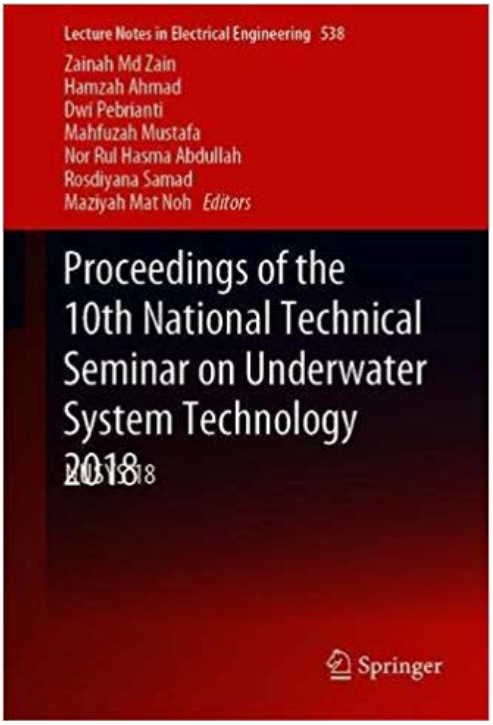




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# Contents

# Stabilization control of a two-wheeled triple links inverted pendulum system with disturbance rejection

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**Abstract.** This paper focuses on the robust controller for triple Links inverted pendulum on two-wheeled system. The development of triple Link inverted pendulum on two-wheeled model using CAD based software, SimWise 4D is proposed. Interval Type-2 Fuzzy Logic Control (IT2FLC) used as control algorithm for the system. This system is multi input and multi output system which means each motor in this system is controlled by one controller to achieve stability or upright position for these three links. The robustness of the controller is tested by applying disturbance to the model to observe the response from the model to handle the uncertainties. The performance of IT2FLC is compared with Type-1 Fuzzy Logic Control (T1FLC) to demonstrate best controller for the system. The experiment results concerning the angular position for each three Links and the maximum value of disturbance rejection for both controllers are obtained by using heuristic tuning for input and output gain control.

**Keywords:** Triple links inverted pendulum on two-wheeled, Type-1 Fuzzy Logic Control, Interval Type-2 Fuzzy Logic Control.

## 1 Introduction

Self-balancing inverted pendulum system have evoked a lot of interest among education both in theory and application for decades. Inverted pendulum system varies from rotary, on cart, and on wheels system. Inverted pendulum system is capable to maintain its upright position even after facing disturbance or any uncertainties. There are also several works done on inverted pendulum which could maintain at any desired angle. The robustness of the inverted pendulum controllers is evaluated on how fast the system can achieve its stability, the closeness of the system to 0 degree, and the capability of the system in handling disturbance or uncertainties.

There are several works done exits for stabilization of inverted pendulum on two-wheeled system [1-4]. Single link mobile inverted pendulum system has been proposed using fuzzy logic based PID controller as stabilizing control to stabilize the model. In this system, 2 loops of controllers are used in order to control the angle and the position of the model independently [1].