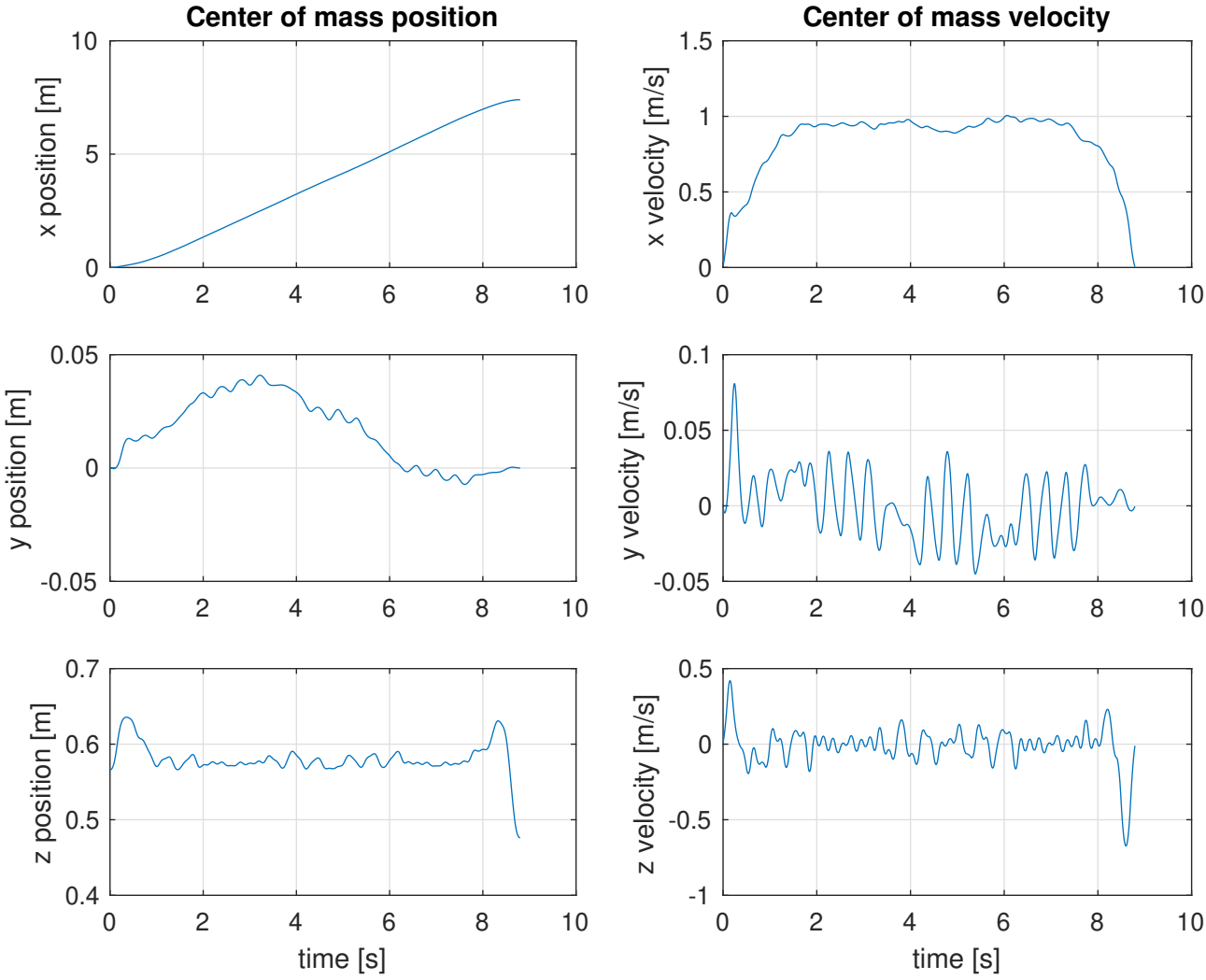
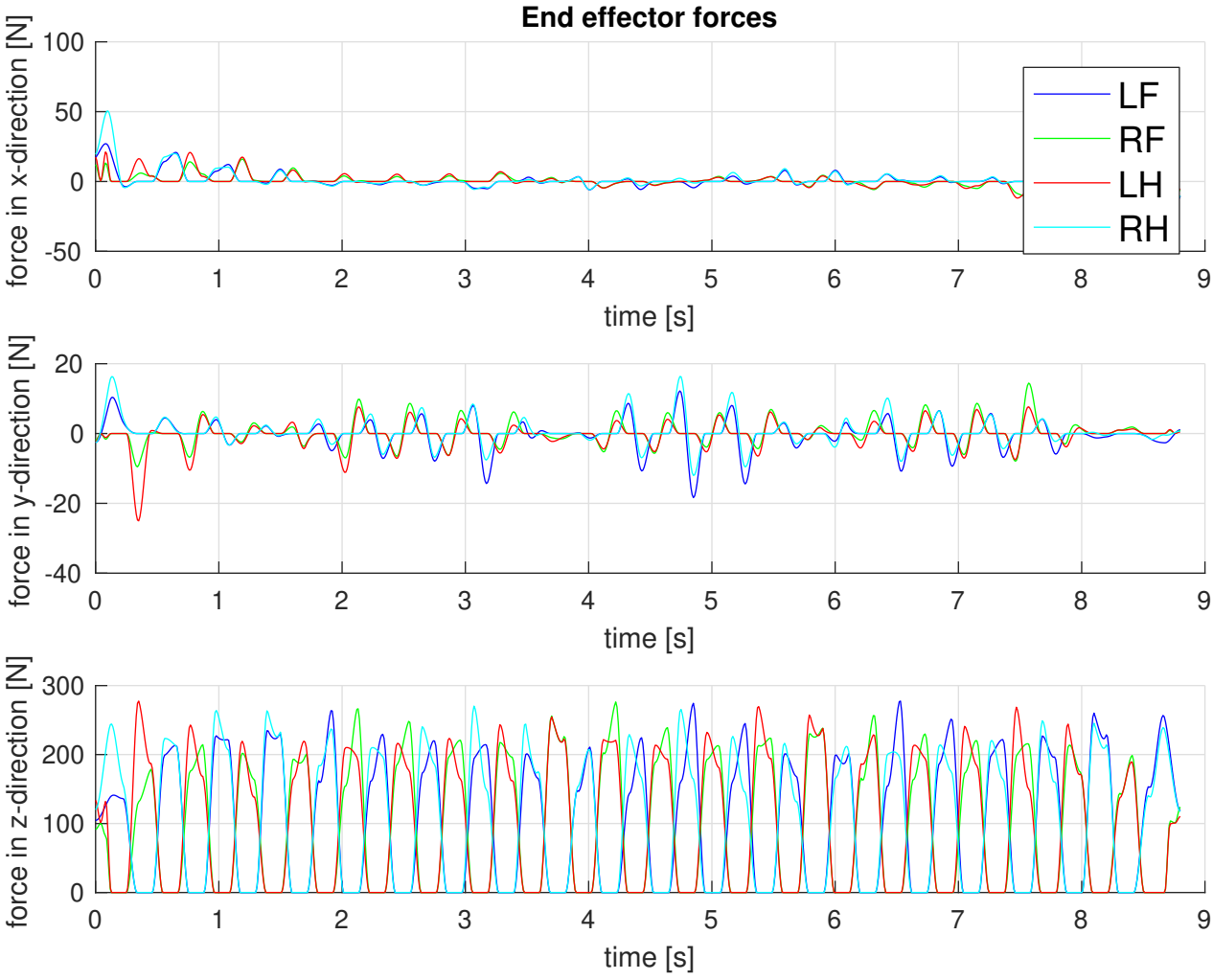
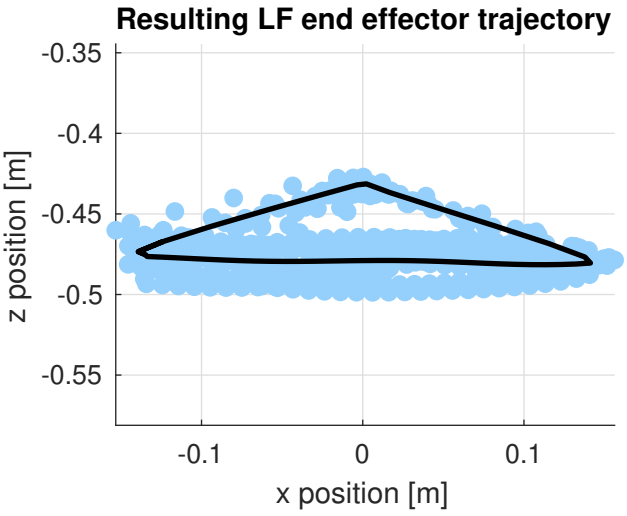
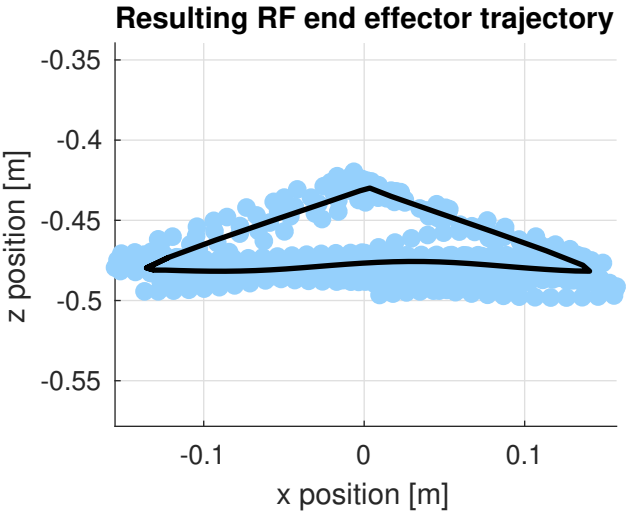
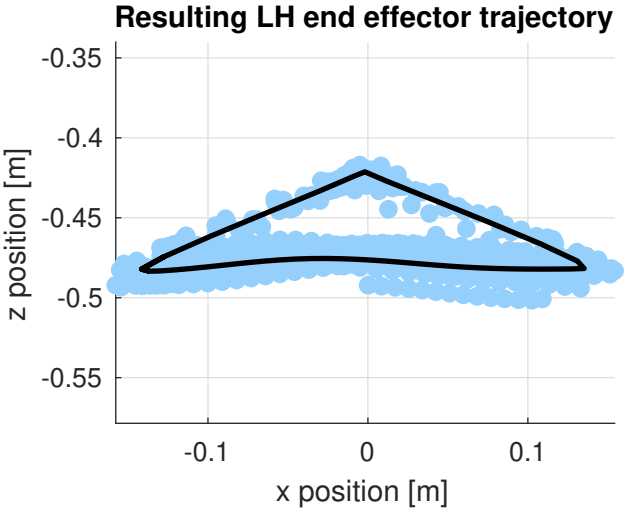
Results of vitruvio simulation for universal trot

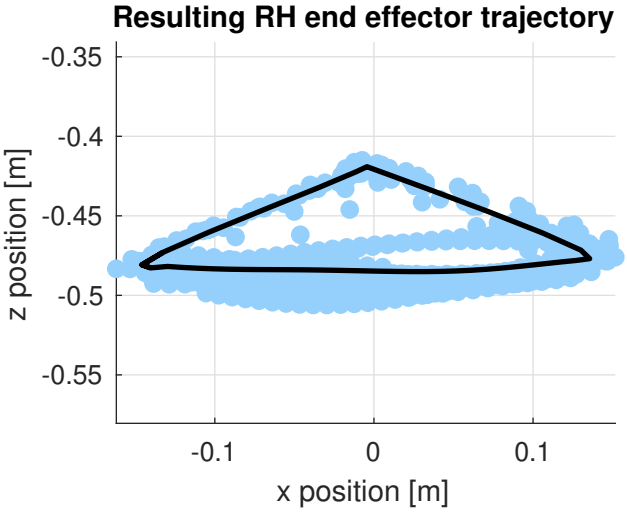

Center of mass position
Center of mass velocity
x position [m]
x velocity [m/s]
y position [m]
y velocity [m/s]
z position [m]
z velocity [m/s]
time [s]
time [s]

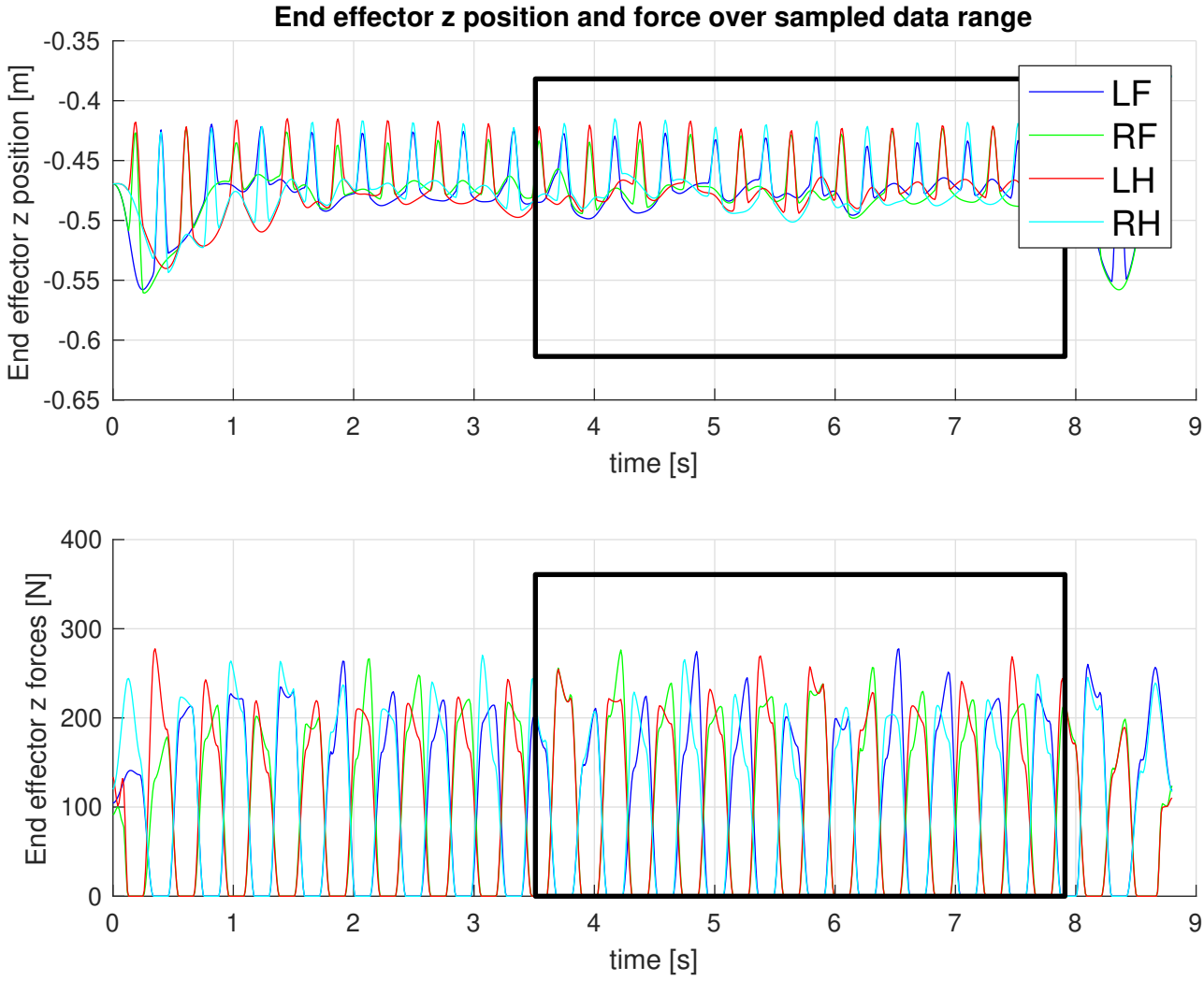

End effector forces
force in x-direction [N]
100
50
0
-50
0
1
2
3
4
5
6
7
8
9
time [s]
LF
RF
LH
RH
force in y-direction [N]
20
0
-20
-40
0
1
2
3
4
5
6
7
8
9
time [s]
force in z-direction [N]
300
200
100
0
0
1
2
3
4
5
6
7
8
9
time [s]

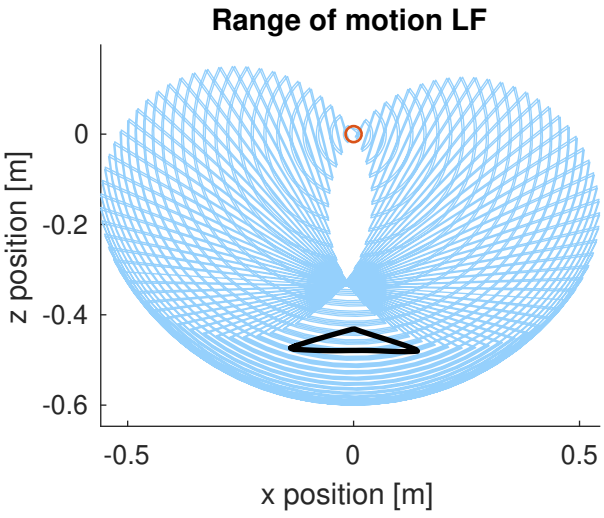

Resulting LF end effector trajectory
-0.35
-0.4
-0.45
-0.5
-0.55
z position [m]
-0.1
0
0.1
x position [m]

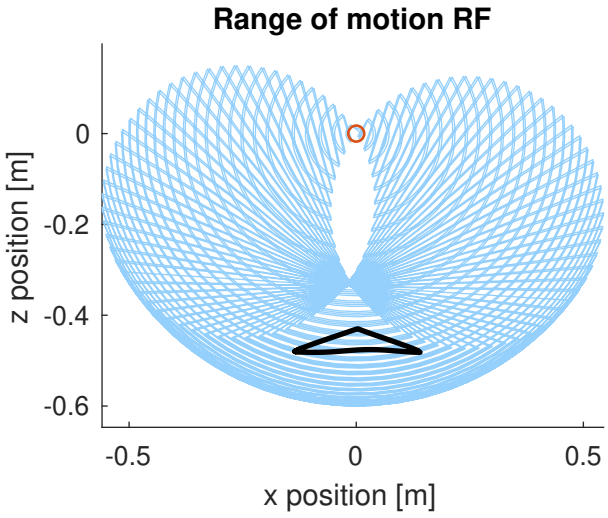

Resulting RF end effector trajectory
-0.35
-0.4
-0.45
-0.5
-0.55
z position [m]
-0.1
0
0.1
x position [m]

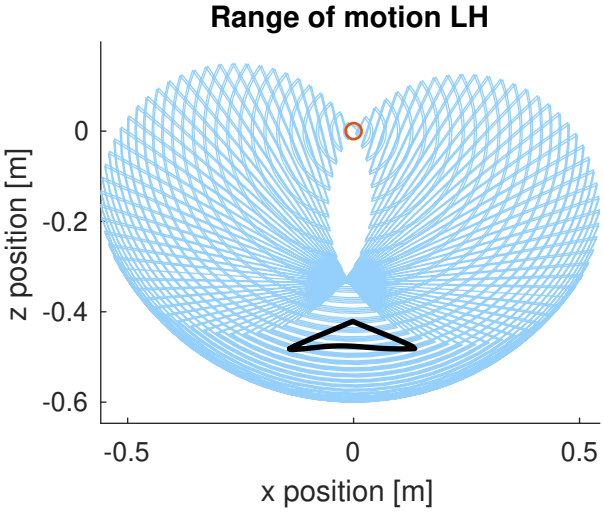

Resulting LH end effector trajectory
-0.35
-0.4
-0.45
-0.5
-0.55
z position [m]
-0.1
0
0.1
x position [m]

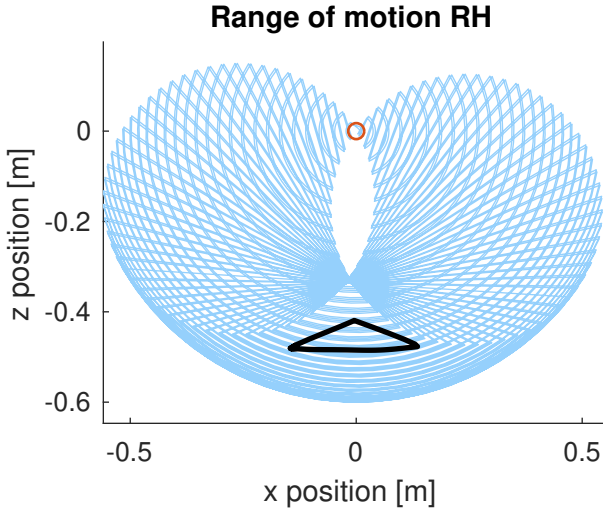

Resulting RH end effector trajectory
-0.35
-0.4
-0.45
-0.5
-0.55
z position [m]
-0.1
0
0.1
x position [m]

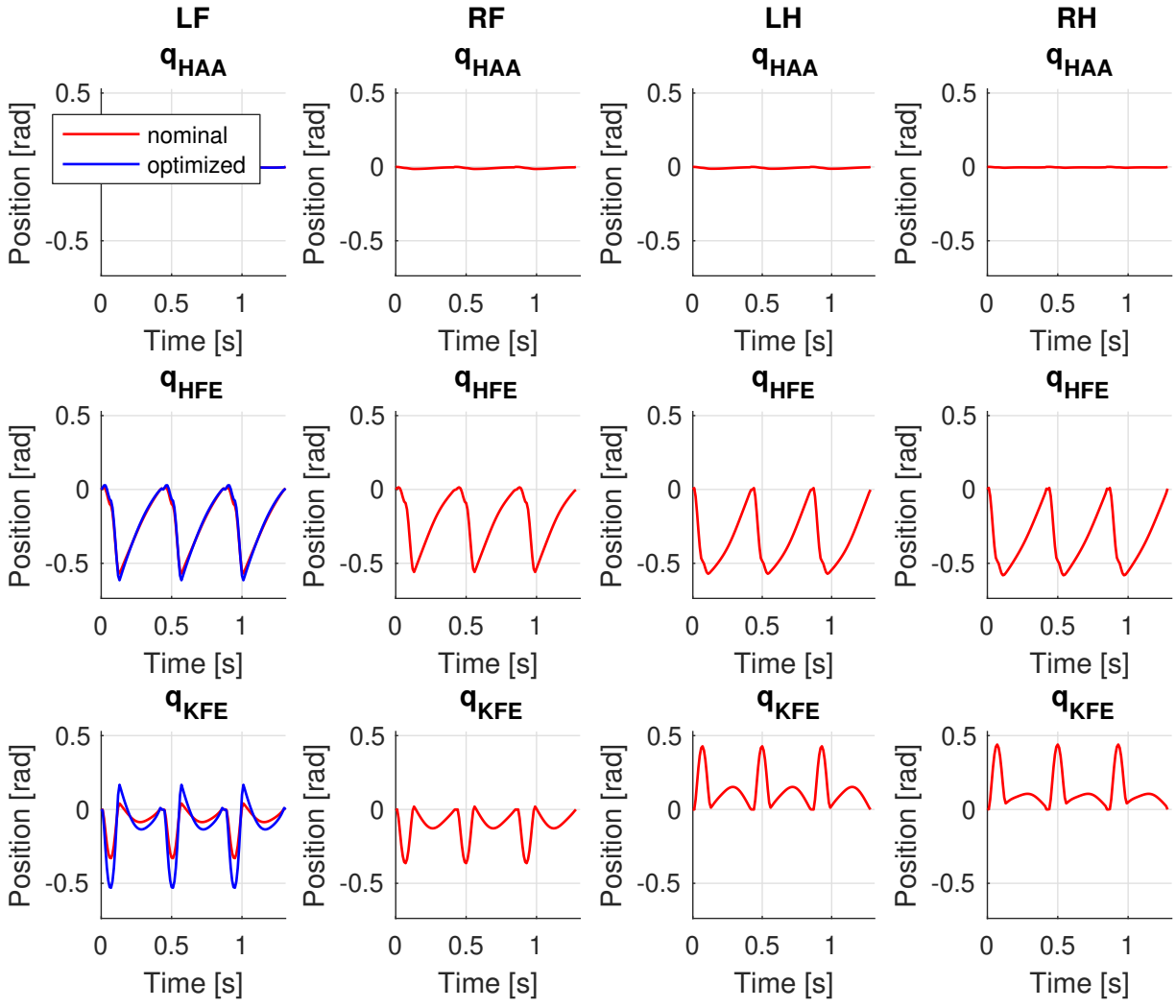

End effector z position and force over sampled data range
End effector z position [m]
-0.35
-0.4
-0.45
-0.5
-0.55
-0.6
-0.65
0
1
2
3
4
5
6
7
8
9
time [s]
LF
RF
LH
RH
End effector z forces [N]
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
time [s]

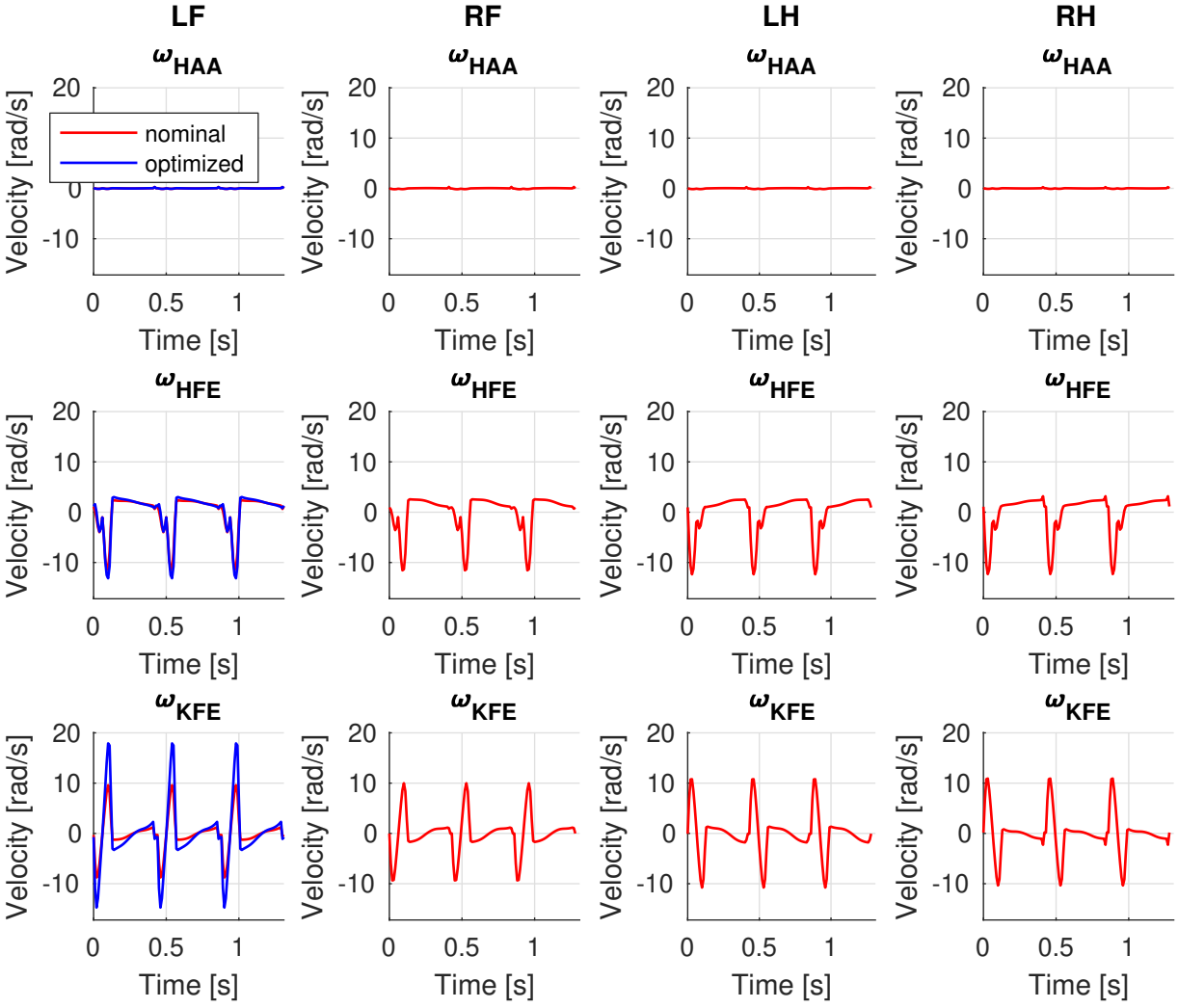

Range of motion LF
z position [m]
0
-0.2
-0.4
-0.6
-0.5
0
0.5
x position [m]

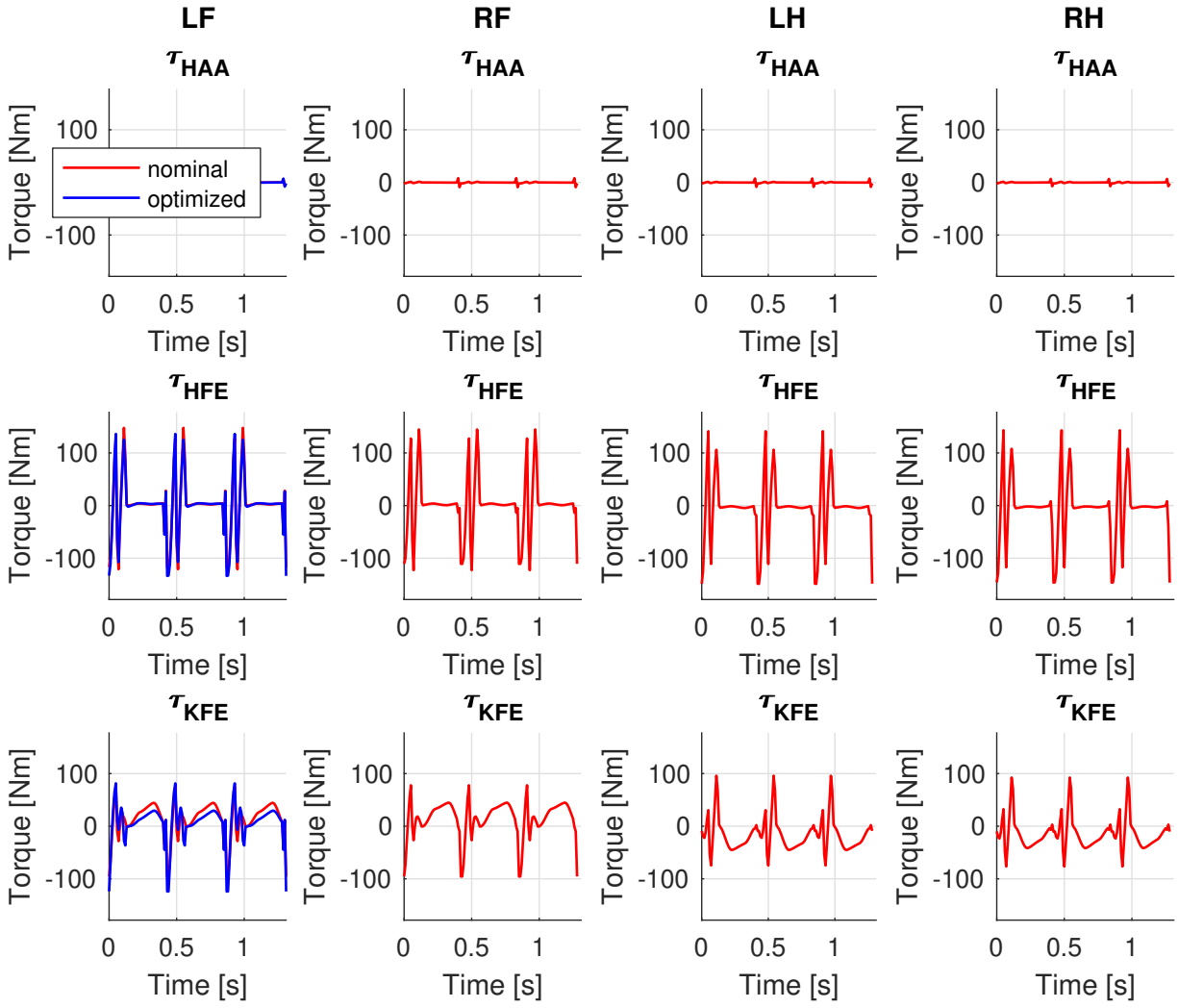

Range of motion RF
z position [m]
0
-0.2
-0.4
-0.6
-0.5
0
0.5
x position [m]

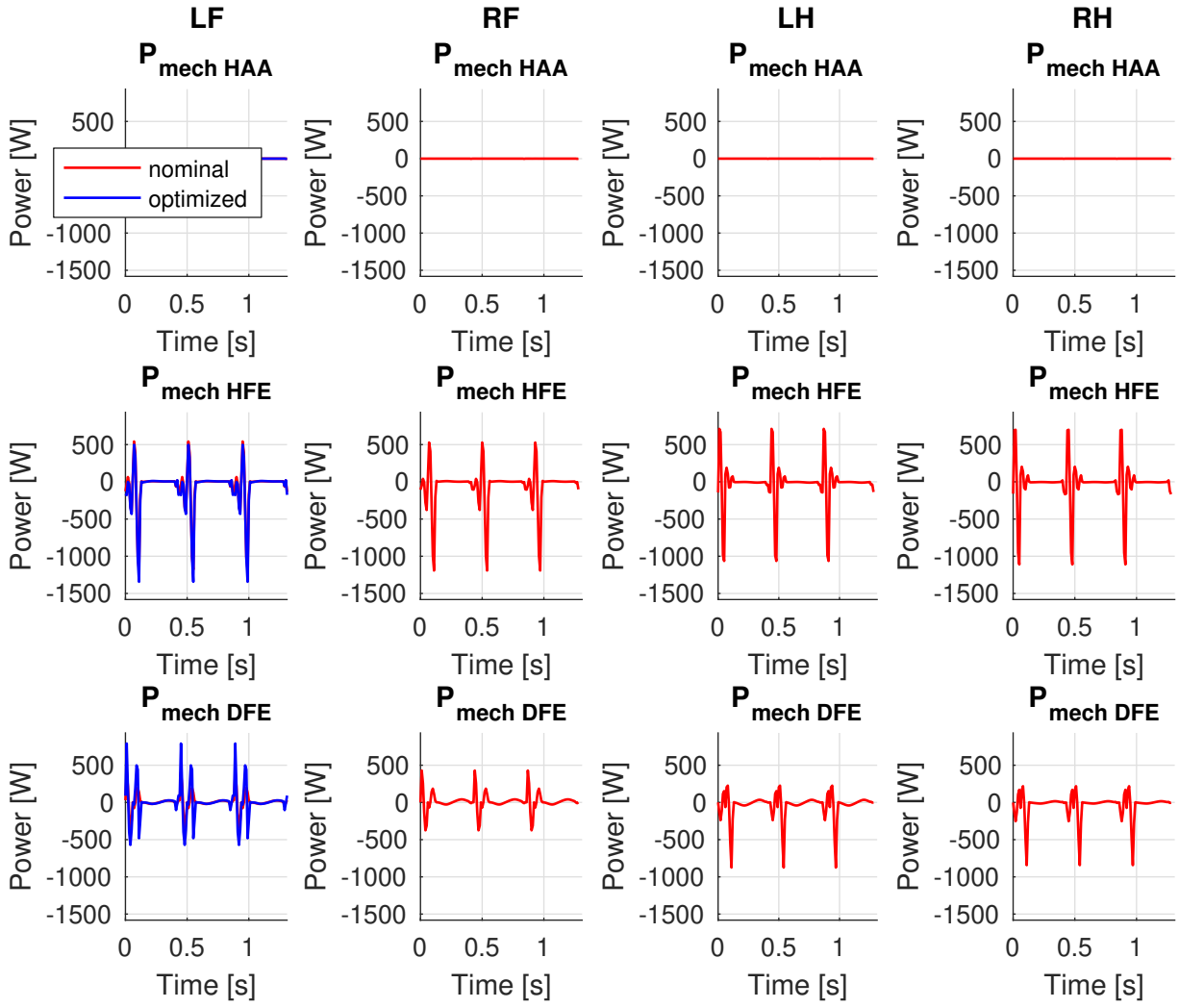

Range of motion LH
z position [m]
0
-0.2
-0.4
-0.6
-0.5
0
0.5
x position [m]

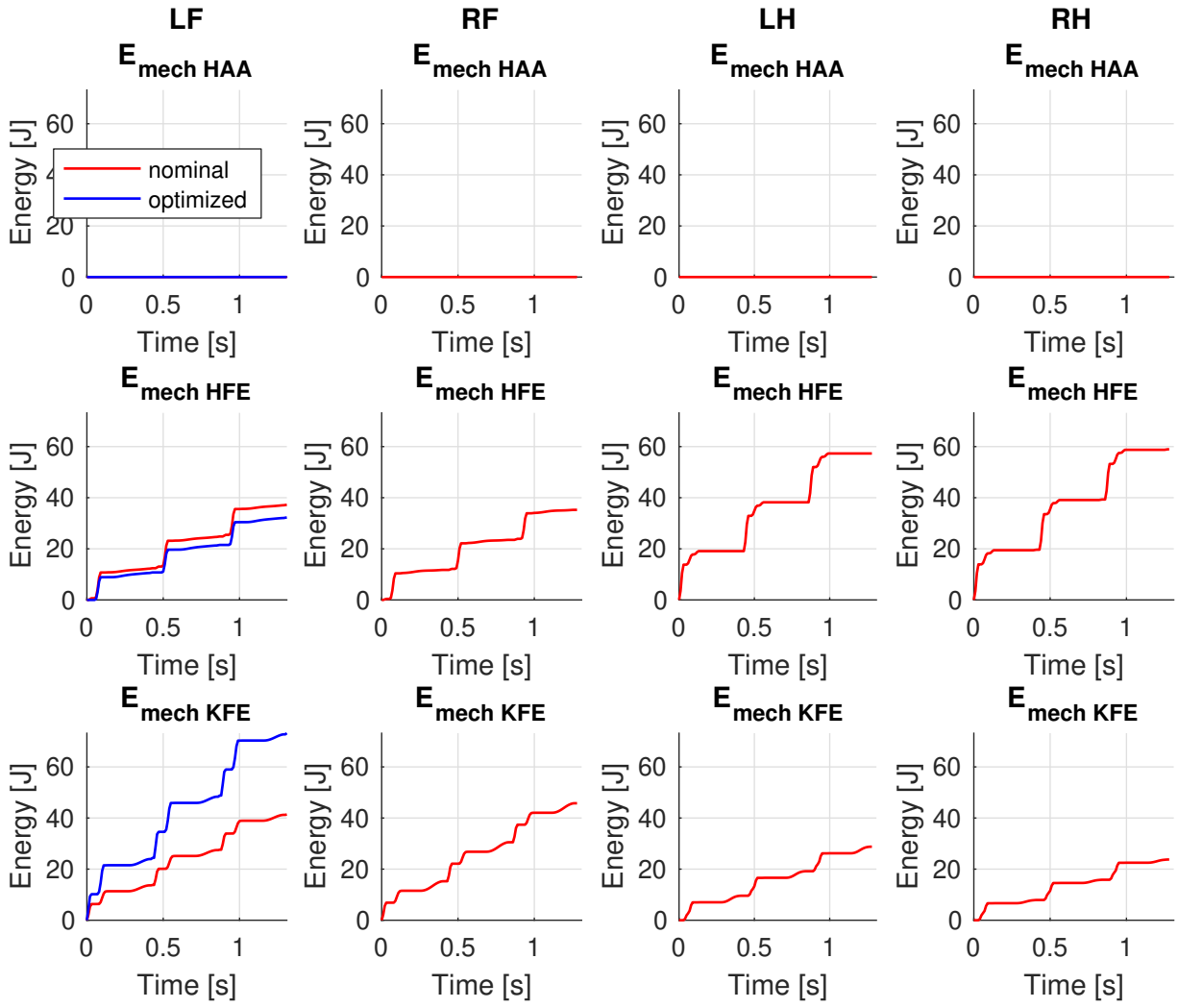

Range of motion RH
z position [m]
0
-0.2
-0.4
-0.6
-0.5
0
0.5
x position [m]

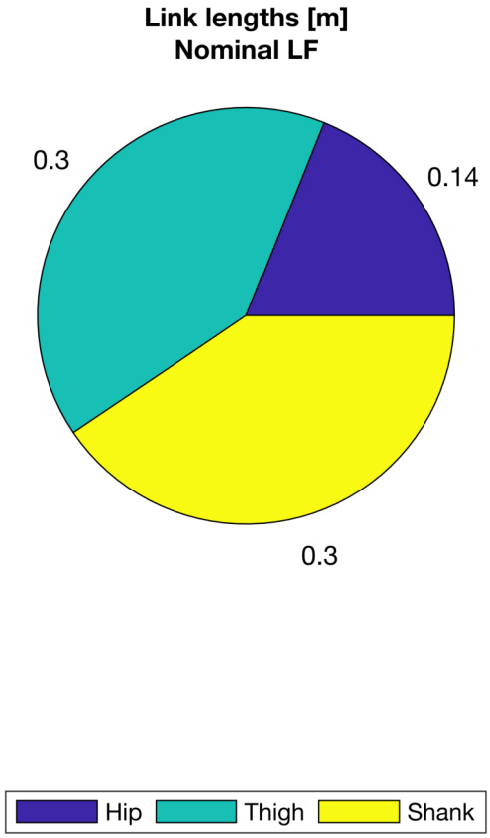

LF
RF
LH
RH
q_{HAA}
q_{HFE}
q_{KFE}
nominal
optimized
Position [rad]
Time [s]
0.5
0
-0.5
0
0.5
1

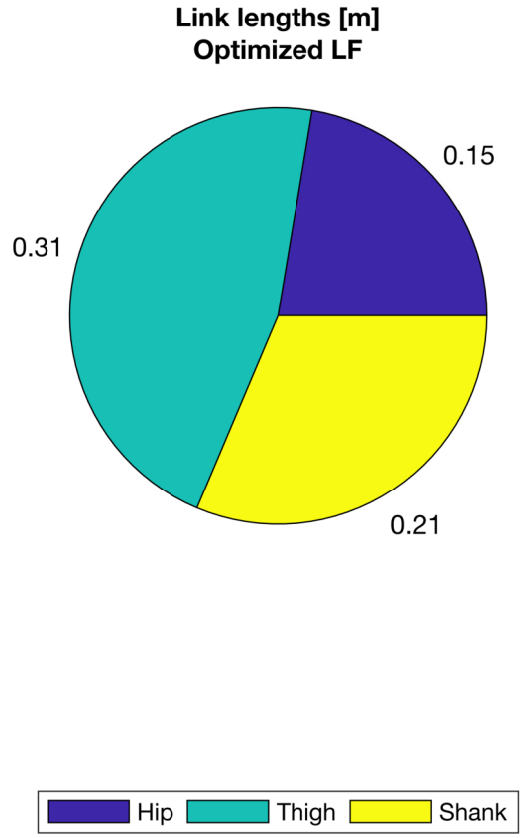

LF
RF
LH
RH
ω_{HAA}
ω_{HFE}
ω_{KFE}
nominal
optimized
Velocity [rad/s]
Time [s]
20
10
0
-10
0
0.5
1

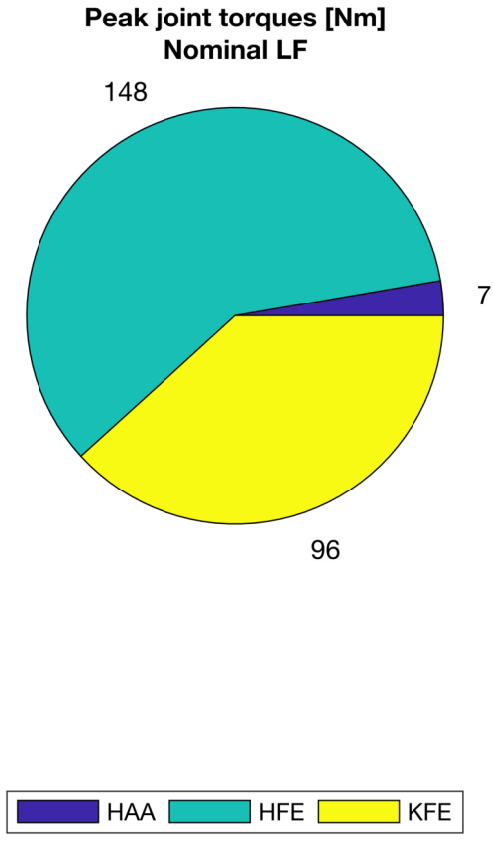

LF
RF
LH
RH
τ_{HAA}
τ_{HFE}
τ_{KFE}
nominal
optimized
Torque [Nm]
Time [s]
100
0
-100
0
0.5
1

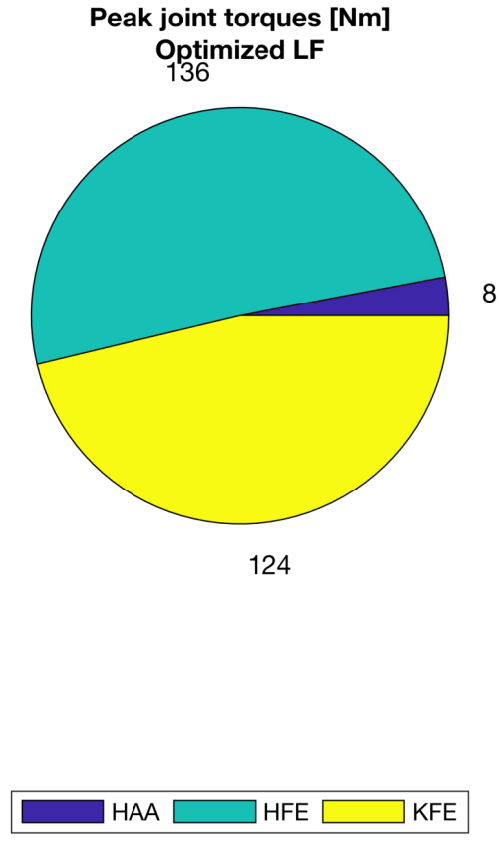

LF
RF
LH
RH
P mech HAA
P mech HFE
P mech DFE
Power [W]
Time [s]
nominal
optimized
500
0
-500
-1000
-1500
0
0.5
1

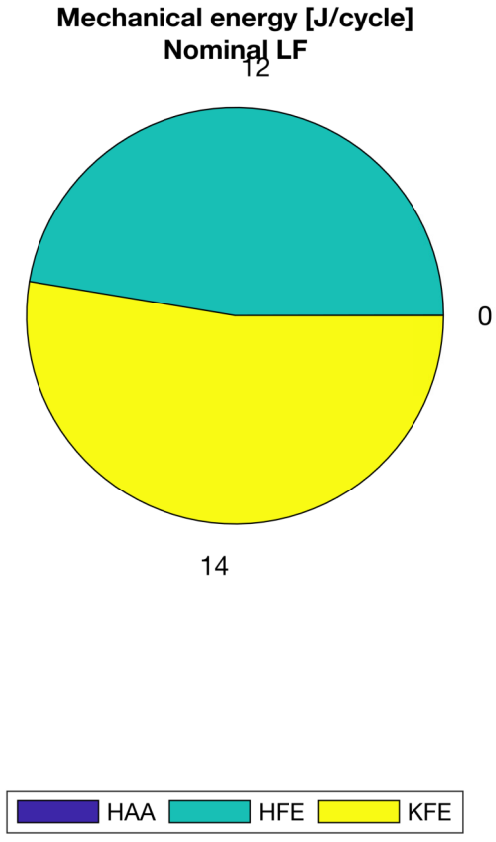

LF
RF
LH
RH
E mech HAA
E mech HFE
E mech KFE
nominal
optimized
Energy [J]
Time [s]
0
20
40
60
0.5
1

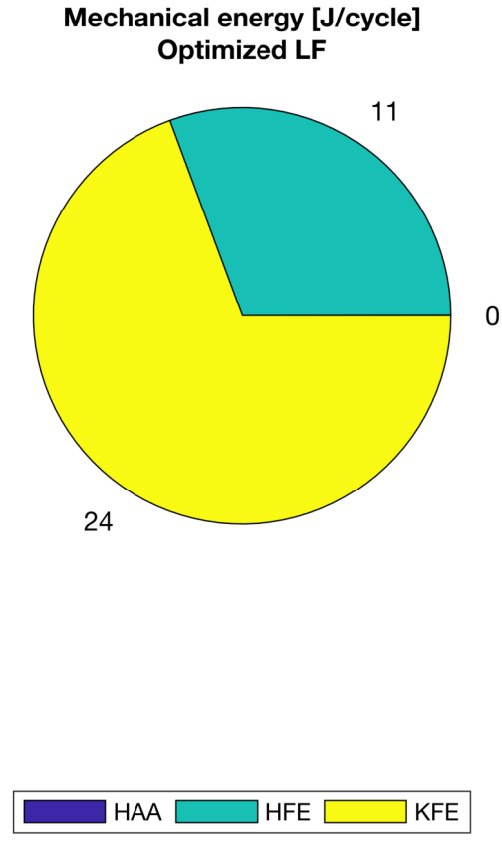

Link lengths [m]
Nominal LF
0.3
0.14
0.3
Hip
Thigh
Shank

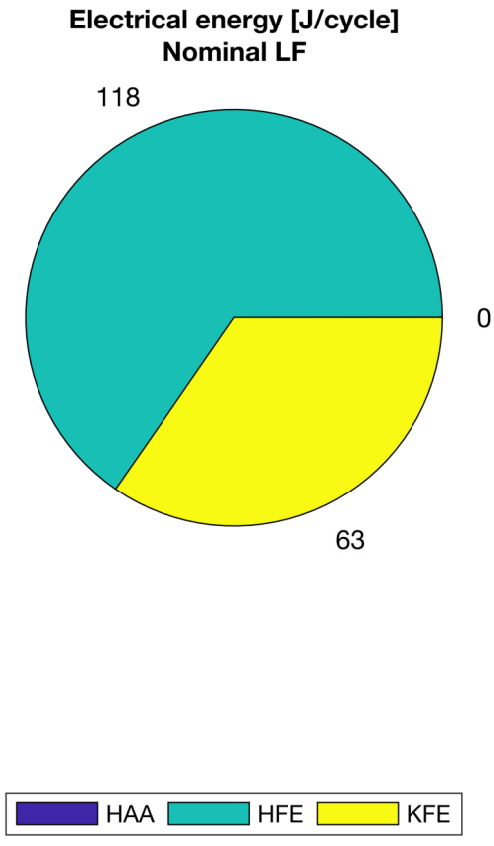

Link lengths [m]
Optimized LF
0.15
0.31
0.21
Hip
Thigh
Shank

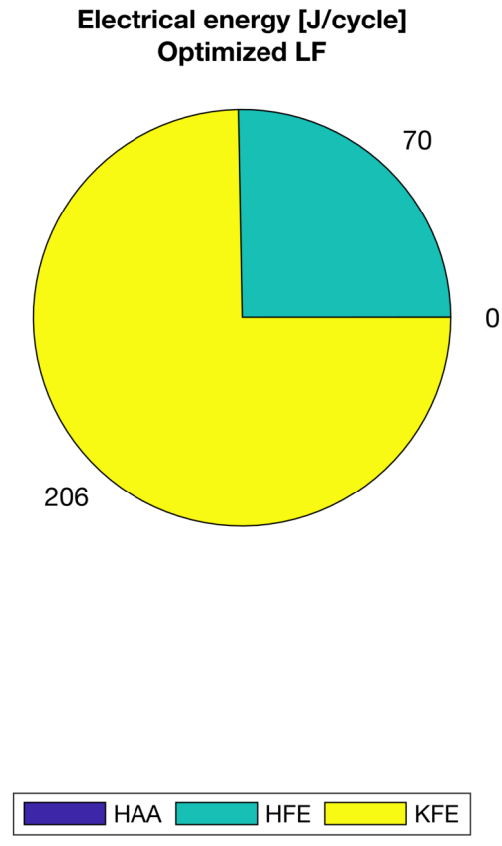

Peak joint torques [Nm]
Nominal LF
148
7
96
HAA
HFE
KFE


Peak joint torques [Nm]
Optimized LF
136
8
124
HAA
HFE
KFE


Mechanical energy [J/cycle]
Nominal LF
12
0
14
HAA
HFE
KFE


Mechanical energy [J/cycle]
Optimized LF
11
0
24
HAA
HFE
KFE


Electrical energy [J/cycle]
Nominal LF
118
0
63
HAA
HFE
KFE


Electrical energy [J/cycle]
Optimized LF
70
0
206
HAA
HFE
KFE