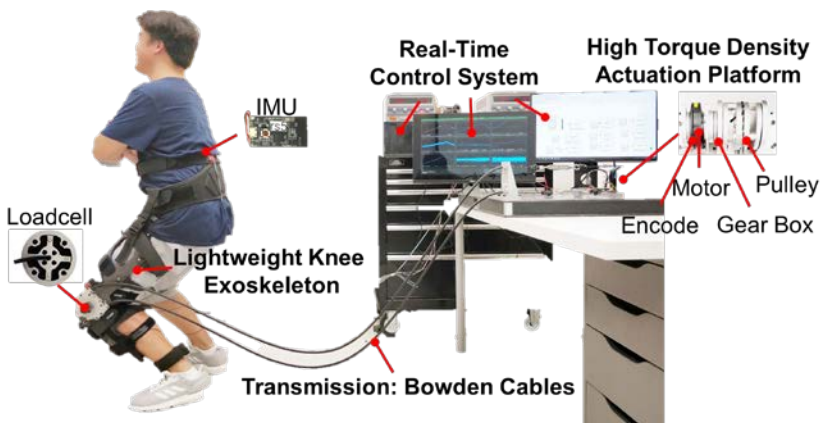


# High Performance Tethered Knee Exoskeleton

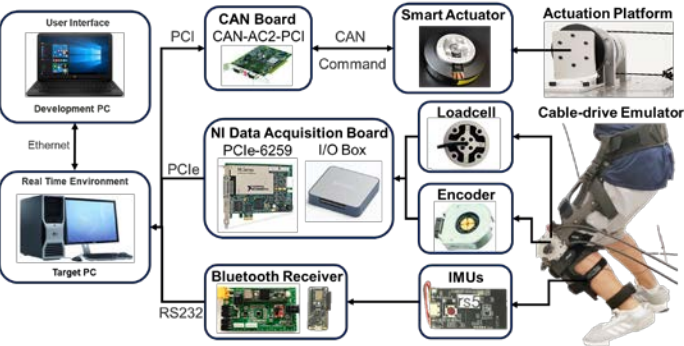
## Benefits/Advantages

<b>Lightweight</b>	Unilateral exoskeleton weight only 1 kg
<b>High torque density motor</b>	7.0 Nm/kg, 4 times for other available devices
<b>Effective assistance</b>	Nominal torque is 48 or 64 Nm, can provide more than 50% torque assist for walking and reduce 75% muscle activities for squatting
<b>High bandwidth</b>	65 Hz, walking and running are super stable
<b>High backdrivability</b>	0.9 Nm, almost no mechanical resistance is felt
<b>High stiffness</b>	> 350 Nm/rad, more than average stiffness value of normal walking 260 Nm/rad
<b>High accuracy</b>	Tracking error < 3%

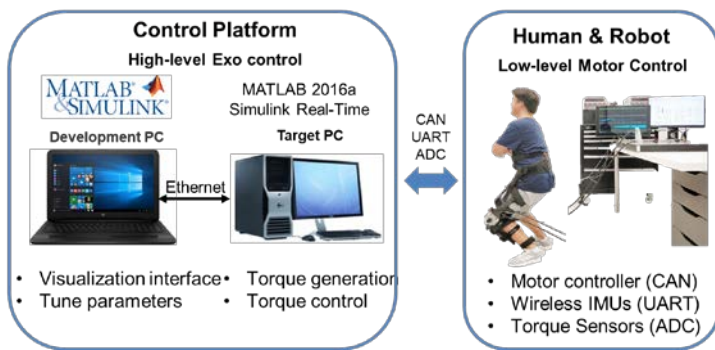


Knee Exoskeleton System Overview

## Tethered Exoskeleton Architecture



## Control Architecture (Simulink Real Time)



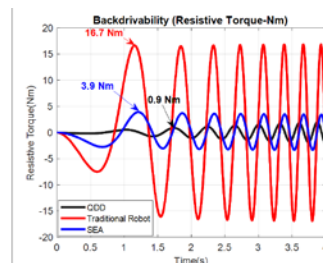
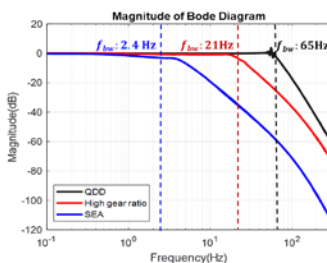
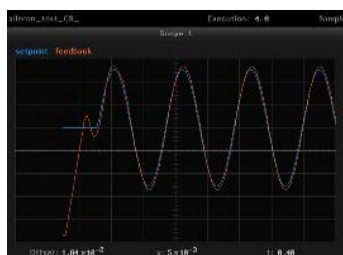
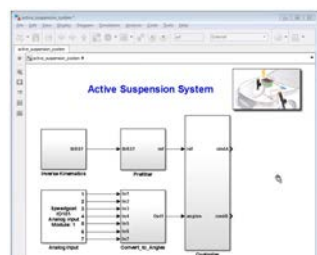
## Software System

### Specification

Controller Environment	MATLAB 2016a/ Simulink Real-time
Sample Rate	1000 Hz
Low Level Control	Position/Torque/Current/ Velocity Control/Various Stiffness
High Level Control	Support Customized Algorithm Implement
Live Data Visualization	Torque; Joint Angles; Velocity; Acceleration; Current; Stiffness
Data Storage	Can Save All Data

## Actuator Unit

Property	Motor	24:1 Gear box	36:1 Gear box
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	
<b>Nominal Torque (Nm)</b>	<b>2</b>	<b>48</b>	<b>64</b>
Nominal Speed (RPM)	1500	63	47
Nominal Speed (rad/s)	157	6.5	4.9
Power Density (W/Kg)	1145	330	330
<b>Torque Density (Nm/Kg)</b>	<b>7.3</b>	<b>50.5</b>	<b>67.4</b>



Host PC User Interface Visualization Data Scope