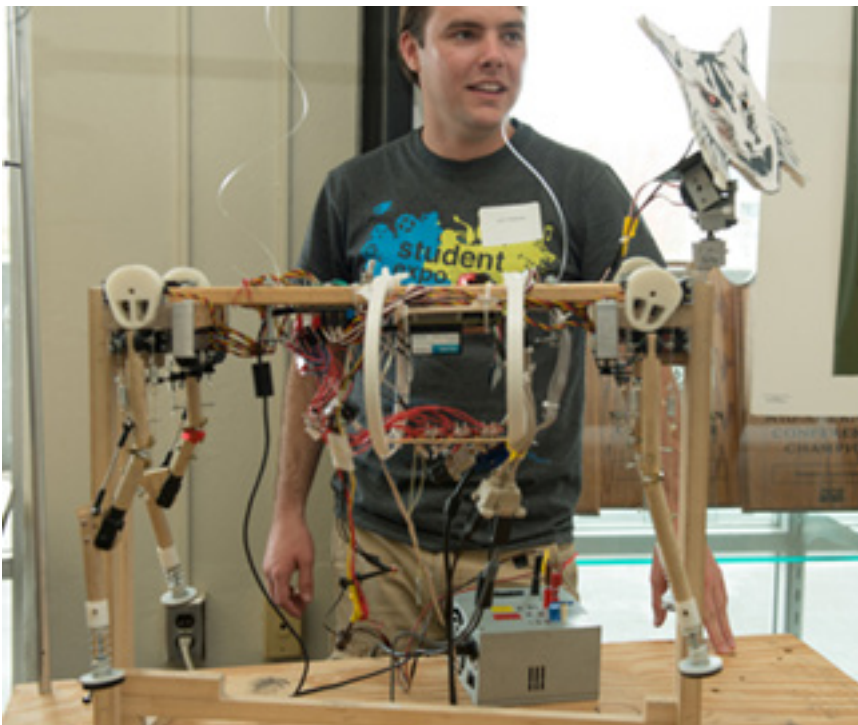# Elastic Cable Driven Robotic Joint
OU ID: #11027

Overview

Most legged robots employ joint-mount motors, which simplifies the analysis and design, but result in legs that are heavy and bulky. Cable-driven robots overcome this shortcoming by allowing the motors to be mounted on or near the torso, thereby reducing the weight and inertia of the legs, resulting in lower overall weight and power-consumption. To facilitate analysis and design, typical cable driven robots use non-stretchable cables, which require n+1 motors for an n Degree-of-Freedom (DoF) joint. Therefore, for a robot with N joints, at least N motors are needed comparing to joint-mounted motors drives. Moreover, the drive train of both joint-mount and cable-driven designs are rigid, which cannot effectively absorb ground impact shocks nor transfer potential energy into kinetic energy and vice versa when the robot is in motion.

The disclosed invention is a stretchable elastic cable-driven joint that is inspired by biological limbs of animals. Although it complicates kinematics and dynamics analysis and design, the elastic cables allow n motors to be used for an n-DoF joint, thereby eliminating N motors for a robot with N joints comparing to non-stretchable cables, further realizing the weight and power savings of the cable driven design. Moreover, the elastic cable driven joints not only effectively absorb ground contact shock, but also effectively transfer potential and kinetic energy during walking or running, thereby improving the robot motion performance and energy efficiency.

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Commercial Application

- There is growing demand for autonomous robots in environments that are unsafe for humans
- Search and Rescue missions, exploration, etc.

Benefits

- Cable driven system allows for much more lightweight and agile legs
- Biomemetic design presents several possible applications
- Camera mounted on neck mechanism provides video feedback to controller

Inventor

Jianchao Zhu, Ph.D. is a professor of electrical engineering and computer science at Ohio University's Stocker Center. Dr. Zhu first conceived this technology in March of 2006 and developed a working model between September 2008 and May 2009.

Contact Us
Mark Foley
Technology Commercialization Manager
P: 740.593.0813
E: foleym@ohio.edu

OHIO UNIVERSITY
1804