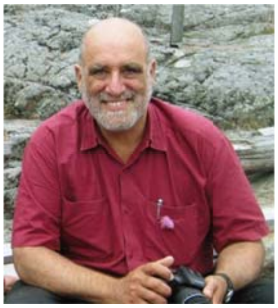
Andy Ruina ‘81
Cornell University

“Gliders, Bicycles, Toys, and Walking Robots”



Wednesday, February 5, 2014
12:00 – 1:30pm
Barus and Holley Room 190

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Many airplanes can, or nearly can, glide stably without control. So it seems natural that the first successful powered flight followed from mastery of gliding. Many bicycles can, or nearly can, balance themselves when in motion. Bicycle design seems to have evolved to gain this feature. Also, as toy makers learned over 100 years ago, we can make robots that, like a stable glider or coasting bicycle, stably walk without motors or control in a remarkably human-like way. So it makes sense to use `passive-dynamics' as a core for developing the control of walking robots and to gain understanding of the control of walking people. That's what I used to think. And we made a very energy-stingy powered robot that way.

But, so far, this approach has not led to robust walking robots. What about human evolution? We didn't evolve dynamic bodies and then learn to control them. Rather, people had elaborate control systems way back when we were fish and even worms. But if control is paramount, why is it that uncontrolled passive-dynamic walkers can walk so much like humans? It seems that energy-optimal control, perhaps a proxy for evolutionary development, arrives at solutions that have features in common with passive-dynamics. Now, rather than thinking of good powered walking as passive walking with a small amount of control added, I think of powered walking as highly controlled, but with much of the motor action titrated out.

This will all be explained with photos, videos, and a few references to, but not detailed indulgence in, real or imagined calculations.

Andy Ruina ’81 was born at the Providence Lying-in Hospital on January 13, 1953. He got his third degree in engineering at Brown in 1981. He spent a year as a geophysicist at the USGS in Menlo Park and then a third of a century and 6 weeks at Cornell in Theoretical and Applied Mechanics, while it lasted, and now in Mechanical Engineering. His research has shifted from solid deformation and friction to rigid-object dynamics, biomechanics, robotics and locomotion: *http://ruina.tam.cornell.edu*

This presentation is part of the HCRI’s Multidisciplinary Speaker Series that showcases diverse and groundbreaking research undertaken by leaders in science, technology, design, and impact of robotics on society.

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