MECHANICAL AND AEROSPACE ENGINEERING
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"Optimal gait generation for walking robots via optimal learning control based on a symmetric property of Hamiltonian systems"

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38-138 Engineering IV
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Abstract: In the last decade, the gait generation problem has been well studied and experimentally demonstrated. Regarding this, an optimization problem of gaits with respect to the energy consumption becomes important subject.

We have proposed an optimal gait generation framework for walking robots via iterative learning control based on a property of Hamiltonian systems. This method allows one to obtain solutions of a class of optimal control problems without using precise knowledge of the plant model by iteration of laboratory experiments. Our approach is robust over modeling error since it does not require the plant information.

Here, we formulate an optimal control type cost function which consists of penalty term for control inputs and constraint term for walking gait. Then, we try to find a control input minimizing it by iterative learning technique. The update law for the control inputs is based on the steepest descent method, so usually precise knowledge of the plant model is necessary to calculate the gradient of the cost function. However, our method can obtain the gradient without using such plant information by utilizing a symmetric property of Hamiltonian systems called variational symmetry.

In this presentation, the algorithm of our method is presented. I will also show some numerical examples of application to a one-legged hopping robot and a compass-type biped walking robot.

Biosketch: Satoshi Satoh was born in Japan. He received the Bachelor of Engineering degree in 2005 and Master of Engineering degree in 2007 from Nagoya University, Japan. He started his Ph.D. research on nonlinear control of Mechanical systems at the same university. His research interests include learning control, walking control and nonlinear stochastic control. He is a member of IEEE. He received the IEEE Robotics and Automation Society Japan Chapter Young Award in 2008.

For more information, please contact Professor Tsu-Chin Tsao at ttsao@seas.ucla.edu
All faculty, teaching assistants, students, and guests are welcome to this event.
(Refreshments will be served.)