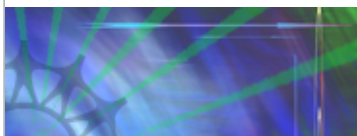




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Award Abstract #1566463

CRII: RI: Energy Effective and Versatile Bipedal Robots Using Event-Based Switching Between Parameterized Steady-State Controllers

NSF Org: [IIS](#)
[Div Of Information & Intelligent Systems](#)

Initial Amendment Date: March 18, 2016

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Award Number: 1566463

Award Instrument: Standard Grant

Program Manager: Reid Simmons
IIS Div Of Information & Intelligent Systems
CSE Direct For Computer & Info Scie & Enginr

Start Date: September 1, 2016

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Awarded Amount to Date: \$159,024.00

Investigator(s): Pranav Bhounsule pranav.bhounsule@utsa.edu (Principal Investigator)

Sponsor: University of Texas at San Antonio
One UTSA Circle
San Antonio, TX 78249-9113 (210)458-4340

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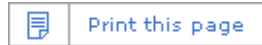
ABSTRACT

Bipedal robots, unlike humans, are either energy-effective or versatile but not both at the same time. For example, the Honda ASIMO can walk over stairs and navigate around obstacles but needs to be recharged about every hour or so. On the other hand, robots inspired by passive dynamics use trivial amounts of energy to move but are limited to a single speed and step length. This project develops a theory that fills this knowledge gap by enabling bipedal robots to make informed decisions about what strategy to follow given a particular circumstance. For example, on rough terrains, a robot may have to decide to expend more energy in order to maximize stability while, in cases where the terrain is flat and regular, the same robot can decide to use its most energy-efficient gait while paying little heed to stability.

There is a need to develop a theory that would simultaneously enable improved

performance metrics for the energy-efficiency and versatility of bipedal robots. The instability of bipedal robots, due to their inverted pendulum like nature, makes this challenge even greater; hence, metrics for balance and stability also need to be met simultaneously. The gap in knowledge is that, it is unclear how to enable bipedal robots to satisfy all these performance metrics, some of which can actually be conflicting (e.g., energy-efficiency trade-offs with stability).

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The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (800) 281-8749

