

# IEEE HUMANOIDS 2009 WORKSHOP

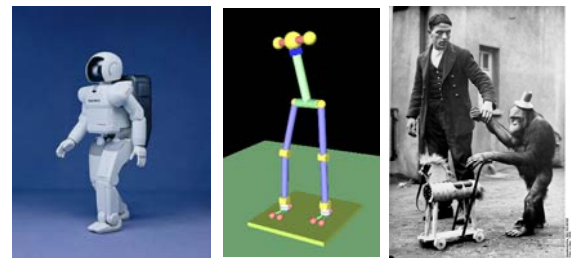
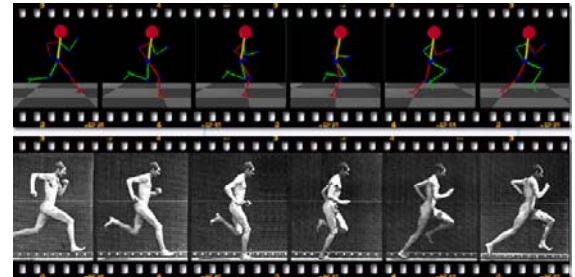
## MODELING, SIMULATION AND OPTIMIZATION OF BIPEDAL WALKING

December 7, 2009, Paris, France

**NEW:** Download Abstracts here [http://www.humanoids2009.org/workshops/BookOfAbstracts\\_WS05.pdf](http://www.humanoids2009.org/workshops/BookOfAbstracts_WS05.pdf)

### Overview:

The model-based investigation of motions of anthropomorphic systems is an important interdisciplinary research topic involving specialists from many fields such as Robotics, Biomechanics, Physiology, Orthopedics, Psychology, Neurosciences, Sport, Computer Graphics and Applied Mathematics. In this context, the study of basic locomotion forms such as walking and running is of particular interest due to the high demand on dynamic coordination, actuator efficiency and balance control. Mathematical models and numerical simulation and optimization techniques, in combination with experimental data, can help to better understand the basic underlying mechanisms of these motions and to improve them. The goal of this full-day workshop is to gather specialists of the related fields to present the state of the art of model-based bipedal walking research at IEEE Humanoids 2009.



Example topics of this workshop are:

- Modeling techniques for anthropomorphic bipedal walking systems
- Optimized walking motions for different objective functions
- Simulation and optimization approaches for humanoid robots
- Biologically inspired control algorithms for bipedal walking
- Generation and deformation of natural walking in computer graphics
- Imitation of human motions on humanoids
- Application of walking simulations in orthopedics
- Simulation of biologically inspired actuators for bipedal walking machines
- Modeling and simulation techniques for the development of new orthoses and prostheses

### Organizers:

Katja Mombaur, LAAS-CNRS, Toulouse, France, [kmombaur@laas.fr](mailto:kmombaur@laas.fr)

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**IEEE Humanoids 2009 Workshop**  
**Modeling, Simulation and Optimization of Bipedal Walking**

**9:00 - 10:30**

**Session1**

- 09:00 Welcome
- 09:10 Katsu Yamane, Disney Research, Pittsburgh, USA :  
Dynamics, Geometry and Biomechanics for Locomotion Synthesis and Control
- 09:30 Hartmut Geyer, ETH, Zürich, Switzerland:  
A model of biped walking based on muscle reflexes that encode principles of legged mechanics
- 09:50 Heiko Wagner, University of Münster, Germany:  
Motor Control and Spinal Pattern Generators in Humans
- 10:10 Rudolphe Héliot, LIRMM, Montpellier, France:  
Coupling CPG-based trajectory generation and optimal control to control online bipedal walking

**10:30-11:00**

**Coffee**

**11:00-12:20**

**Session2**

- 11:00 Julien Pettre, INRIA-IRISA, Rennes, France :  
Motion-capture based locomotion synthesis for digital actors
- 11:20 Hideki Kadone, LPPA, Paris, France:  
Kinematic cues underlying the expression and perception of emotions during human gait
- 11:40 Katja Mombaur, LAAS-CNRS, Toulouse, France :  
Forward and Inverse Optimal Control of Bipedal Running
- 12:00 Andre Seyfarth, University of Jena, Germany:  
Walking and running: how leg compliance shapes the way we move

**12:20 - 14:00**

**Lunch**

**14:00-15:20**

**Session3**

- 14:00 Chris Atkeson, CMU, Pittsburgh, USA:  
Dynamic programming approaches to humanoid behavior optimization
- 14:20 Wael Suleiman, AIST, Tsukuba, Japan:  
Optimization and Imitation Problems for Humanoid Robots
- 14:40 Sigrid Leyendecker, TU Kaiserslautern, Germany  
Structure preserving optimal control of three-dimensional compass gait
- 15:00 Doik Kim, KIST, Seoul, Korea :  
Whole body motion control framework for arbitrarily and simultaneously assigned upperbody tasks and walking motion

**15:20 - 16:10**

**Poster Session**

**16:10 - 16:40**

**Coffee**

**16:40 - 18:00**

**Session 4**

- 16:40 Thilo Kerscher, FZI, Karlsruhe, Germany:  
Elastic actuation for biped walking using fluidic muscles
- 17:00 Dirk Lefeber, FU Brussels, Belgium:  
Use of compliant actuators in prosthetic foot designs
- 17:20 Tobias Luksch, TU Kaiserslautern, Germany :  
Modeling and Control of Dynamic Walking Bipedal Robots
- 17:40 Philippe Bidaud, ISIR, UPMC, Paris, France:  
LQP-based controller design for iCub whole-body motion