title

Jhon Charaja[1] and Samir Munoz[2]

[1]Universidade de São Paulo, Brasil
[2]Universidad de Ingeniería y Tecnología, Perú

January 27, 2022

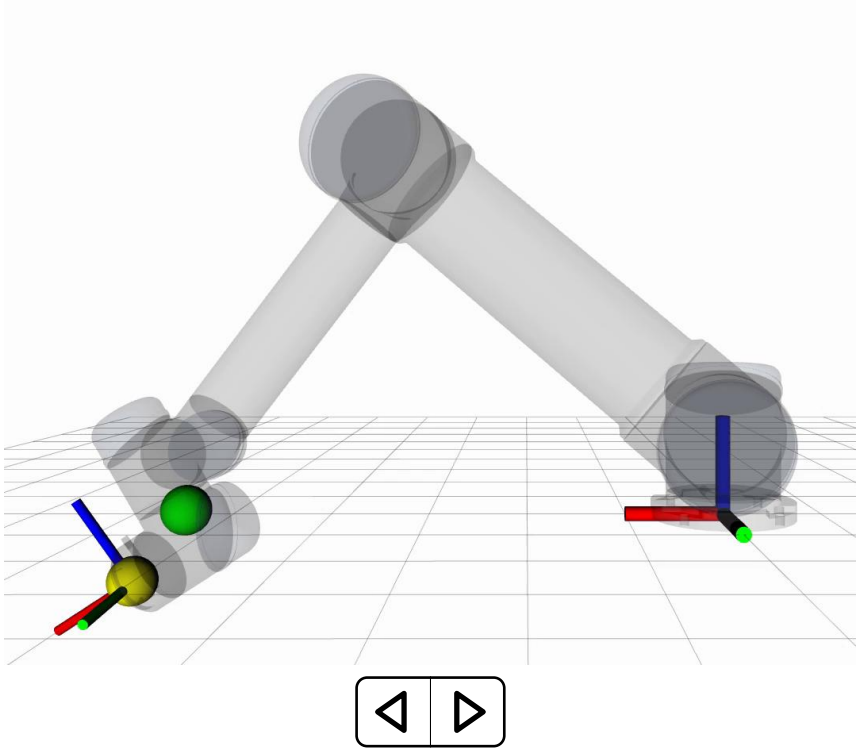
Sliding mode control with fixed gains

factory value ($m_6 = m_6$)

uncertainty: 0%

desired pose: ●

current pose: ●

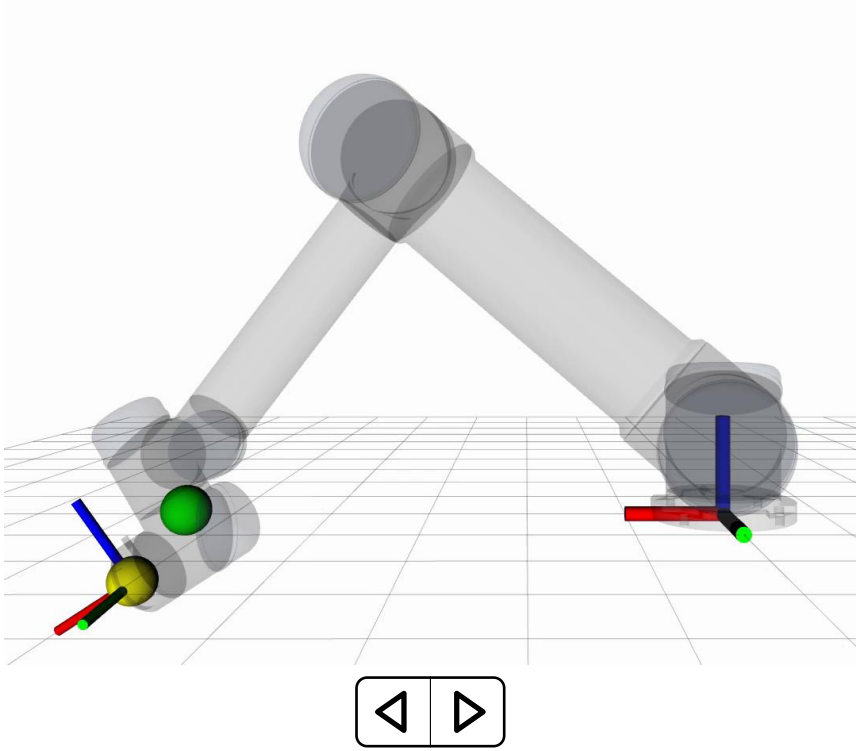


new mass value ($m_6 = 2m_6$)

uncertainty: 100%

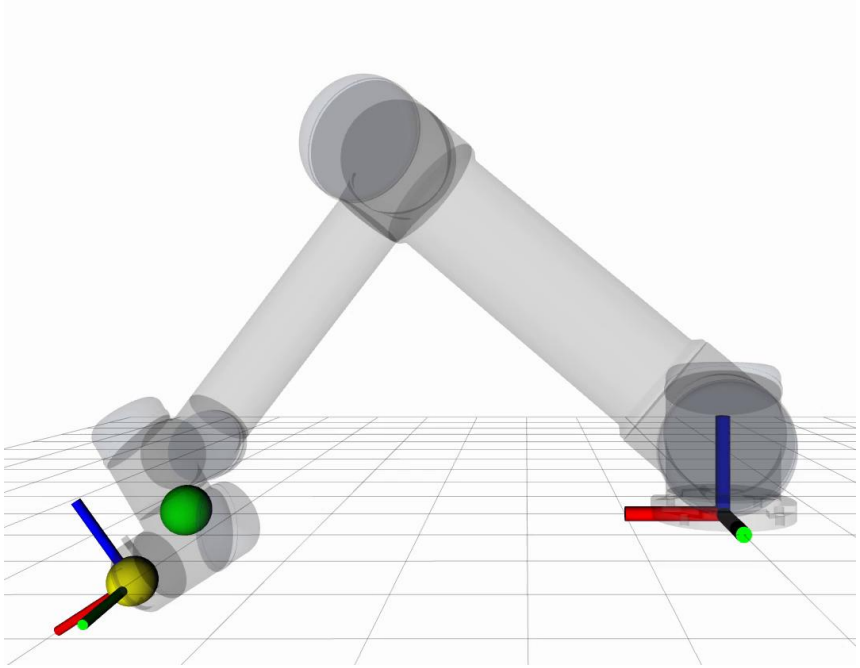
desired pose: ●

current pose: ●



Sliding mode control with optimization equations

fixed gains ($m_6 = 2m_6$)



optimized gains ($m_6 = 2m_6$)

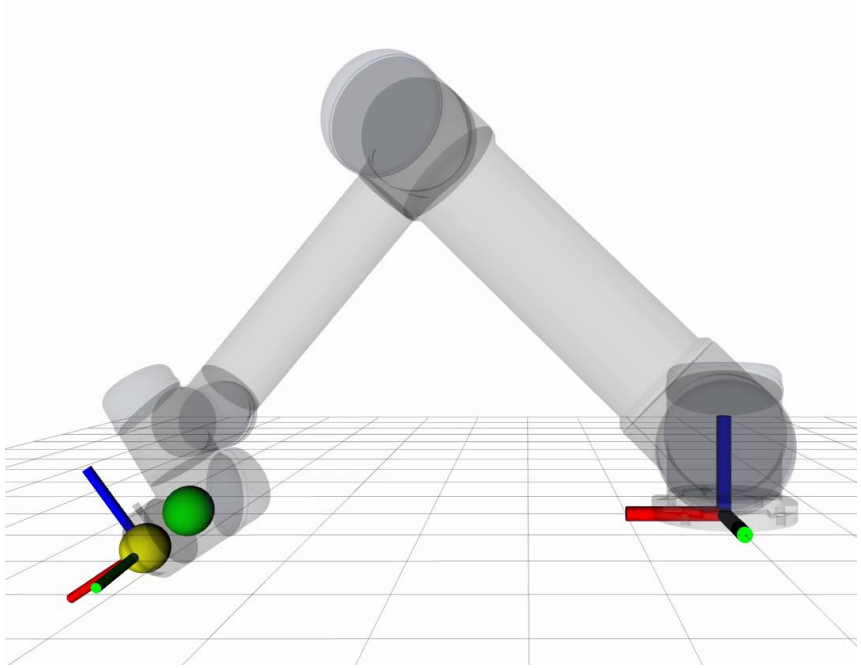


Table: trajectory tracking error with L2 norm ($t = 500$ s)

gain type	position (mm)	orientation ($^\circ$)	jerk linear ($\frac{\mathrm{mm}}{\mathrm{s}^3}$)	jerk angular
fixed	19.7	50.3	3.04	0
optimized	7.28	4.5	0.98	0

Sliding mode control

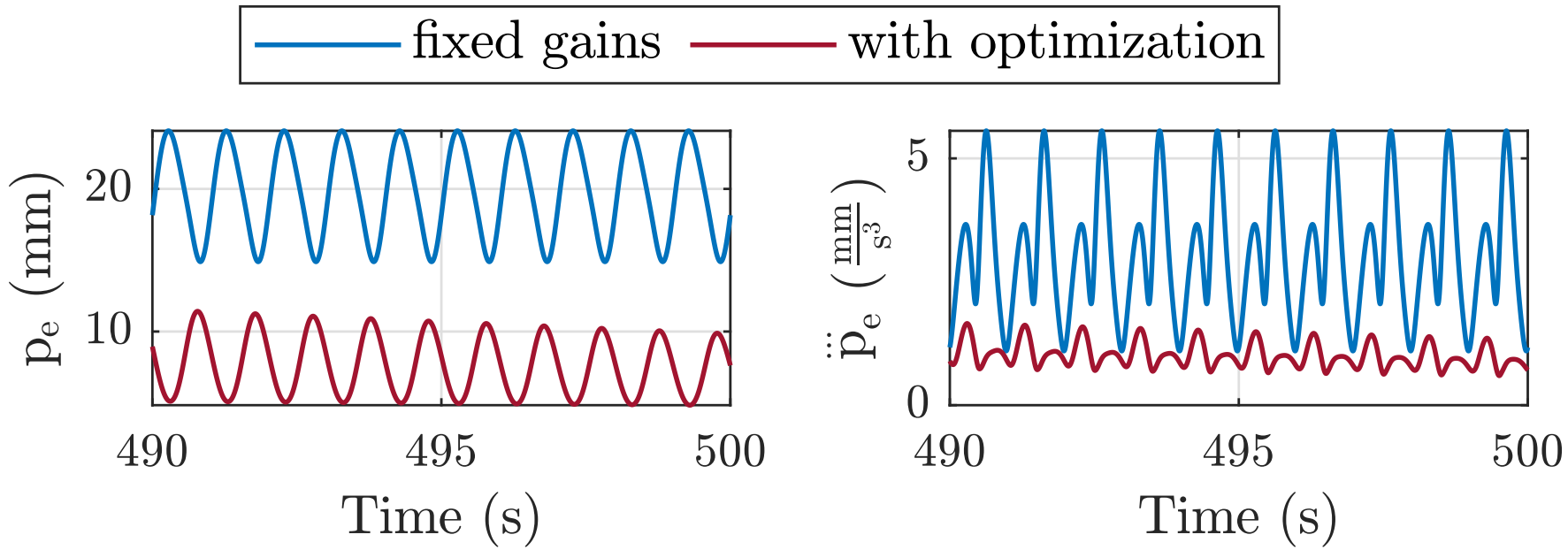


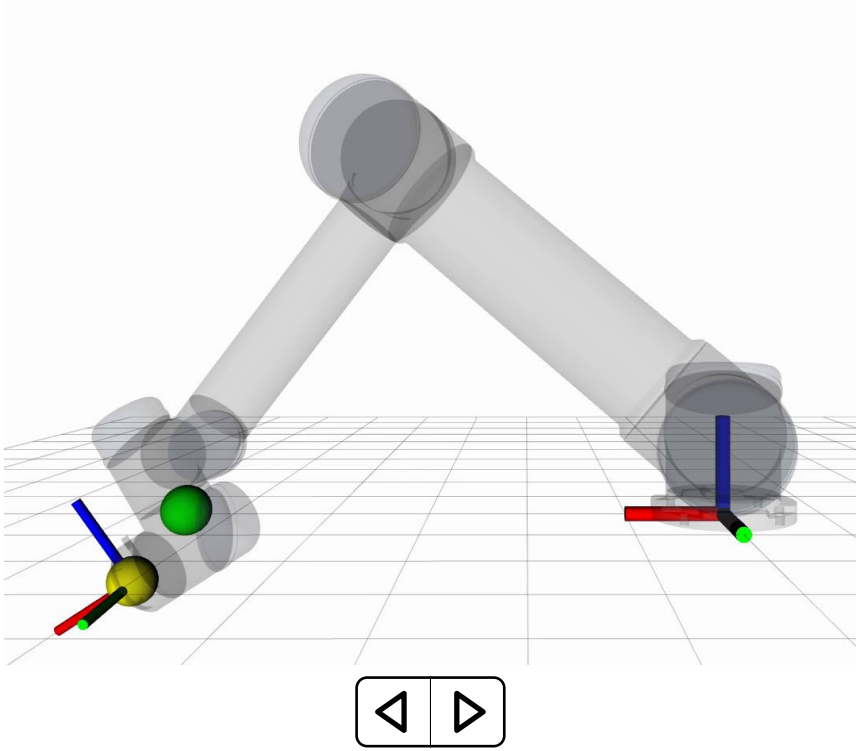
Table: trajectory tracking error with L2 norm ($t = 500$ s)

gain	position (mm)	orientation (°)	jerk linear $\left(\frac{mm}{s^3}\right)$	jerk angular
fixed	19.7	50.3	3.04	0
optimized	7.28	4.5	0.98	0

Proportional-Derivative control with fixed gains

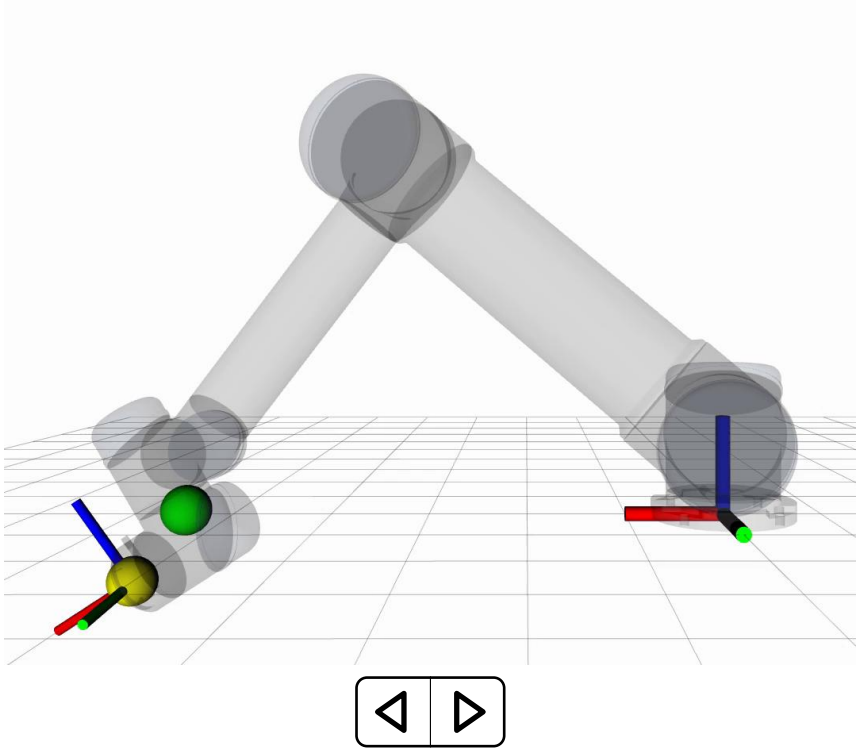
factory value ($m_6 = m_6$)

uncertainty: 0%
desired pose: ●
current pose: ●



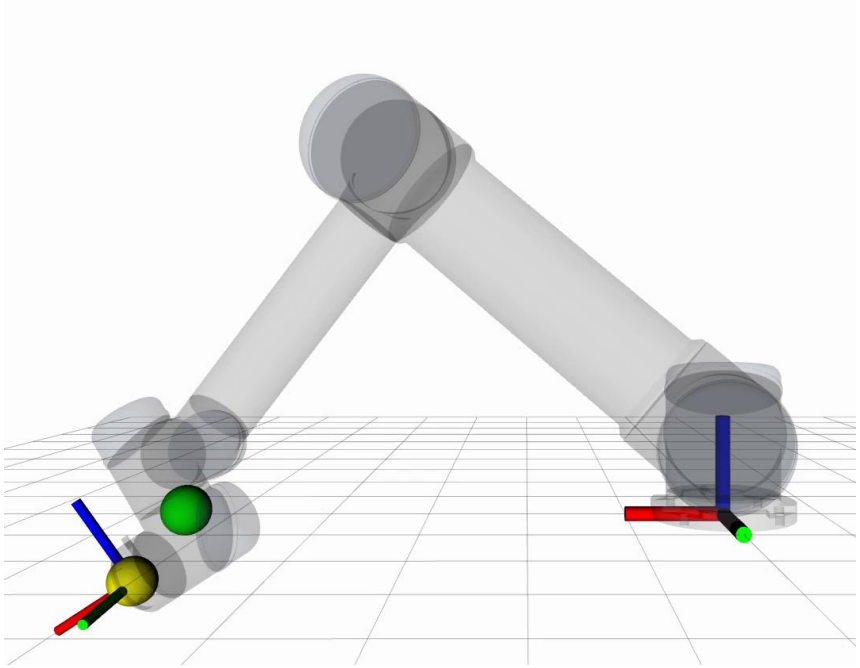
new mass value ($m_6 = 2m_6$)

uncertainty: 100%
desired pose: ●
current pose: ●



Proportional-Derivative control with optimization equations

fixed gains ($m_6 = 2m_6$)



optimized gains ($m_6 = 2m_6$)

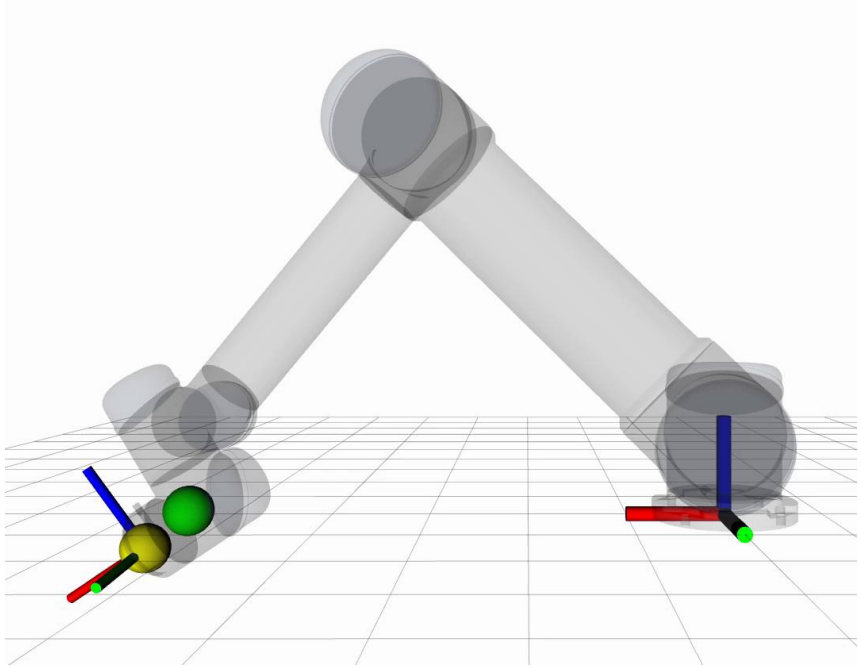


Table: trajectory tracking error with L2 norm ($t = 500$ s)

gain	position (mm)	orientation ($^\circ$)	jerk linear ($\frac{\mathrm{mm}}{\mathrm{s}^3}$)	jerk angular
fixed	49.2	27.9	1.34	0
optimized	20.5	8.12	0.85	0

Proportional-Derivative control

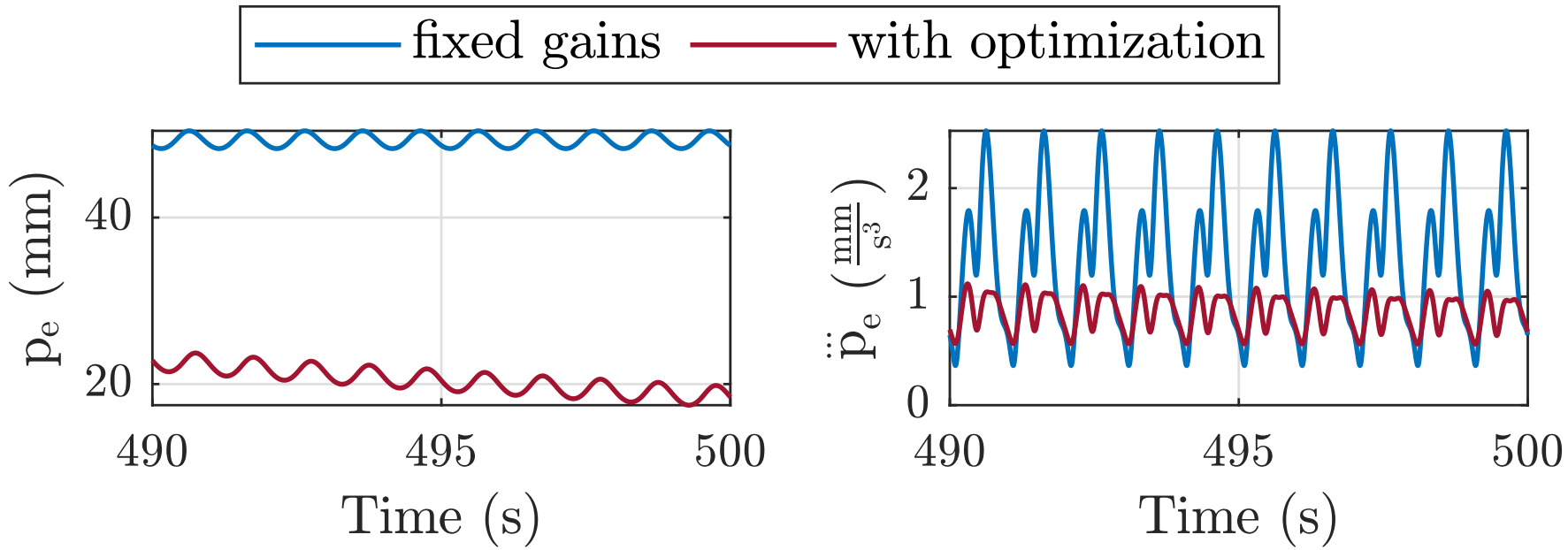


Table: trajectory tracking error with L2 norm ($t = 500$ s)

gain	position (mm)	orientation (°)	jerk linear ($\frac{mm}{s^3}$)	jerk angular
fixed	49.2	27.9	1.34	0
optimized	18.6	7.5	0.83	0

Table: trajectory tracking error with L2 norm ($t = 500$ s)

control method	uncertainty (%)	position (mm)	orientation ($^\circ$)	jerk linear ($\frac{\mathrm{mm}}{\mathrm{s}^3}$)	jerk angular ($\frac{^\circ}{\mathrm{s}^3}$)
PD	25	19.7	7.81	0.45	
	50	23.8	8.94	0.67	
	75	21.7	8.31	0.77	
	100	18.57	7.52	0.83	
SMC	25	7.46	3.02	0.66	
	50	8.21	3.76	0.91	
	75	8.06	4.32	0.98	
	100	7.23	4.48	0.91	