

## Development of a Modularized Seating System to Actively Manage Interface Pressure

Chung-Huang Yu \*, Tung-Yu Chou, Cheng-Huan Chen, Fu-Cheng Wang and Poyin Chen

### Abstract

Pressure ulcers can be a fatal complication. Many immobile wheelchair users face this threat. Current passive and active cushions do reduce the incidence of pressure ulcers and they have different merits. We proposed an active approach to combine their advantages which is based on the concept that the interface pressure can be changed with different supporting shapes. The purpose of this paper is to verify the proposed approach. With practical applications in mind, we have developed a modular system whose support surface is composed by height-adjustable support elements. Each four-element module was self-contained and composed of force sensors, position sensors, linear actuators, signal conditioners, driving circuits, and signal processors. The modules could be chained and assembled together easily to form different-sized support surfaces. Each support element took up a  $3\text{ cm} \times 3\text{ cm}$  supporting area. The displacement resolution was less than  $0.1\text{ mm}$  and the force sensor error was less than 1% in the  $2000\text{ g}$  range. Each support element of the system could provide  $49\text{ N}$  pushing force ( $408\text{ mmHg}$  over the  $3\text{ cm} \times 3\text{ cm}$  area) at a speed of  $2.36\text{ mm/s}$ . Several verification tests were performed to assess the whole system's feasibility. Further improvements and clinical applications were discussed. In conclusion, this modularized system is capable of actively managing interface pressure in real time.