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Abstract
For the old and disabled, the traditional manual wheelchair is a mobility assistive device most often used in their daily life. However, the traditional manual wheelchair driving system has some inherent drawbacks, such as low mechanical efficiency, high risk of strain-induced damage and limited mobility range. The aim of this research is to design an auxiliary power unit for the traditional manual wheelchair, so wheelchair users can switch the manual mode to the electrical mode and vice versa. It can easily turn the manual wheelchair into “a perfect manual/electrical wheelchair.”
This research provides a systemized approach in designing the “Simplified Auxiliary Power Unit for Wheelchairs.” The requirements were confirmed and the function specifications were set using the QFD (Quality Function Deployment). The conceptual design of the “Simplified Auxiliary Power Unit for Wheelchairs” was divided into four parts: the mounting device, the steering system, the driving system and the retract mechanism. Among them, the retract mechanism uses the creative mechanism design method, which carries on the design by (4, 4) generalized chain, and obtains 7 feasible mechanisms. Furthermore, in order to make the entire structure simple and light, the equivalent transformation is used to generate possible options, and we choose the optional retract mechanism with the screw mechanism, either manual or electrically operated. In the concrete design stage, we use the SolidWorks, a CAD/CAE software, in making engineering drawings and full-scale mockup construction. Finally, the prototype was manufactured, assembled, and tested under various standards, such as ANSI WC, ISO and CNS. The test result shows that the design specification is conformed and the functional requirements are met.
Compared to the six member module, our research has appealing merits, such as performance enhancement, cost reduction, lightweight, easily use and so on. Our innovative design meets the manual wheelchair users’ needs and promotes their life quality. At the same time, it provides a solution for the care and rehabilitation of old people in an aged society.
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