BIPED ROBOT PERFORMANCE DETERMINATION VIA GENETIC ALGORITHM

Pasan Kulvanit, Assoc. Prof. Dr. Nachol Chaiyaratana, and Assoc. Prof. Dr. Djitt Laowattana

Introduction

Biped robotics technology is seen as a promising technology that can improve human well-being and/or extend our senses and manipulability into the uncharted territory. Many systems have been successfully built and tested, however, there are not yet any measures to determine the relationship between the performance and the crucial parameters of the biped systems.

Problem Statement

There are various factors that influence biped robot locomotion. Assuming flat and smooth terrain, each robot with different design can walk differently. We are interested in finding the best possible performance that can be extracted from the existing robot. Hopefully, the finding may help us tracing back to the design of the robot and may lead, eventually, to the recipe for the best performing biped robot.

Methods

We would like to determine the performance of the existence small-sized biped robot testbed. The two indices are walking speed and traversing stability measure. The parameters that need to be adapted are side sway angles, foot clearance, hip height during walking, and angular momentum. Each parameter will be coded into binary bits. Each bit is combined to become an individual population (possible solution) in the search space of the Genetic Algorithm (GA). We assume the linear inverted pendulum model as a dynamic model representing the biped robot.

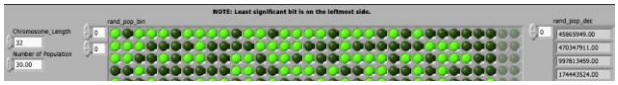

Figure1: Part of the control panel used to execute GA. Population: 30 Bit Length (Chromosome length): 32

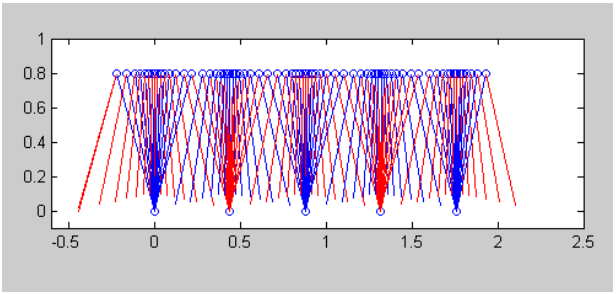

Figure2: Two-dimensional Linear Inverted Pendulum Model in action

Results

With GA, we can optimize each walking parameters, according to the predetermined performance objectives, at the same time. Currently, the optimizing algorithm will be tested on 2-D simulation model. Ultimately, the real biped robot will be used as a system under test to determine system performance.

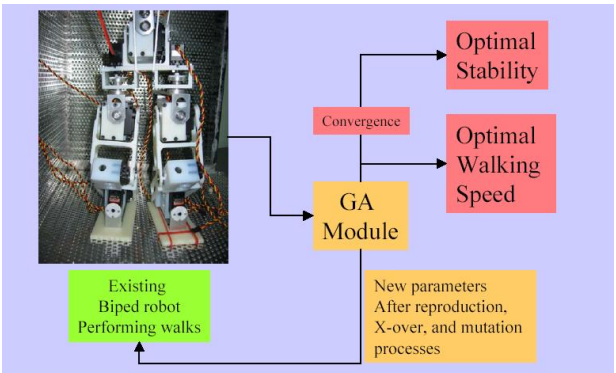

Figure3: Plan biped testing system using Multi-Objectives Genetic Algorithm (MOGA)

S p o n s o r

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