Elastic rope energy storage mechanism

What is the energy density of twisted ropes?

Notably,the gravimetric energy density of these twisted ropes reaches up to 2.1 MJ kg -1,exceeding the energy storage capacity of mechanical steel springs by over four orders of magnitude and surpassing advanced lithium-ion batteries by a factor of three.

What are the functions of elastic storage device using spiral spring?

The principal functions of elastic storage device using spiral spring are energy storage and transfer in space and time. Elastic energy storage using spiral spring can realize the balance between energy supply and demand in many applications.

Can mechanical energy be used in twisted ropes?

To demonstrate the application and energy conversion efficiency of the stored mechanical energy in the twisted rope samples, we rotated a circular disc 8 × 10 3 times heavier than that of the y-rope (TPU) using the energy stored in the twisted ropes.

Can a twisted rope reversibly store nanomechanical energy?

Here we produced SWCNT ropes wrapped in thermoplastic polyurethane elastomers,and demonstrated experimentally that a twisted rope composed of these SWCNTs possesses the remarkable ability to reversibly store nanomechanical energy.

How does a twisted SWCNT rope store energy?

Unlike a bundle of carbon fibres consisting of irregular graphitic nanoribbons that store energy during stretching,four different channelsstore energy in a twisted SWCNT rope 15,16,17. When the rope is twisted,each strand is subjected to stretching,twisting,compression and bending.

How do you calculate energy storage in twisted ropes?

Using this expression,the energy storage in twisted ropes can be calculated by first minimizing E/Nwith respect to these strains,taking into account the interrelation between them,as given by Eqs. (A1) and (A2) in the Appendix. The energy per atom can then be converted to the total gravimetric energy density J using J (E/N

The three primary energy storage mechanisms are tension, torsion, and gravity. What are the 4 types of catapult? ... or twisted material. To prepare a catapult to launch a rock, it takes work to twist a rope (provide torsion), to ...

This new lift system is able to effectively utilize the high lift mechanism of hummingbirds, and this study innovatively utilizes elastic energy storage elements and installs them at the wing root to help improve aerodynamic performance. A flapping angle of 154° is achieved through the optimization of the flapping mechanism parameters.

Here we produced SWCNT ropes wrapped in thermoplastic polyurethane elastomers, and demonstrated experimentally that a twisted rope composed of these SWCNTs ...

Dielectric elastomer (DE) is a soft material that can deform to a large degree under the action of an electric field. In this paper, multilayer DE films were stacked in parallel to prepare a 20-layer dielectric elastomer actuator ...

Part of the appeal of elastic energy storage is its ability to discharge quickly, enabling high power densities. ... 805 âEUR" 810 need to be improved by reducing energy loss mechanisms and hysteresis losses deed, hysteresis, and stress softening are all phenomena that have been observed [14]. Electromagnetic generators are also studied in ...

Using ab initio and parametrized density functional calculations, we determine the elastic range and energy storage capacity of twisted carbon nanotubes and nanotube ropes. ...

Secondly, a spring energy storage and trigger mechanism is designed, including incomplete gear, one-way bearing, torsion spring, and so on, to realize the complete jumping function of the robot, that is, elastic energy ...

How does a catapult get its energy to launch items? A catapult uses the sudden release of stored potential energy to propel its payload. Most convert tension or torsion energy that was more slowly and manually built up within the device before release, via springs, bows, twisted rope, elastic, or any of numerous other materials and mechanisms.

This approach accelerates the elastic deformation of individual SWCNTs, thereby enhancing the performance of SWCNT ropes for energy storage. Because ropes produced by the yarn method appear to be ...

It works mainly by using potential and kinetic energy stored in the rubber bands. Potential energy is the store energy where as the kinetic energy is the energy in motion. Also, the three primary energy storage mechanisms that ...

The released elastic energy drives the whole robot to jump into the air,and completes periodic jumping through the action of missing gear. 3.Working principle The bouncing mechanism is composed of spring energy storage device and intermediate connecting rod device. The motor drives the missing gear and spring to complete the bouncing action.

We determine the deformation energetics and energy density of twisted carbon nanotubes and nanotube ropes that effectively constitute a torsional spring. Using ab initio and ...

The potential performance of carbon nanotubes (CNTs) as springs for elastic energy storage is evaluated.

Models are used to determine an upper bound on the energy density that can be stored in ...

Using ab initio and parametrized density functional calculations, we determine the elastic range and energy storage capacity of twisted carbon nanotubes and nanotube ropes. We find that a twisted nanotube rope may reversibly store energy by twisting, stretching, bending, ...

The invention relates to a bionic multi-body-joint mechanism containing an elastic energy storage and release device, in particular to a mechanism device capable of storing and instantly releasing elastic strain energy, which can realize the swinging motion and the quick bounce of a multi-body-joint composite micro robot and belongs to the field of robots.

On the basis of the previous expressions, the limit slipping velocity is: Reo, with: co - vibration frequency of rope incoming side, s"1 k - dynamic factor for elevators, k « 0.1 to 0.3 /u - friction coefficient between rope and pulley, Sst -rope static load at the incoming point C, N T - period of vibration cycle, s"1 If the elevator speed v exceeds the limit

PHYSICAL REVIEW B 88, 245402 (2013) Limits of mechanical energy storage and structural changes in twisted carbon nanotube ropes Zacharias G. Fthenakis, 1Zhen Zhu, David Teich, 2Gotthard Seifert, and David Tomanek´,* 1Physics and Astronomy Department, Michigan State University, East Lansing, Michigan 48824, USA 2Physikalische Chemie, ...

The reminder of this paper is organized as follows. Jumping mechanism of animals always taken as bionic objects will be introduced in Section 2, including their muscle force, power, coordination and kinematics Section 3, Bionic mechanical structures design and dynamic modelings are illustrated.The design and application of actuators and energy storages are ...

Nanomechanical Energy Storage in Twisted Nanotube Ropes David Teich,1 Zacharias G. Fthenakis,2 Gotthard Seifert,1 and David Toma´nek2,* 1Physikalische Chemie, Technische Universita¨t Dresden, D-01062 Dresden, Germany 2Physics and Astronomy Department, Michigan State University, East Lansing, Michigan 48824-2320, USA (Received ...

these twisted ropes reaches up to 2.1 MJ kg -1, exceeding the energy storage capacity of mechanical steel springs by over four orders of magnitude and surpassing ...

A novel variable stiffness mechanism is proposed based on springs and wire ropes. ... actuator effectively eliminates the antagonistic effect of the elastic components and improves the shock absorption and energy storage capacity. And based on the passive and active stiffness adjustment modes, the variable stiffness speed can be effectively ...

Large-scale energy storage technology is crucial to maintaining a high-proportion renewable energy power system stability and addressing the energy crisis and environmental problems.

The paper combines the characteristics of the exoskeleton"s power and the patient"s residual capacity, and proposes a clutch-type elastic actuator (CEA) based on ratchet pawl mechanism, which organically couples the elastic energy storage element with the motor drive as the hip joint actuator of the exoskeleton. The actuator takes advantage of the slow gait speed of the ...

In 2009, Wang Meng and others of Harbin Institute of Technology [27] used the driving principle of springs instead of muscles for energy storage and developed a jumping robot, through the spring-rope and a hindlimb structure of one degree of freedom; this robot has a horizontal jump distance of 865 mm and a vertical jump height of 345 mm.

Secondly, a spring energy storage and trigger mechanism is designed, including incomplete gear, one-way bearing, torsion spring, and so on, to realize the complete jumping function of the robot, that is, elastic energy storage and regulation, elastic energy release, and rapid leg retraction.

Catapult physics is basically the use of stored energy to hurl a projectile (the payload). The three primary energy storage mechanisms are tension, torsion, and gravity. ... Catapults take advantage of elastic force, ...

Through in silico studies and continuum elasticity theory, here we show that the ultra-thin carbon nanothreads-based bundles exhibit a high mechanical energy storage ...

In this paper, the accumulation of damage in a climbing rope by successive dynamic impacts under UIAA standard conditions 6 and its subsequent fracture are investigated. Its central goal is to develop models for the damage mechanisms which diminish the energy storage capacity of the rope. These relatively simple models can be treated ...

According to the American Council for an Energy-Efficient Economy, transition from conventional wire ropes to PU-coated multiple-rope belts has significantly increased energy efficiency of lifting mechanisms, so expanding this experience to the design of gravity energy storage systems seems very promising.

A catapult works because energy can be converted from one type to another and transferred from one object to another. When you prepare the catapult to launch, you add energy to it. This energy is stored in the launching ...

To launch the payload the restraining rope is released. The other type of energy storage mechanism is a torsion device, which can consist of twisted rope. This allowed for greater throwing power than the tension device, in ancient ...

Also, Lu et al. [23] examine recent progress in energy storage mechanisms and supercapacitor prototypes, the impacts of nanoscale research on the development of electrochemical capacitors in terms of improved capacitive performance for electrode materials, and significant advances in electrode and device configurations.

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