

Optimized Handle-Based Device for Continuous Wheelchair Propulsion

A novel handle based wheelchair propulsion device with an optimized continuous movement shape was developed, which reduces joint excursions and joint loads on the one hand and increases mechanical efficiency on the other hand compared to standard push-rim propulsion. The novel propulsion mechanism is mounted on a standard wheelchair on both sides in the same planes as the wheels and due to its compact design it is suitable for daily in- and outdoor use. Especially longtime wheelchair users, who are often suffering from joint injuries, can benefit from the novel handle based propulsion mechanism, which is an attractive alternative to standard push-rim propulsion.

BACKGROUND

Worldwide, more than 131 million people require a wheelchair for enhancing personal mobility and activities of daily life. The push-rim is the most common method for manual wheelchair propulsion, characterized by low mechanical efficiency around 10%. Using the push-rim is problematic for the upper limb musculoskeletal system and may lead to severe injuries, as large joint excursions occur in combination with high joint loads. Long-term wheelchair users often suffer from joint injuries, especially at the wrist and shoulder joints. This causes further limitations in their independent life and may increase expenses in health care systems.

TECHNOLOGY

The novel wheelchair propulsion device consists of a handle-crank mechanism, which is following a predefined circular path, optimized for the musculoskeletal system of the upper extremity (Kurup et al., 2017). The continuous movement allows applying propulsion forces over the whole rotation - joint excursions and joint loads are significantly smaller than in standard push-rim propulsion.

The propulsion device is attached to the wheelchair on both sides in the same parasagittal plane as the wheels. The handle is attached to a crank, which is able to change its length to follow the optimized path. The torque generated in the crank center is transferred to the back wheels via timing belts with a gear ratio of 3:2.



ADVANTAGES

- Continuous movement with higher efficiency than standard discontinuous push-rim wheelchair propulsion
- Movement optimized to the musculoskeletal system of upper limbs
- Smaller joint excursions and lower joint loads reduces the risk of injuries
- Compact design makes the novel propulsion device suitable for daily use
- Easily adaptable for individual body sizes

REFERENCE:

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APPLICATIONS:

Wheelchair propulsion

DEVELOPMENT STATUS:

Prototype available

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Wheelchair drive,
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IPR:

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EP and US filed

OPTIONS:

R&D – Cooperation,
License Agreement,
Patent sale

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