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Stabilization of Two-wheeled Wheelchair with Movable Payload Based Interval Type-2 Fuzzy Logic Controller



N. F. Jamin, N. M. A. Ghani, Z. Ibrahim, M. F. Masrom and N. A. A. Razali

Abstract In this paper, an Interval Type-2 Fuzzy Logic Control (IT2FLC) is proposed to control a stabilization of two-wheeled wheelchair system with moving payload. The two-wheeled wheelchair system is similarly with double-links inverted pendulum system but with additional of movable payload up to 0.3 m to reach a higher level of height. Thus, this two-wheeled wheelchair configuration becomes more complex, unstable and highly nonlinear system. The 300 N concentrated force is applied at the back of the wheelchair seat in two conditions; in the initial condition before the payload is lifted and in the maximum height of the payload to test the robustness of the controller. SimWise 4D (SW4D) software is used to develop a 3-Dimensional (3D) model of the two-wheeled wheelchair, which replaces a complex mathematical representation. The SW4D is used to visualize the movement of the system as it is integrated with Matlab Simulink. IT2FLC will be compared with Fuzzy Logic Control Type 1 (FLCT1) and the simulation results show that the IT2FLC give a good performance in term of angular position of both links in the upright position and maintain stable.

Keywords Two-wheeled wheelchair with movable payload
Double-link inverted pendulum · Interval Type-2 fuzzy logic control
SimWise 4D

1 Introduction

Generally, disabled and elderly people depend on the use of wheelchair as an important transportation device to perform their daily routine and mobile from one place to another independently.

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