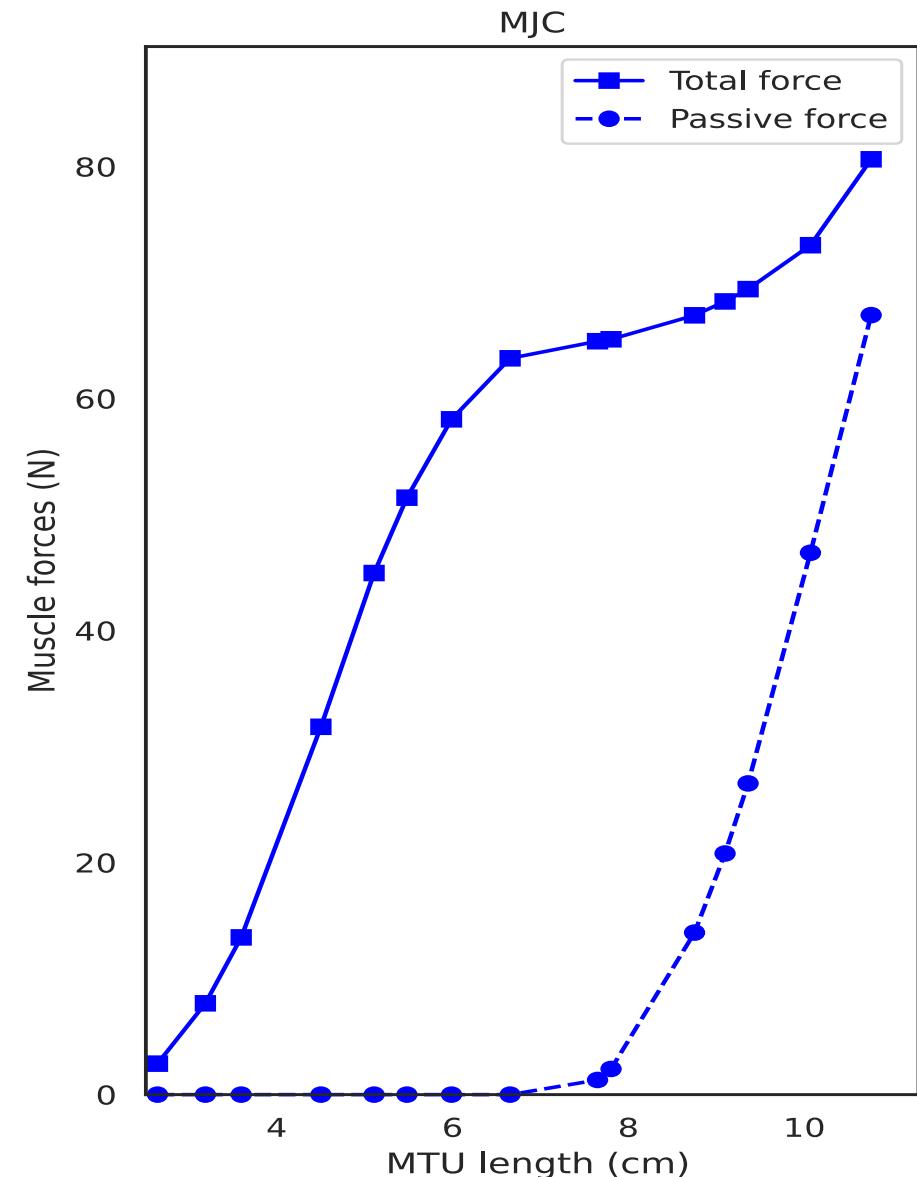
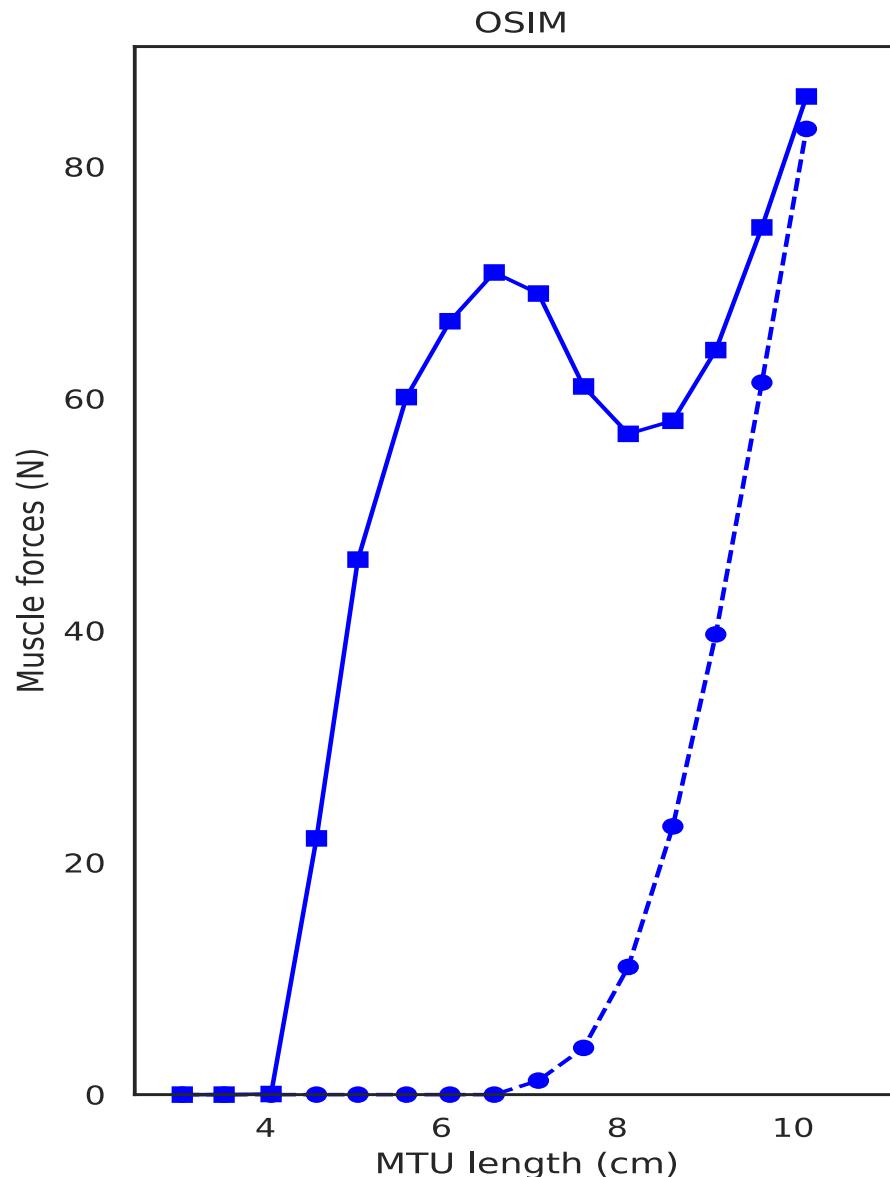
Muscle specific force comparison before/after optimization

longissi_cerv_c4thx



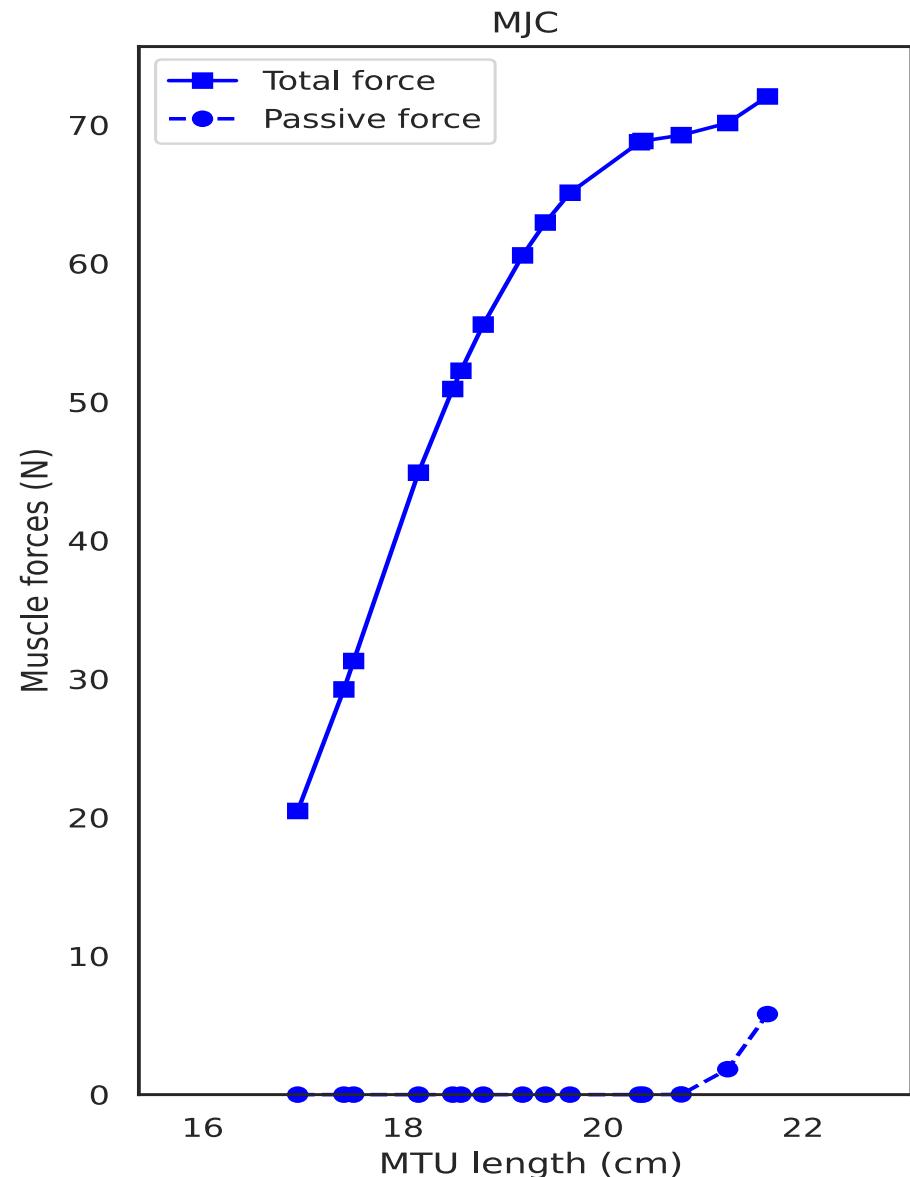
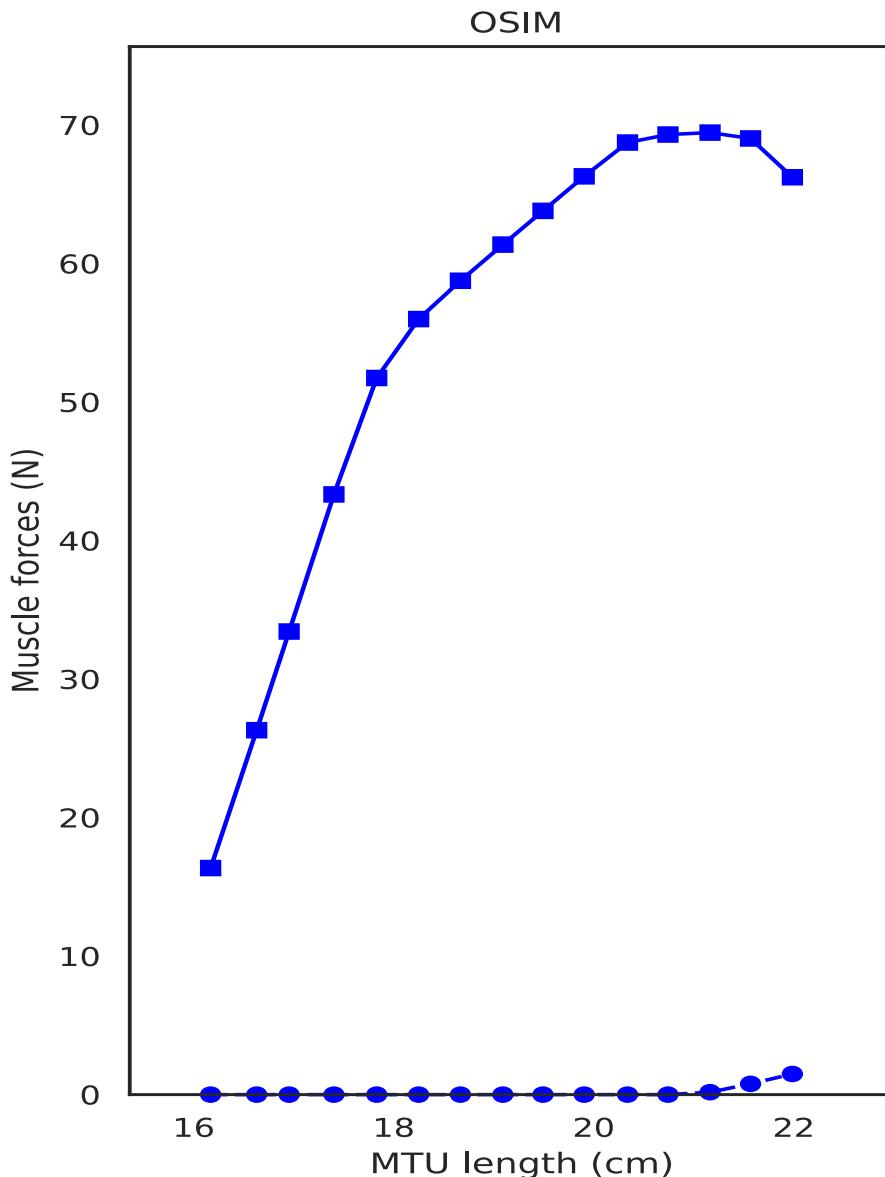
Muscle specific force comparison before/after optimization

Omo_hyoid_L



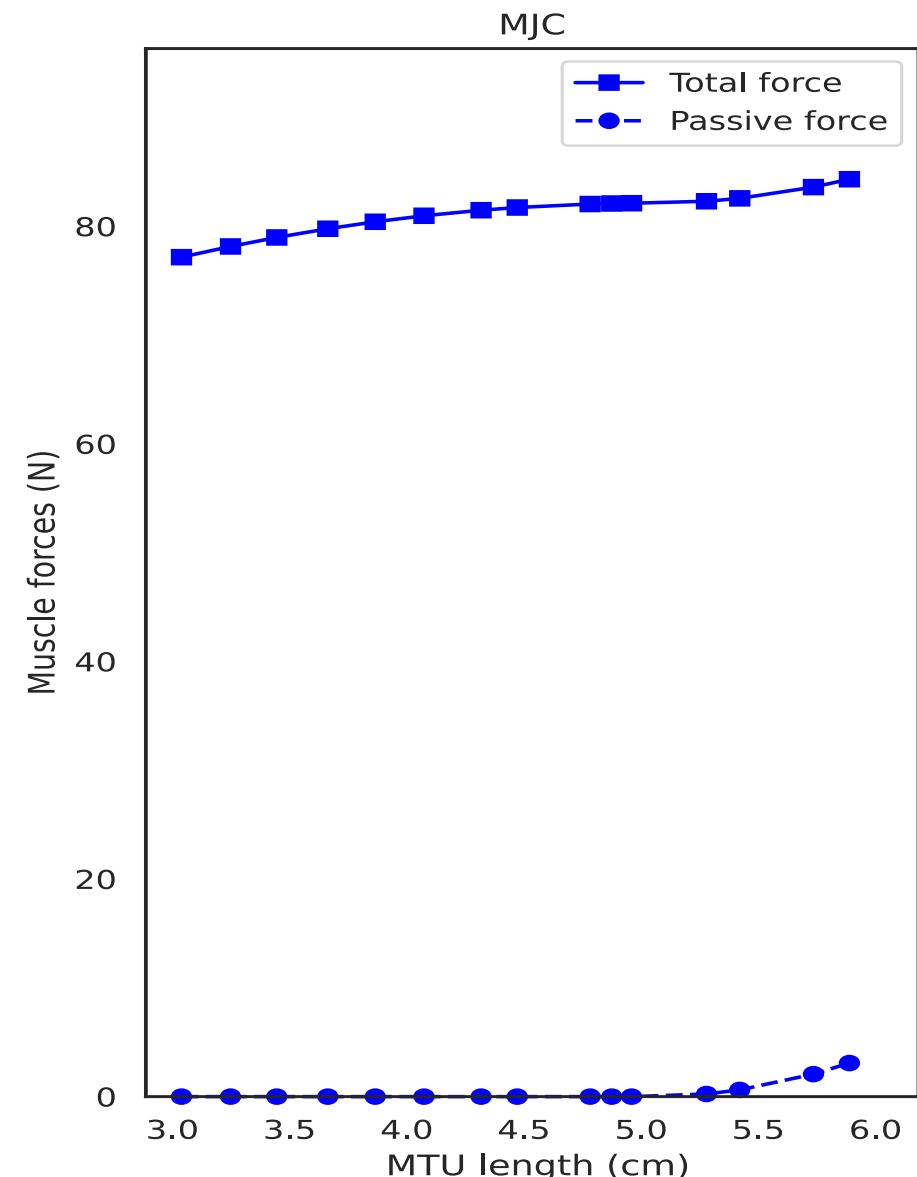
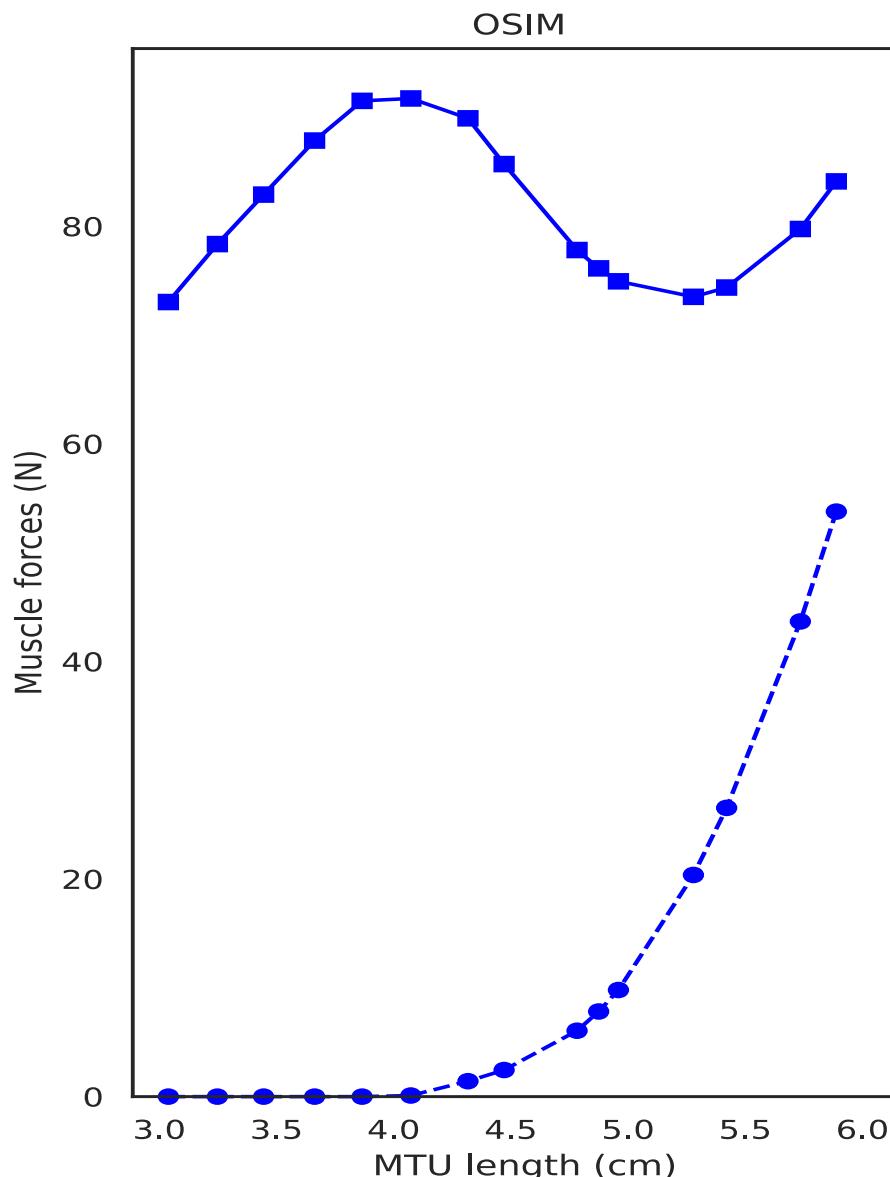
Muscle specific force comparison before/after optimization

splen_cerv_c3thx



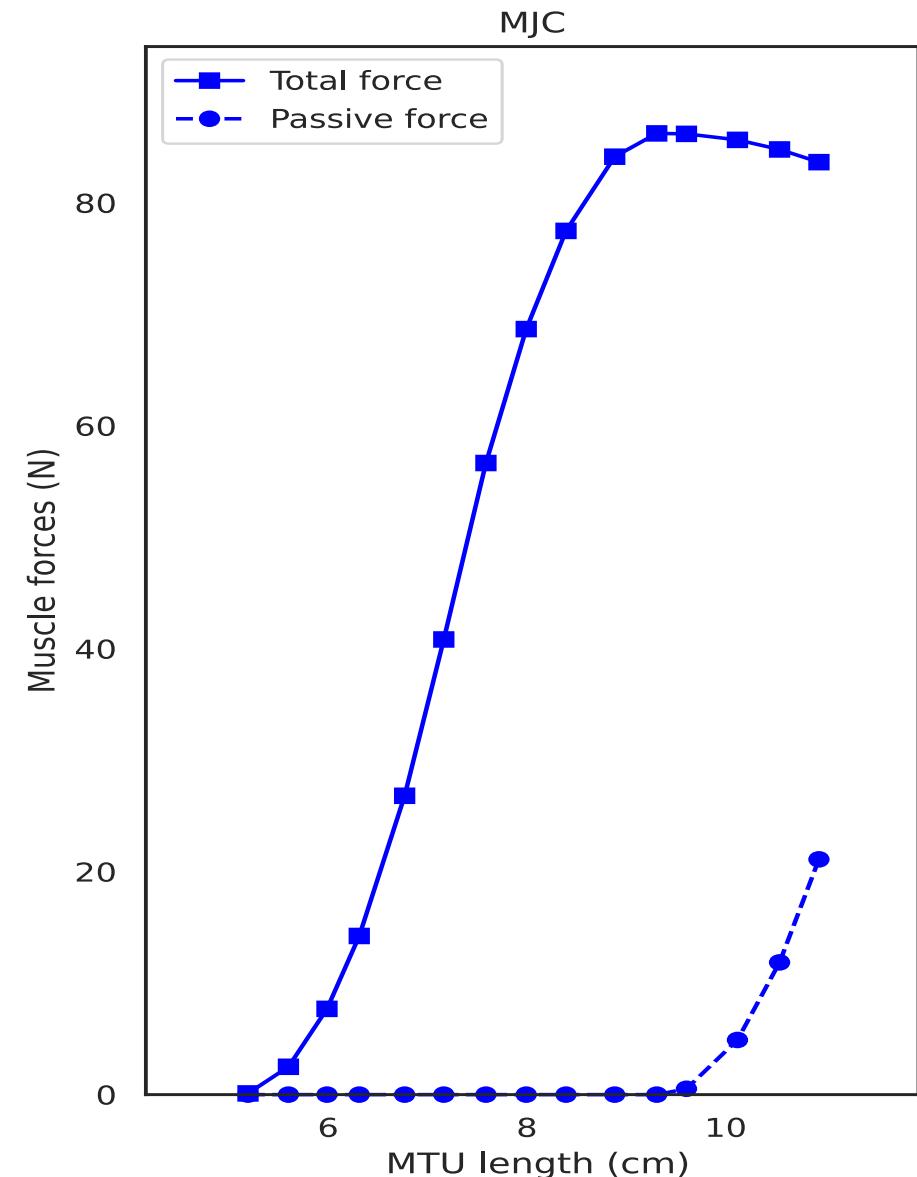
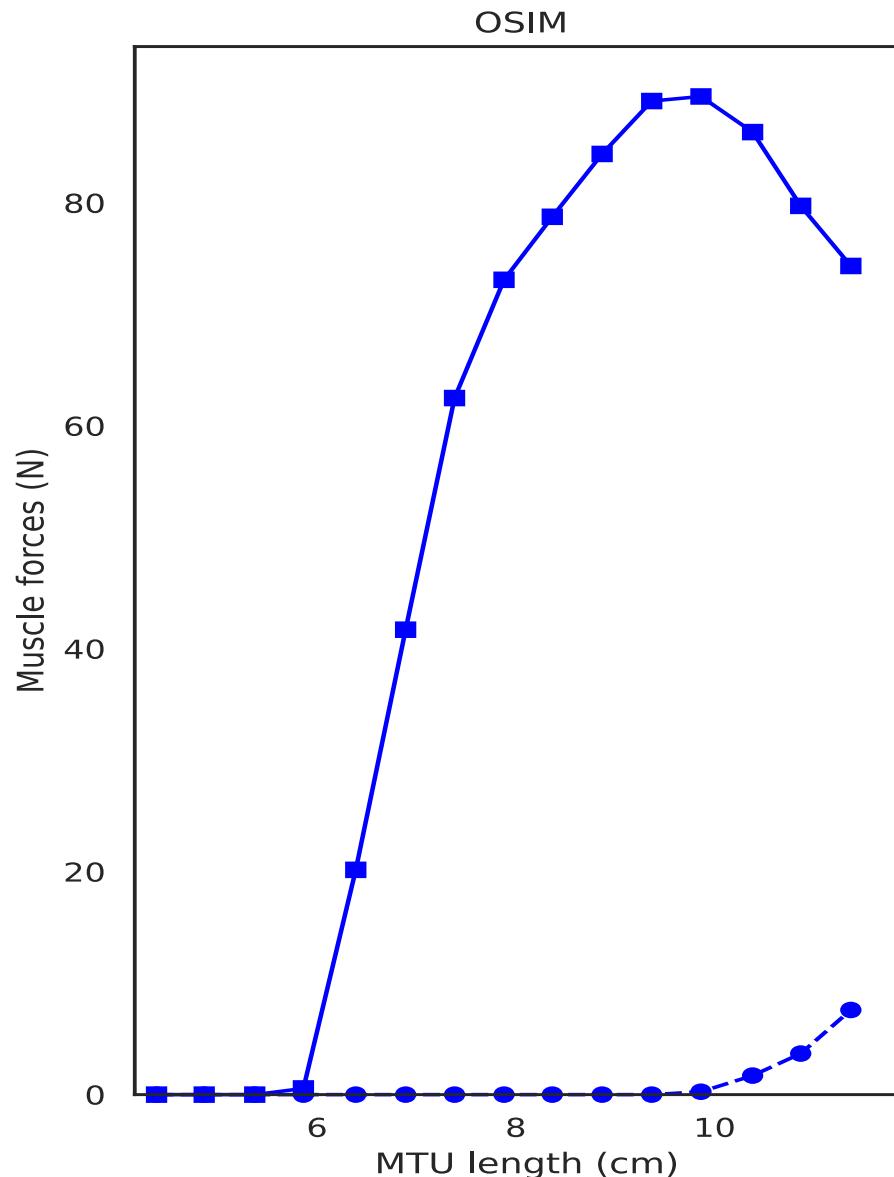
Muscle specific force comparison before/after optimization

Geniohyoid



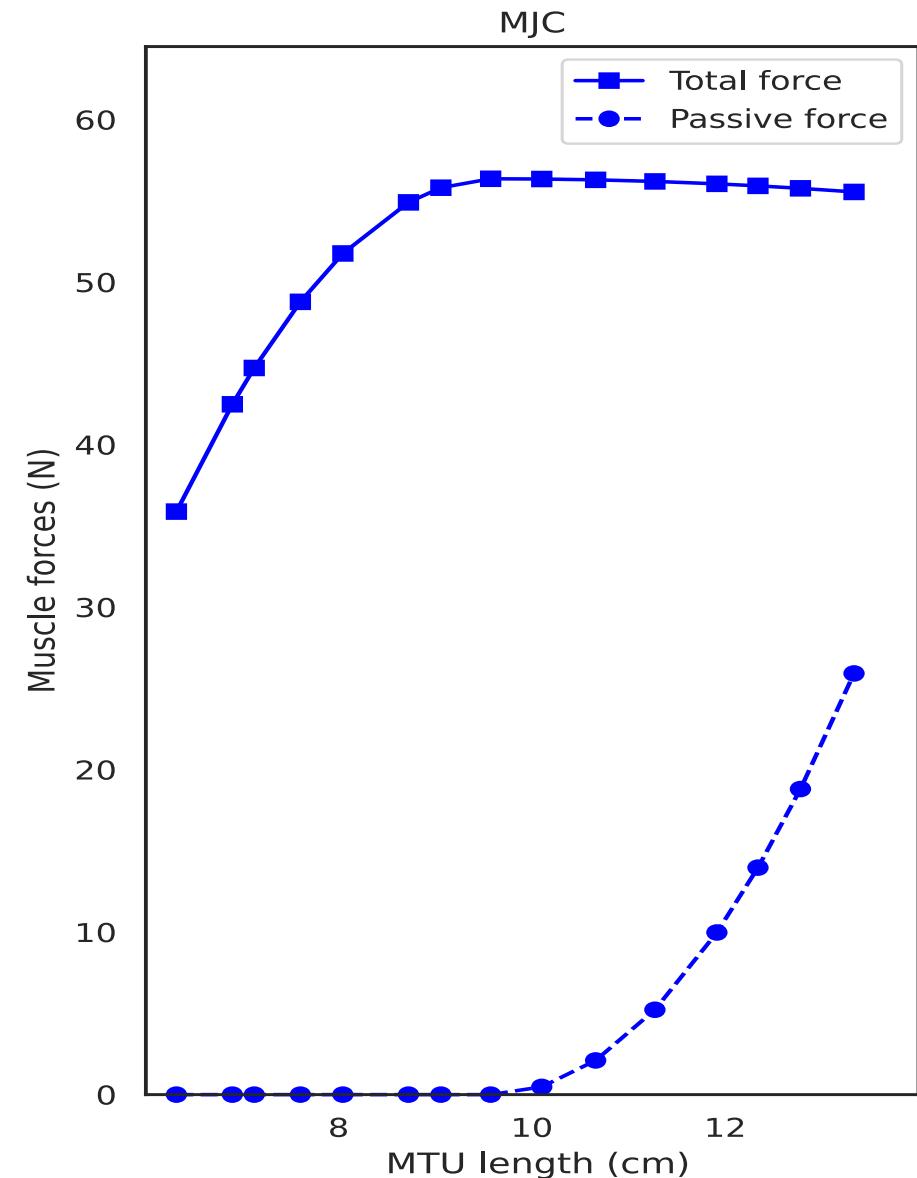
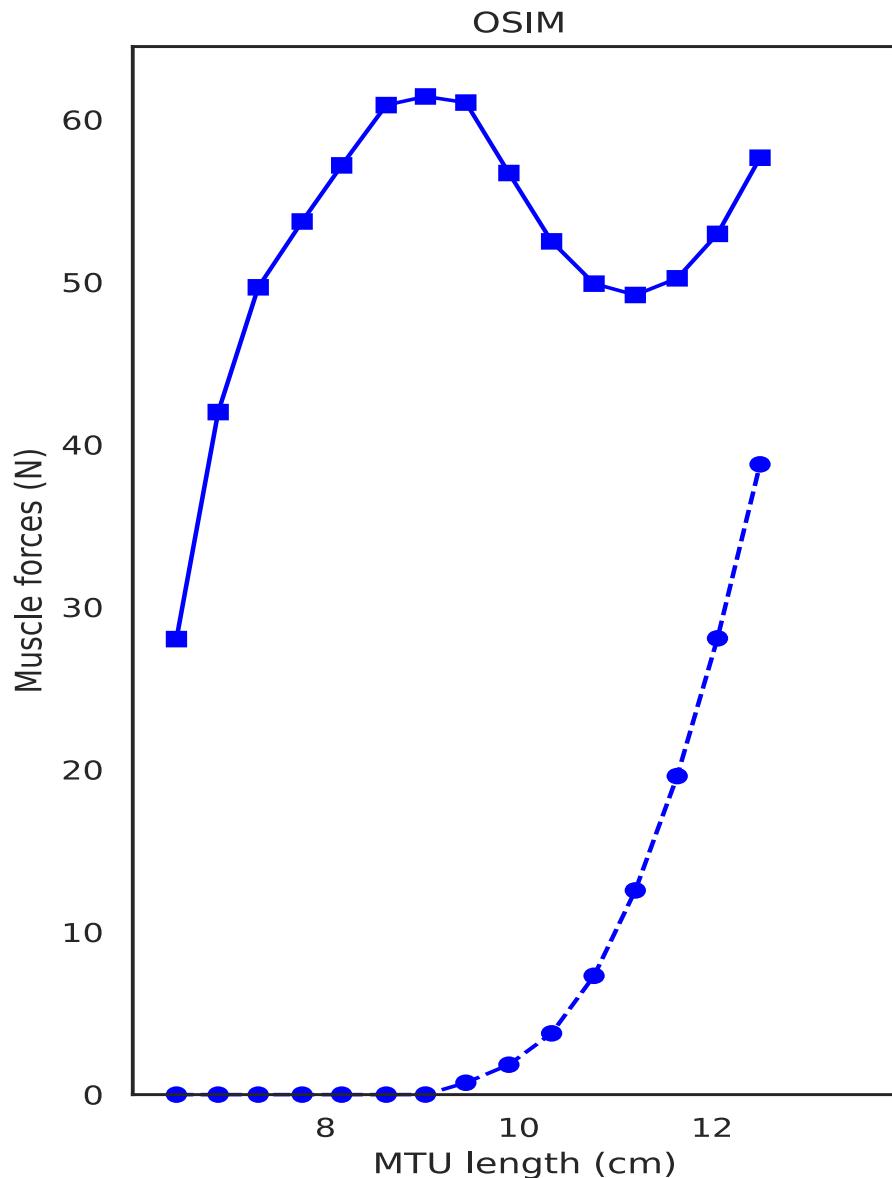
Muscle specific force comparison before/after optimization

semi_cerv_c3thx_L



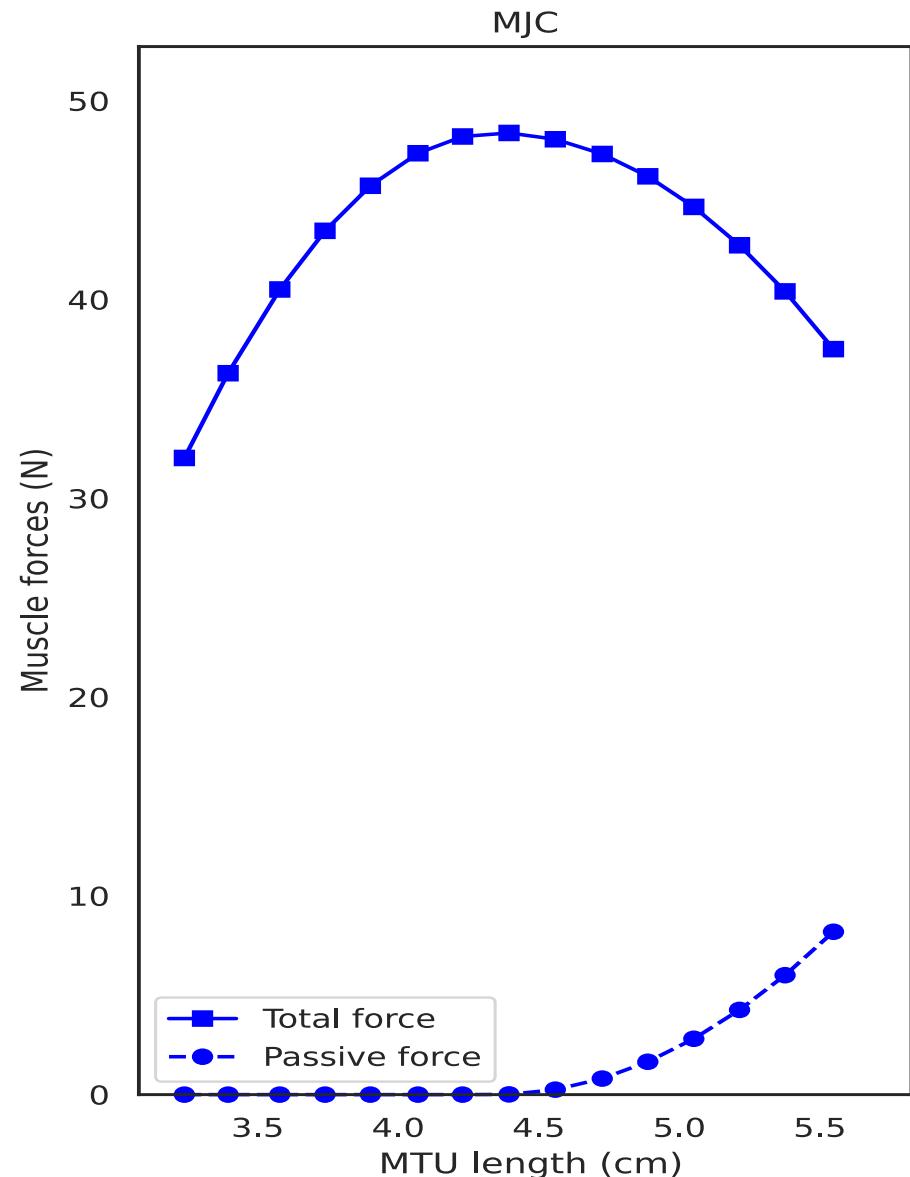
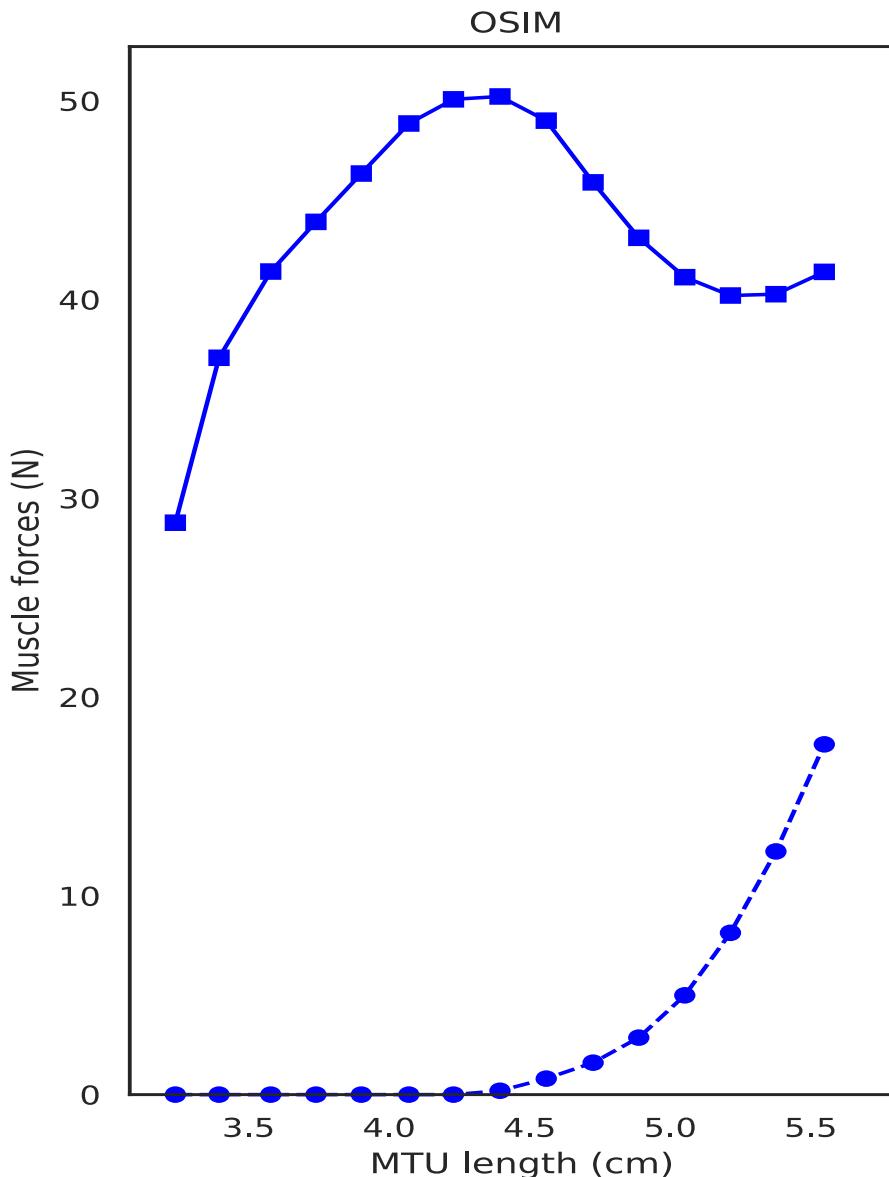
Muscle specific force comparison before/after optimization

SternoThyroid



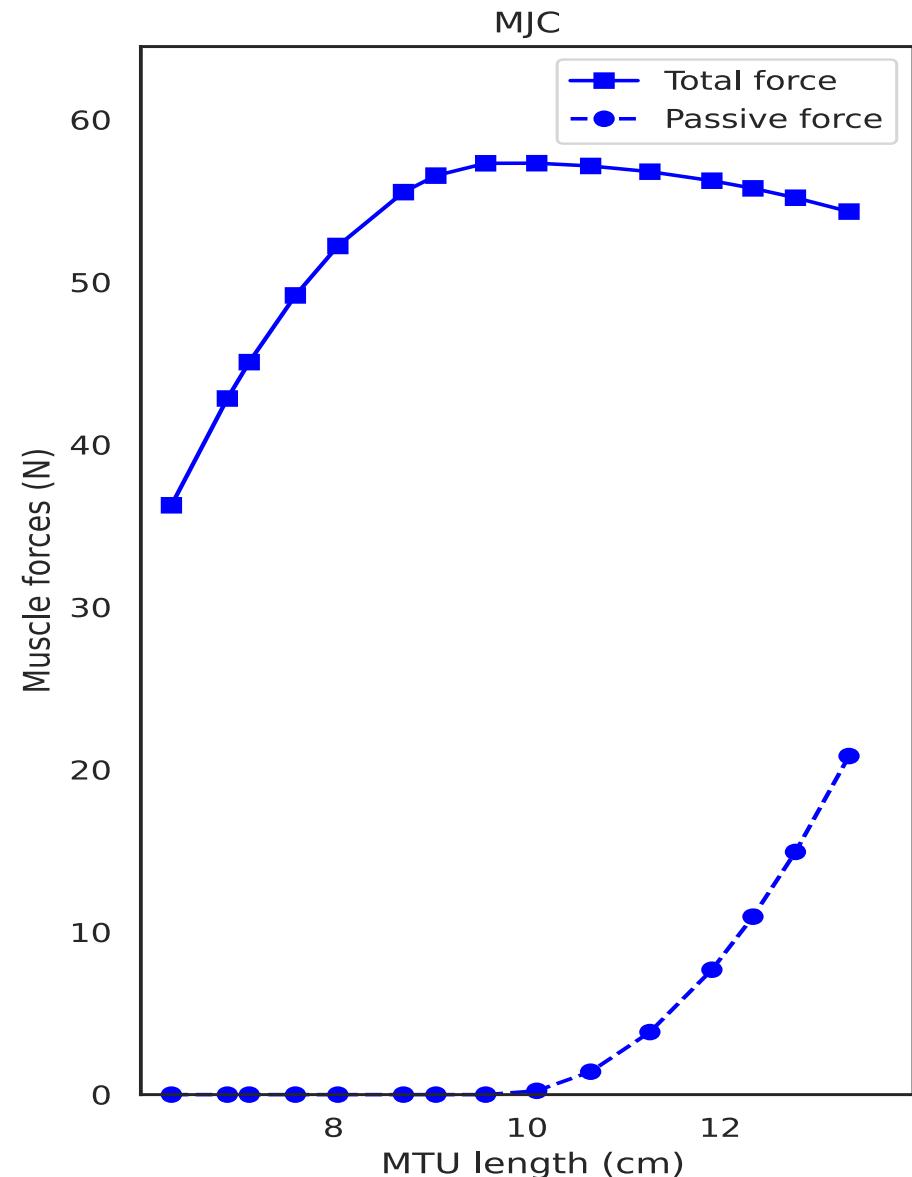
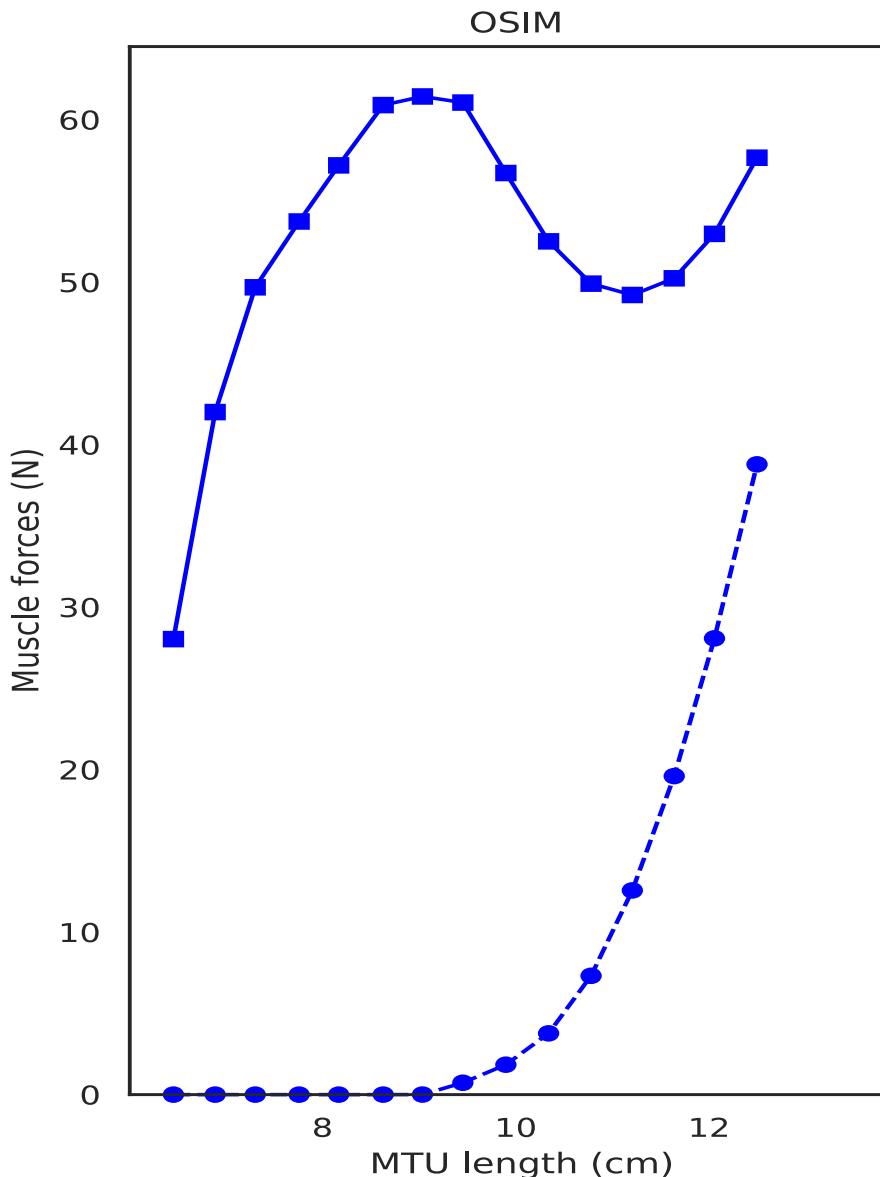
Muscle specific force comparison before/after optimization

Mylohyoid_Post_L



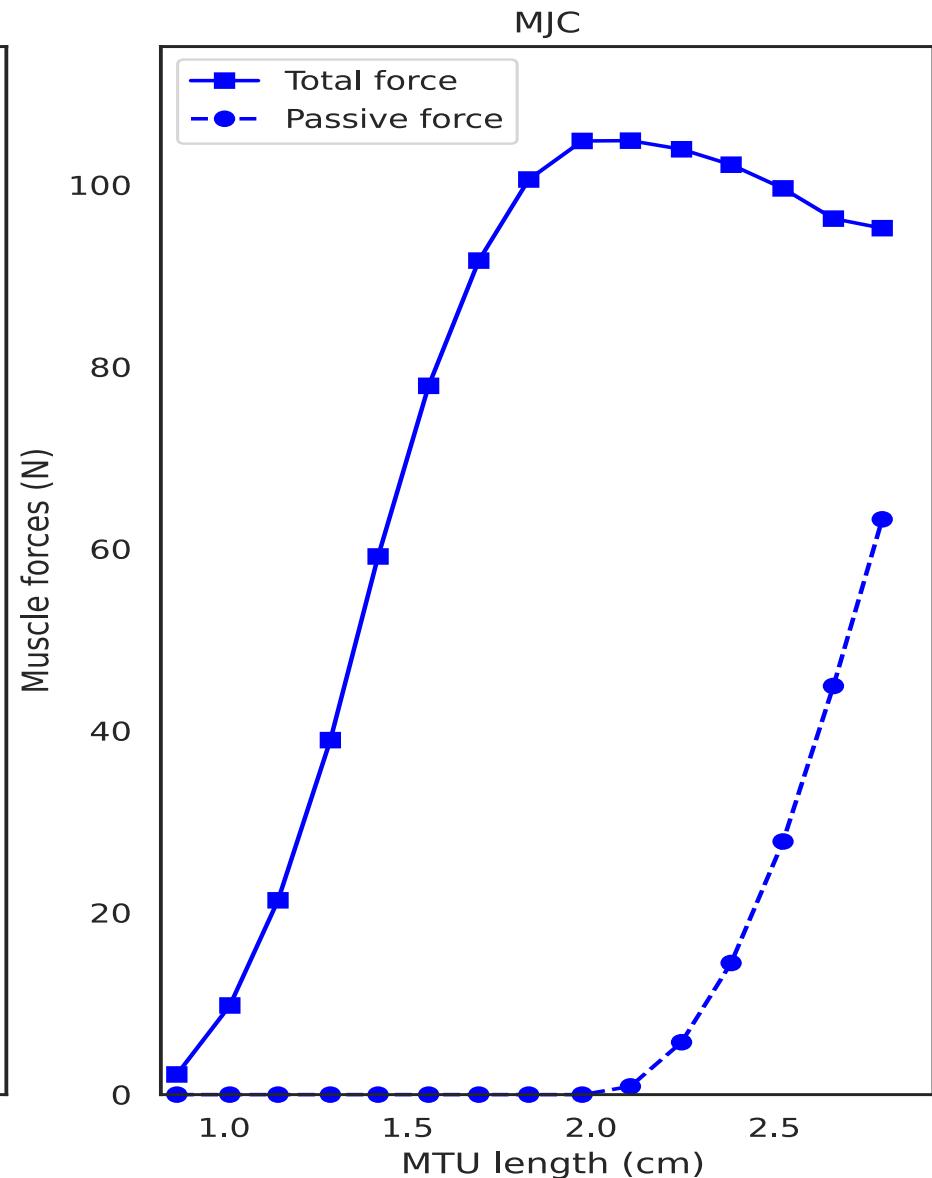
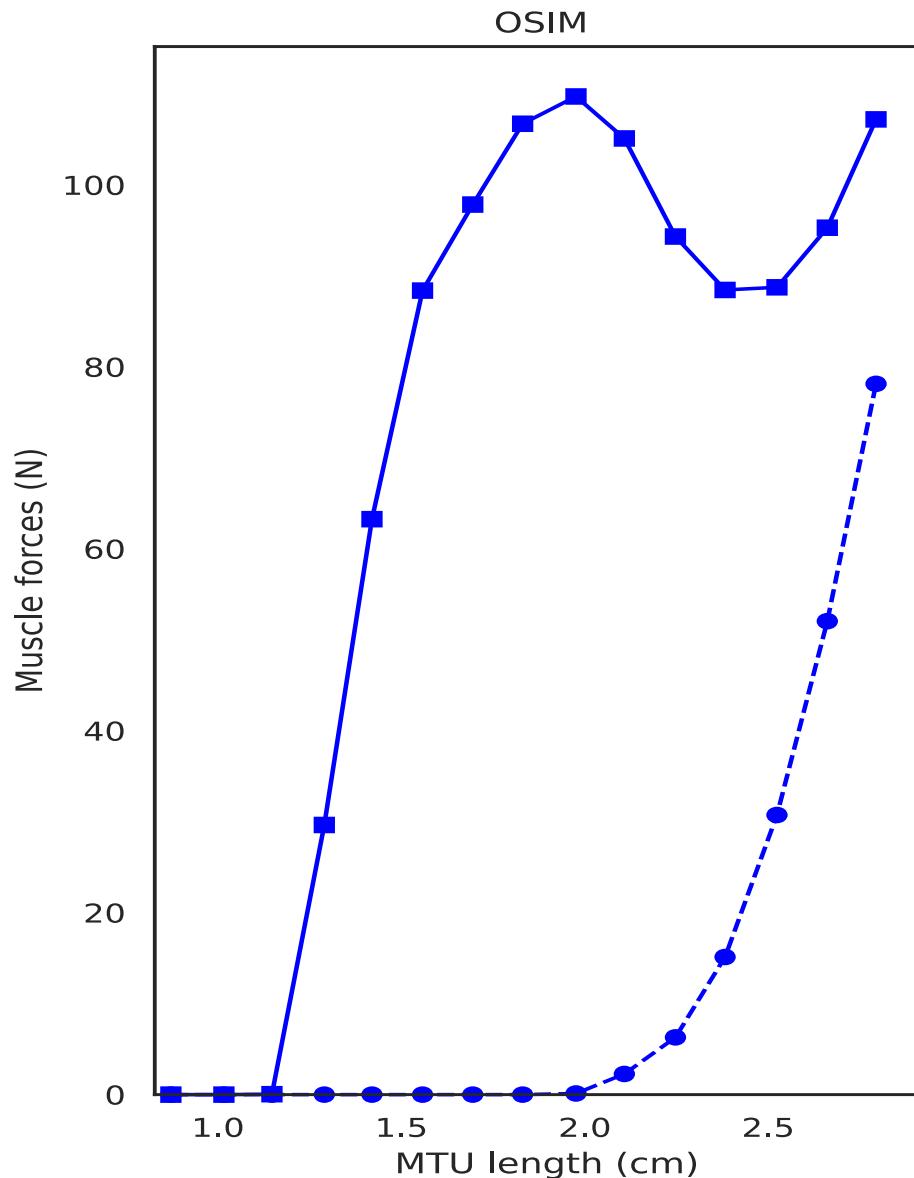
Muscle specific force comparison before/after optimization

SternoThyroid_L



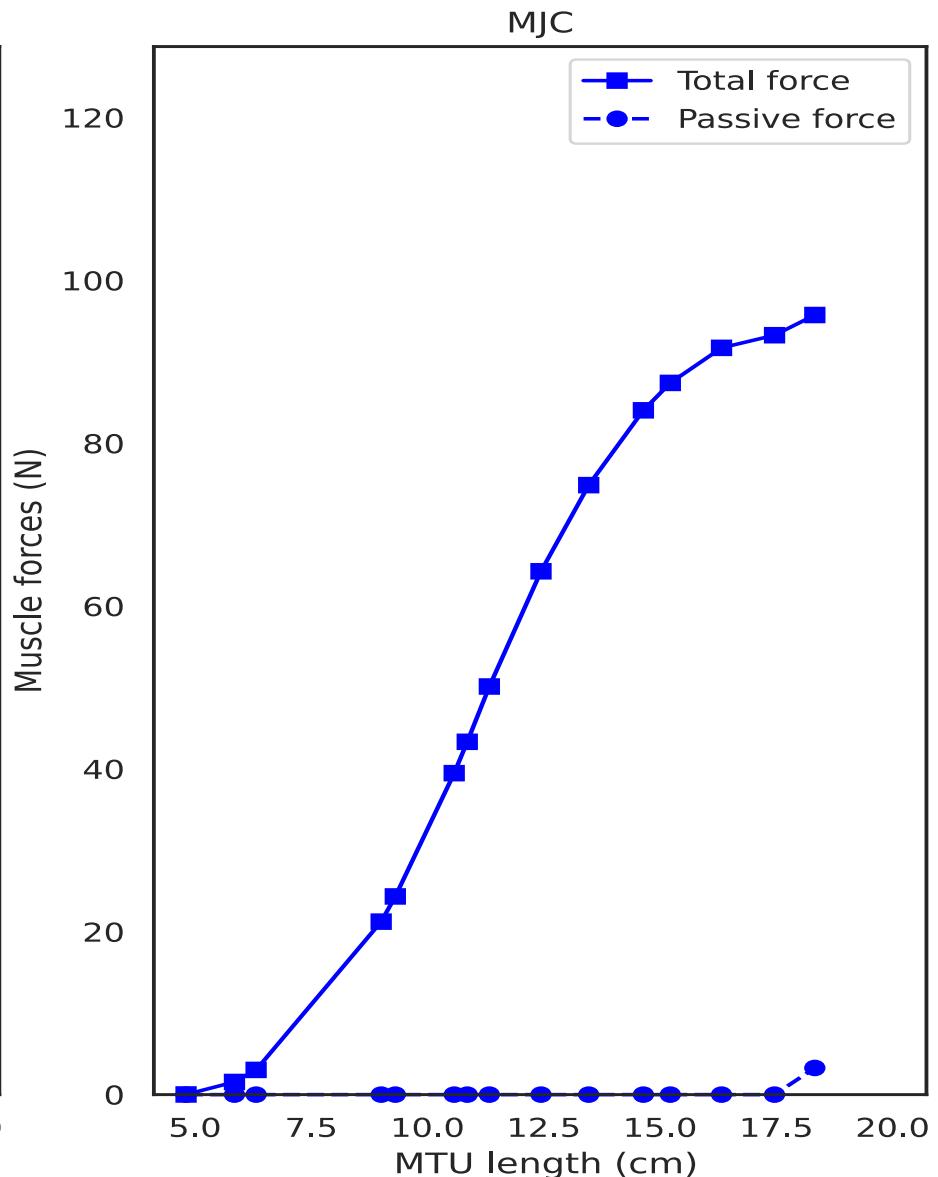
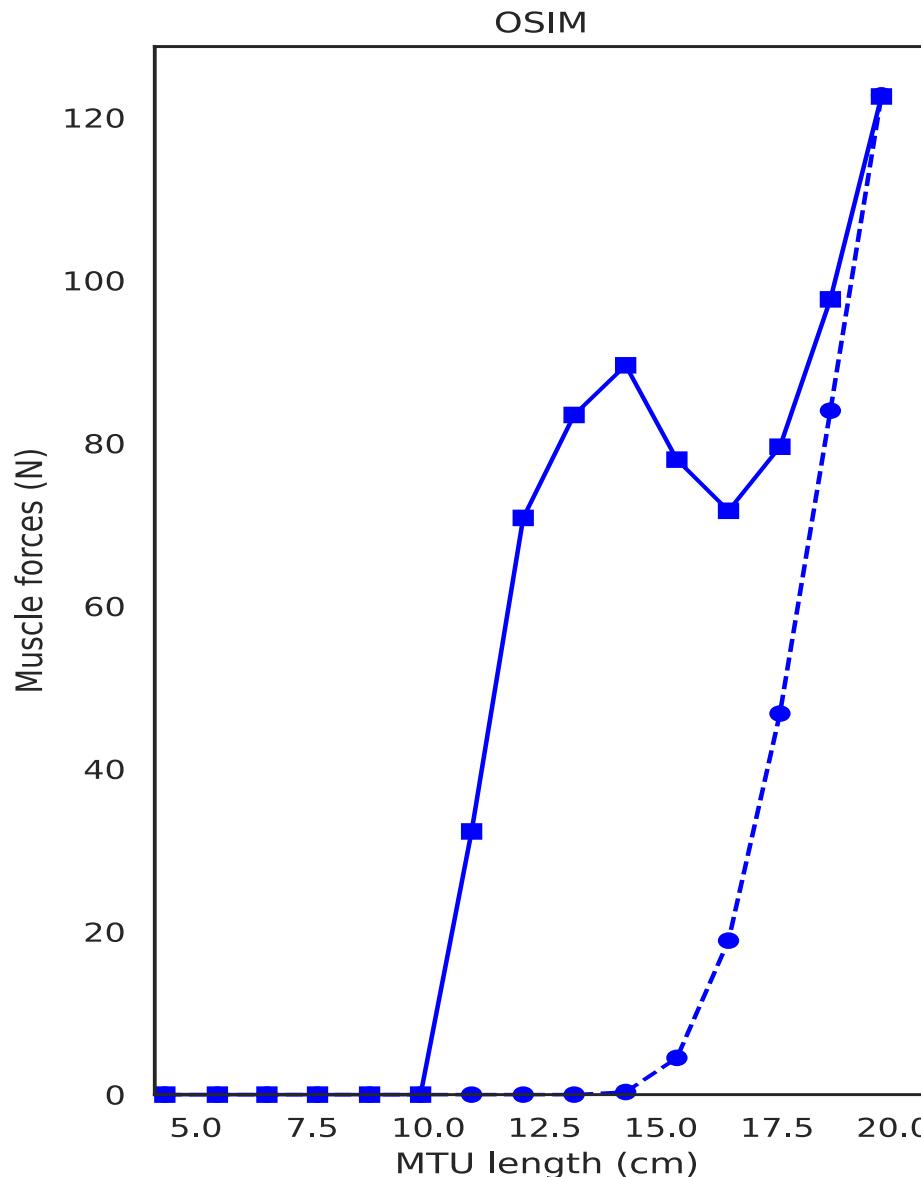
Muscle specific force comparison before/after optimization

digastric_ant_L



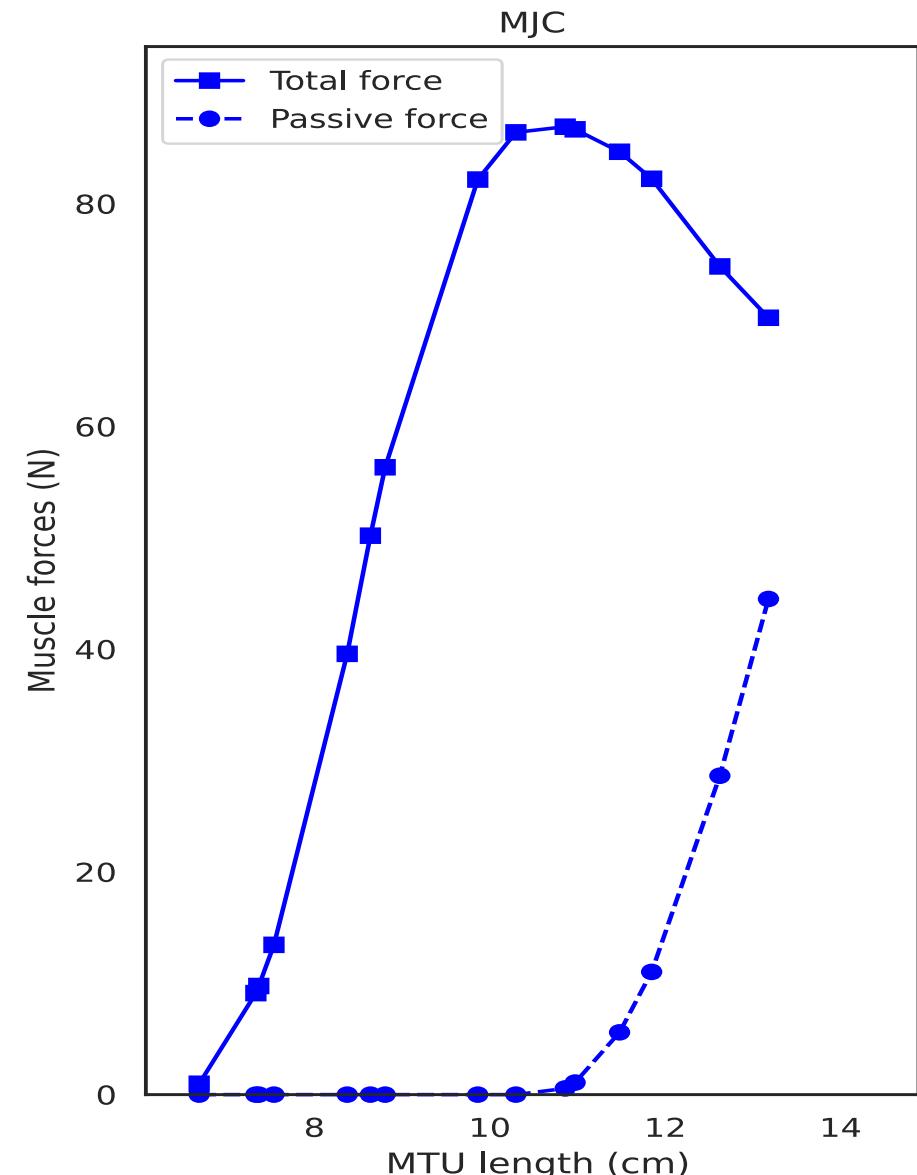
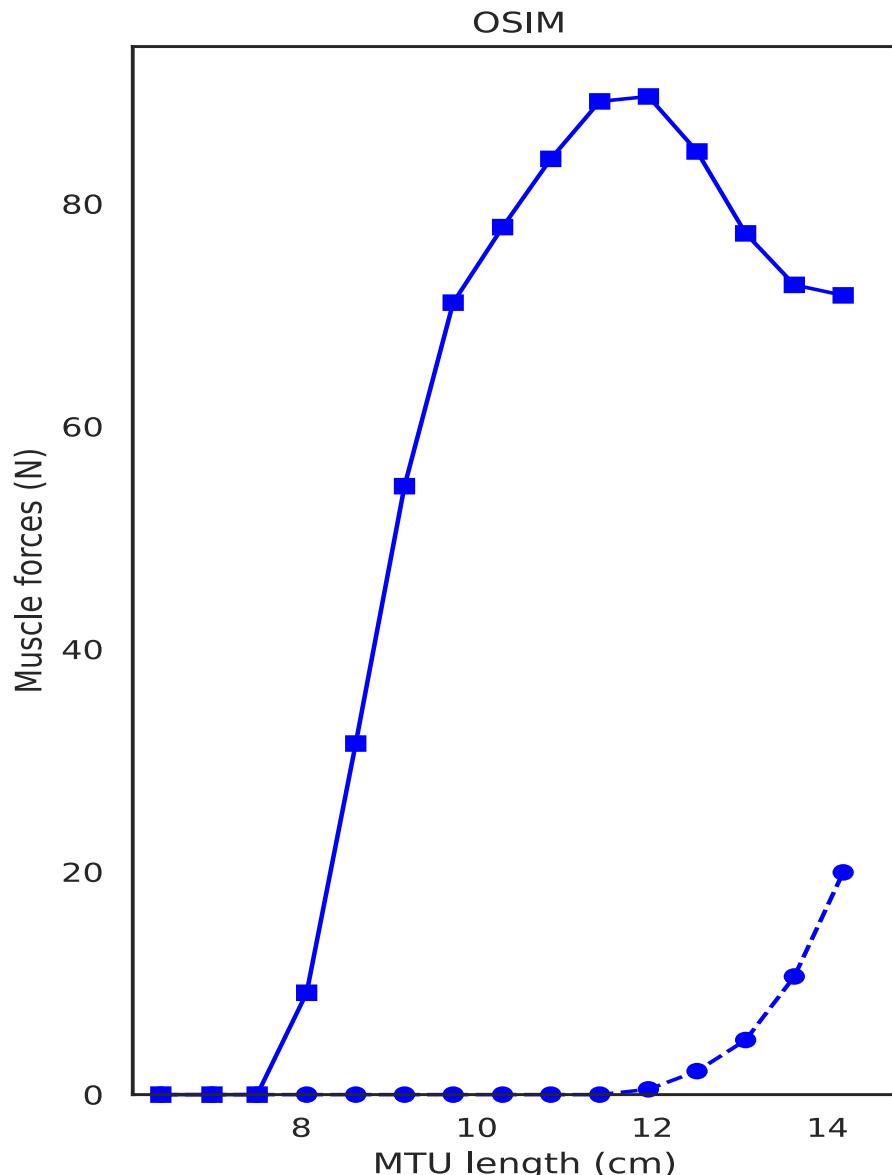
Muscle specific force comparison before/after optimization

semi_cap_sklthx_L



Muscle specific force comparison before/after optimization

semi_cap_sklc5



Muscle specific force comparison before/after optimization

digastric_ant

