Appendix B

Motors Specifications

B.1 NAO

Table B.1: Specifications of the four types of motors in NAO (adapted from [25])

Type	1	2	3	4
Maxon motor model	RE-Max 24	RE-Max 17	RE-Max 24	RE-Max 17
Speed reduction ratio	201.3	150.27	130.85	173.22
No load speed $[rpm]$	39.7	79.2	61.1	68.7
Stall torque $[Nm]$	12	2.3	7.8	2.6
Nominal speed $[rpm]$	31.4	58.6	48.4	50.9
Nominal torque $[Nm]$	2.5	0.6	1.6	0.7
Terminal resistance $[\Omega]$	6.44	23.1	6.44	23.1
Torque contant $[Nm/A]$	4.3	2.5	2.8	2.9
Speed constant $[rmp/V]$	2.2	3.8	3.4	3.3
Joints	HipYawPitch HipRoll AnkleRoll	HeadYaw ShoulderPitch ElbowYaw	HipPitch KneePitch AnklePitch	HeadPitch ShoulderRoll ElbowRoll

B.2 CoMan

Table B.2: Specifications of the three types of motors in CoMan (adapted from [19])

Type	1	2	3
Motor inertia $[kg * m^2]$	0.1387	0.1387	0.1387
Motor back EMF constant $[Nm * s/rad]$	25.52	25.52	25.52
Voltage to torque ratio $[Nm/V]$	6.175	6.175	6.175
Torque constant $[Nm/A]$	4.13	4.13	4.13
Terminal resistance $[\Omega]$	0.66	0.66	0.66
Stiffness coefficient $[Nm/rad]$	120	395.46	8400
Damping coefficient $[Nm * s/rad]$	0.198	0.198	4.2
Joints	ShoulderRoll ElbowPitch ShoulderPitch	HipPitch KneePitch TorsoPitch FootPitch TorsoYaw	HipRoll HipYaw FootRoll ShYaw TorsoYaw

B.3 WalkMan

Table B.3: Specifications of the four types of motors in WalkMan (adapted from `https://gitlab.robotran.be/walkman/walkman_robotran`)

Type	1	2	3	4
Motor inertia $[kg * m^2]$	0.1387	0.416	0.30208	0.811
Motor back EMF constant $[Nm * s/rad]$	25.52	385.1575	38.3489	31.17
Voltage to torque ratio $[Nm/V]$	6.175	32.865	5.606	6.852
Torque constant $[Nm/A]$	4.13	11.719	6.84	4.62
Terminal resistance $[\Omega]$	0.66	0.356	1.22	0.6744
Stiffness coefficient $[Nm/rad]$	500	5000	1300	10000
Damping coefficient $[Nm * s/rad]$	1	1	1	1
Joints	NeckYaw	TorsoRoll	HipYaw	HipRoll
	NeckPitch		TorsoYaw	HipPitch
	ElbowYaw		ShoulderPitch	KneePitch
	WristPitch		ShoulderRoll	AnklePitch
	WristRoll		ShoulderYaw	AnkleRoll
			ElbowPitch	TorsoPitch