

A Biped Robot Design

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Doktorarbeit

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Abstract

This thesis presents a biped robot structure designed to study biped walking and biped control algorithms. The project was divided into three main parts: biped design, walking techniques, and balance control algorithms. A hybrid approach was adopted, which is based on classical and soft-computing techniques. A fuzzy algorithm is proposed for the biped's robots balance. For walking, an algorithm based on cubic polynomial interpolation of the initial conditions for the robot's position, velocity and acceleration was implemented. For the biped design, experiences gain on two previous biped's structures and a modular design, made the biped's mechanisms and structure more stable. The robot designed has 10 degrees of freedom (DOF) and each joint is driven by a DC servo motor. The final biped robot structure was controlled using the balance and walking algorithms working together, but on separate on-board microcontrollers. As a result of the combination of these modules and techniques, the control system achieved real time walking, robust control and be portable to others similar biped's robot structures.

Zusammenfassung

Diese These präsentiert, eine Zweifüßler-Roboter-Struktur entworfen, um Zweifüßler laufen Theorie und Kontrolle-Algorithmen zu studieren. Das Projekt wurde in Drei Haupt Teile geteilt: Die Zweifüßler-Design, Laufen Techniken, und Gleichgewicht-Kontrolle-Algorithmen. Ein hybrid-Ansatz, der auf klassischen und "soft-computing" Techniken gegründet wird, wurde adoptiert. Ein Fuzzy-Algorithmus wird für die Roboter des Zweifüßlers vorgeschlagen, um sich zu balancieren. Für das Laufen wurde ein Algorithmus, der auf kubischer Polynom-Interpolierung der anfänglichen Zustände für die Position des Robot-

ers, Geschwindigkeit und Beschleunigung gegründet wird, ausgeführt. Für das Zweifüßler-Design, gewinnen Erfahrungen auf den Strukturen von zwei vorausgehendem Zweifüßler und einem modularen Design, machten die Mechanismen des Zweifüßlers und seine Struktur stabiler. Der Roboter, der entworfen wird, hat 10 “Degrees of freedom” (DOF) und jedes Gelenk wird von einem DC servo Motor gefahren. Die letzte Zweifüßler-Roboter-Struktur wurde das Benutzen des Gleichgewichtes und das Laufen Algorithmen, die zusammenarbeiten, kontrolliert, aber auf getrenntem Bord Mikrocontrollers. Als ein Ergebnis von der Kombination von diesen Bauelementen und den Techniken, erreichte das Kontrolle-System recht-Zeit laufen, robuste Kontrolle und ist die Roboter-Strukturen von ähnlichem Zweifüßler zu anderen tragbar.

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