



**The Chinese University of Hong Kong
Department of Biomedical Engineering**



Graduate Seminar – PhD Oral Defence

Student : Mr. LIANG Dezhi
Supervisor : Prof. TONG Kai Yu Raymond
Date : 4 February 2026 (Wednesday)
Time : 4:00 pm
Venue : Room 1122, William M W Mong Engineering Building, CUHK

Title: Early Intervention for Children with Cerebral Palsy Using Treadmill Training with Soft Knee Exosuit

Cerebral palsy (CP) is the most common disability of childhood, often leading to lower limb dysfunction of crouch gait, which severely affects daily activities. Pediatric period is the window for rehabilitation of walking independence and lower limb function due to the high neural plasticity. However, the delicate skin, joints, and soft tissue of young children's lower limbs pose great challenges for traditional rigid exoskeletons. Comfortable and sufficient assistance on knee joint are crucial in early intervention for pediatric CP subjects.

This thesis presents a lightweight, pneumatic soft knee exosuit designed for extension assistance in stance phase of gait cycle. A mathematical model of soft knee exosuit was developed to determine the extension torque for CP children with various body weights and severities of crouch gait. To quantitatively evaluate walking independence, a partial body weight support system was established to monitor the proportion of body weight from the treadmill, handle frame, and harness. The comfort and immediate effect were assessed in recruited CP children. With the assistance of the soft knee exosuit, the crouch gait and dependence on external support from the handle frame and harness were notably reduced. To investigate the clinical training effect, a 20-session soft exosuit assisted walking trial was implemented. After training, the participants exhibited decreased of reliance on external support as more body weight was borne by the lower limbs. Additionally, the gross motor function, balance, and walking ability showed significant improvement. These findings support the hypothesis that the motor function and walking independence enhance as the strengthening of the knee extensor.

In summary, this work introduces a feasible early intervention for promoting lower limb function of CP children, delivering comfortable and effective assistance at different stages of rehabilitation.

***** ALL ARE WELCOME *****

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