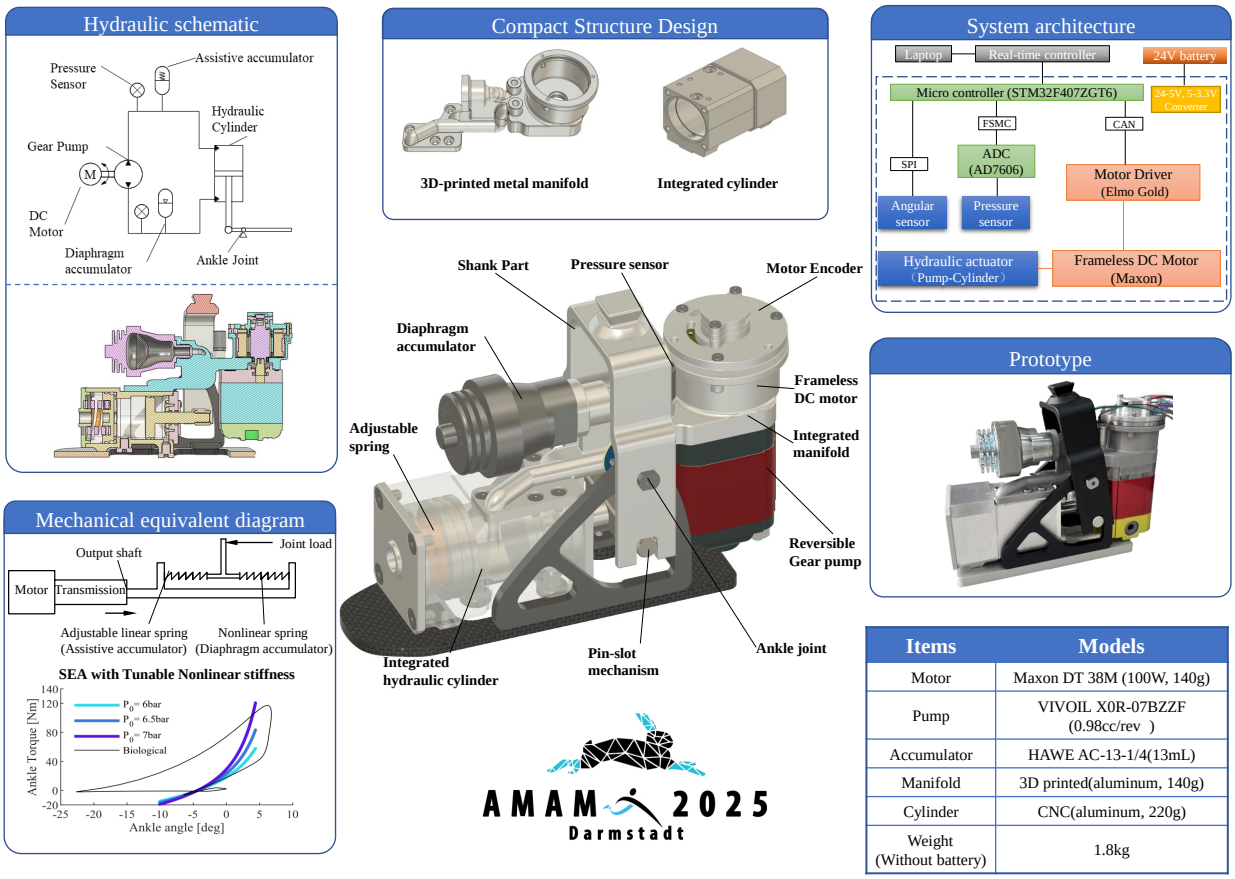
A Hydraulic Powered Ankle-Foot Prosthesis with Adjustable Nonlinear Stiffness

Bowen Li, Yulong Xiong, Qitao Huang
Department of Fluid Control and Automation, Harbin Institute of Technology, China
li_bowen@stu.hit.edu.cn

In this demonstration, we will present the hardware design of a powered ankle-foot prosthesis, including the assembled prototype and key mechanical components. The prosthesis features a novel combination of Series Elastic Actuation (SEA) and Electro-Hydrostatic Actuation. By integrating a hydraulic accumulator into the SEA structure, the system achieves nonlinear and tunable stiffness, enabling potential adaptation to different locomotion modes. Although full gait-level demonstrations are still under development, a video will be provided to illustrate the prosthesis's working principle throughout the gait cycle. Figure 1 shows the structural design, operating concept, and prototype.

Equipment to be Brought: Prosthesis prototype; Laptop; Power supply and cables.
Special Requirements at Venue: Table space (approx. 1 m wide); Power access (AC outlet).
Submitted Abstracts: Design and Simulation of a Hydraulic Powered Ankle-Foot Prosthesis with Adjustable Nonlinear Stiffness.



Items	Models
Motor	Maxon DT 38M (100W, 140g)
Pump	VIVOIL X0R-07BZZF (0.98cc/rev)
Accumulator	HAWE AC-13-1/4(13mL)
Manifold	3D printed(aluminum, 140g)
Cylinder	CNC(aluminum, 220g)
Weight (Without battery)	1.8kg

Figure 1: Overview of the powered ankle-foot prosthesis design and prototype.

License: CC BY 4.0 International - Creative Commons, Attribution https://creativecommons.org/licenses/by/4.0/