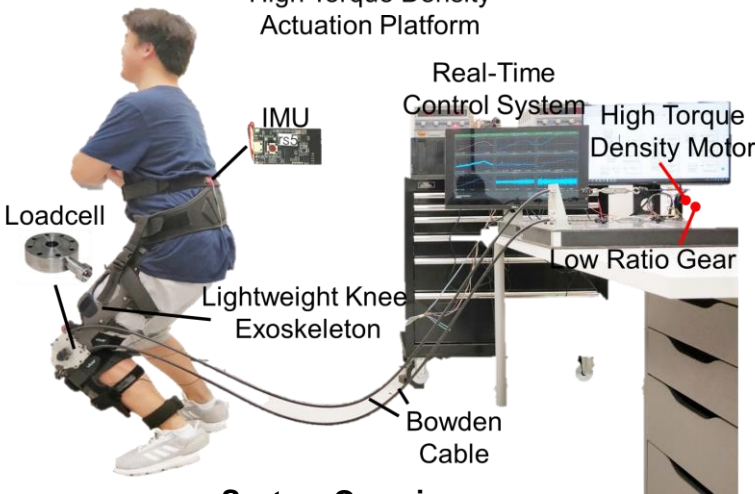


High Torque Tethered Knee Exoskeleton

High Torque Density
Actuation Platform



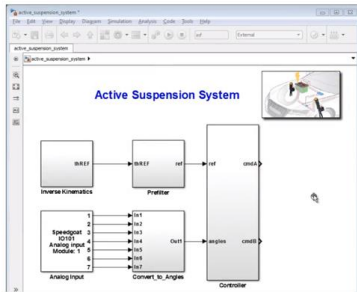
System Overview

Tethered Exoskeleton Specification

Wearable Mass	1 kg
Motor Voltage	42 V
Motor Speed	>47 RPM
Gear Ratio	>24:1
Torque Output	>50 Nm
Output Speed	>6.5 rad/s
Transmission	Bowden Cable, Bi-directional actuation
Range of Motion	0-160°
Actuation Type	Tethered

Control System

Host Computer



Any Computer with
Intel 9301CT gigabit (PCI-e)

MATLAB 2016a
Simulink Real-Time
High-Level Control Algorithm

Target Computer



Dell Precision
Tower 7000 Series
(7810) with Intel
9301CT gigabit
(PCI-e)



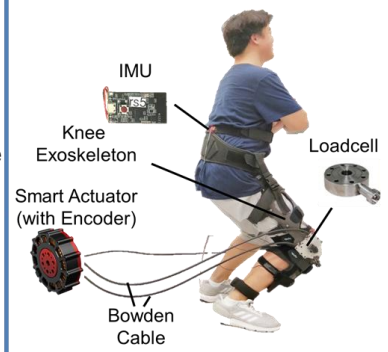
PCIe-6259



CAN-AC2-PCI

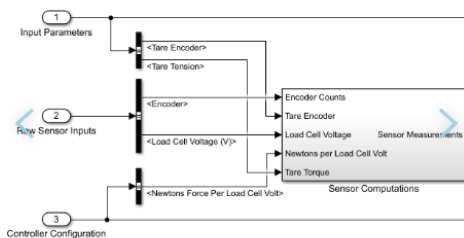
1. Motor Control
2. Motor Encoder
3. IMU Read
4. Torque Sensor Read

Human & Exoskeleton Sensor and Actuation System



1. Motor Controller (CAN)
2. Motor Encoder (CAN)
3. IMU (ADC)
3. Torque Sensor (ADC)

Simulink Code



Visualization Data Scope









1. Software

Specification

Controller Environment	MATLAB 2016a/ Simulink Real-time
Sample Rate	1000 Hz
Low Level Control	Position/Torque/Current/ Velocity Control
High Level Control	Support Customized Algorithm Implement
Data Interface	Live Data Visualization
Data Storage	Can Save Data within 200s

2. Hardware

Component	Model	Image	Quantity
ADC Board	NI PCI-e-6259		1
ADC Converter	NI SCB-68A-782536-01		2
ADC Cable	NI SHC68-68-EPM Cable (2m)		2
CAN Board	CAN-AC2-PCI		1
Target PC	Precision Tower 7000 Series (7810)		1
Host PC	Intel 9301CT gigabit (PCI-e)		1

Actuator Unit

Property	Motor	Motor + 24:1 gear + electronics + driver	Motor + 32:1 gear + electronics + driver
Mass (g)	274	950	950
Dimensions (mm)	87D*32H	102D*80H	102D*80H
Nominal Power (W)	314		
Nominal Voltage (V)	42		
Nominal Current (A)	7.47		
Nominal Torque (Nm)	2	48	64
Nominal Speed (RPM)	1500	63	47
Nominal Speed (rad/s)	157	6.5	4.9
Power Density (W/Kg)	1145	330	330
Torque Density (Nm/Kg)	7.3	50.5	67.4



**Customized
High Torque Motor**

