



## Soft-computing – Gait Generator for dynamic walking of a humanoid robot

Investigator: Hataitap Wongsuwarn

How can we control a bipedal walking robot so that it walks stably and robustly in complex environment? One approach is to develop an online self-learning control algorithm for bipedal robots to walk dynamically with dynamic balance over uncertain terrains.

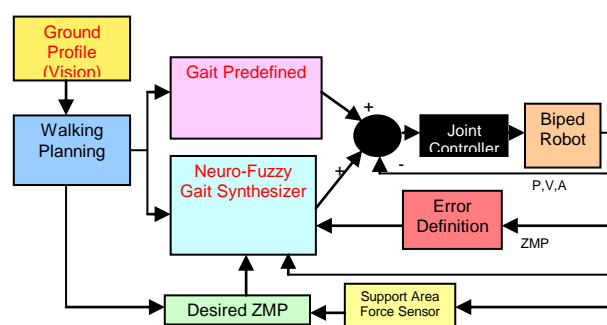
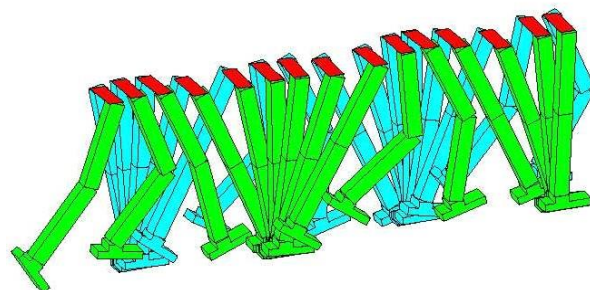
Bipedal walking robots are typical systems affected by uncertainty. The leg kinematics and dynamics are highly nonlinear and known with low accuracy, gait length depends on types of surfaces. Walking robots are usually designed to move in uncertain environment so the information from various external sensors must be processed. Following these considerations soft - computing is a possible approach to deal with several problems in bipedal walking robots.

Soft Computing is a new discipline that brings together all features of fuzzy-logic, genetic programming and neural networks. The main peculiarity of soft computing is capability to treat uncertain systems that could not be easily modeled and controlled by using classical approaches such as systems involves various unknown parameter. While fuzzy-logic, genetic programming and neural networks have been separately applied to classical and bipedal walking robots to solve different kind of problems, with soft-computing approach these techniques are differently combined to reach desired tasks.

First, we analyze characteristics of a human walking, by experimenting ourselves as models. Based on these experiments, we will develop initial specifications of our robot. Second, we will derive an appropriate learning model for enhancing robot performance in stability and robustness. There are three aspects that are presently being focused on this research :

- Designing a learning controller for dynamic bipedal walking robots.
- Generating and sustaining gait stability in order to achieve global dynamic stability for bipeds.
- Investigating adaptation in different ways i.e. dynamic level, smooth surface.

In conclusion, Bipedal locomotion is difficult to control because of nonlinear, time varying and complex structural dynamics. Stability and robustness are two important performance requirements for a dynamical walking robot. Learning and adaptation is, at present, a debating issue in improving stability and robustness.



### Sponsoring Agencies:

1. Thailand Research Found (TRF).
2. National Electronics and Computer Technology Center (NECTEC).