# Energy storage stiffness

The energy storage performance is influenced by various essential factors, such as the choice of the polymer matrix, the filler type, the filler morphologies, the interfacial engineering, and the composite structure. ... The enhancement of various properties, such as hardness, stiffness, wear and impact resistance, thermal stability, and ...

In this study, based on the analysis of the energy flow characteristics and stiffness change characteristics of lower limb joints during a human walking on flat ground, a ...

Variable Stiffness Actuation (VSA) is an efficient, safe, and robust actuation technology for bionic robotic joints that have emerged in recent decades. By introducing a variable stiffness elastomer in the actuation system, the mechanical-electric energy conversion between the motor and the load could be adjusted on-demand, thereby improving the performance of ...

non-linear stiffness characteristics. Energy storage in the system occurs through exerting aninput force using an actuator on the top mass to deform the elastic element. The reaction forcedis- - placement relationship of the nonlinear spring can be generally represented by a . C

The design of leaf springs for a sub-class of VSAs that use variable lever arm ratios as means to change their output stiffness are discussed, given the trade-off between compactness and the maximum energy storage capacity. The increasing use of Variable Stiffness Actuators (VSAs) in robotic joints is helping robots to meet the demands of human-robot ...

Stiffness and energy storage were highly non-linear in both the sagittal and coronal planes. Across all prosthetic feet, stiffness decreased with greater heel, forefoot, medial, and lateral orientations, while energy storage increased with forefoot, medial, and lateral loading orientations. Stiffness category was proportional to stiffness and ...

Orientation, manufacturer, stiffness category, and heel wedge inclusion greatly influenced stiffness and energy storage characteristics of prosthetic feet, and these results may help improve clinical prescriptions by providing prosthetists with quantitative measures to compare prosthetic Feet.

Structural composite energy storage devices (SCESDs), that are able to simultaneously provide high mechanical stiffness/strength and enough energy storage capacity, are attractive for many structural and energy requirements of not only electric vehicles but also building materials and beyond [1].

Abstract: Theory suggests an inverse relation between the stiffness and the energy storage capacity for linear helical springs: reducing the active length of the spring by 50% increases its stiffness by 100%, but reduces its energy storage capacity by 50%. State-of-the-art variable stiffness actuators used to drive robots are characterized by a similar inverse relation, implying ...

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Decreasing foot stiffness can increase prosthesis range of motion, mid-stance energy storage and late-stance energy return, but the net contributions to forward propulsion and swing initiation may be limited as additional muscle activity to provide body support becomes necessary.

State-of-the-art compliant actuators with variable stiffness meet the requirements for exoskeletons only to a limited extent, usually due to their higher mechanical complexity and large mass. In this letter, we present a quasi-passive lightweight pneumatic mechanism that emulates stiffness modulation in the pneumatic cylinder using fast-switching valves and without the need of an air ...

Known test setups for single-cell testing from literature fail to meet important requirements. A realistic module stiffness must be simulated by highly plane parallel plates to achieve a homogeneous load onto the cell. The cell shall be sufficiently and homogeneously cooled. ... Journal of Energy Storage, Volume 13, 2017, pp. 211-219. Anup ...

where, (K_{d1}) is the energy storage rigidity of viscoelastic damper; (K_{d2}) is the loss rigidity of viscoelastic damper; (G_{1}) is the energy storage shear modulus of viscoelastic material; (G_{2}) is the loss shear modulus of viscoelastic material; (eta) is the loss factor of viscoelastic material; A is the area of viscoelastic material layer; n is the number of ...

Nature Communications - Carbon nanothreads are promising for applications in mechanical energy storage and energy harvesting. Here the authors use large-scale molecular ...

Aiming at the present passive energy storage walking assist exoskeleton adopts fixed stiffness joint, a passive variable stiffness energy storage walking assist hip exoskeleton is designed, on the base of joint energy flow characteristics in the process of people walking and the change of stiffness characteristics. The human-exoskeletons ...

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The conclusion is that the maximum energy that the device can store is 1.415 J at the stiffness ratio equaling 0.46, and the energy storage efficiency is 1.3608 at the ratio equaling 0.45, when the weight of the device is 3.54 kg and the apparent stiffness is ...

In tandem with the decade of this discovery the concept of the Energy Storage and Return (ESAR) prosthesis progressively evolved. ... The influence of energy storage and return foot stiffness on walking mechanics and muscle activity in below-knee amputees. Clin Biomech 26:1025-1032. Article Google Scholar Hsu MJ, Nielsen DH, Lin-Chan SJ ...

Data suggest the need for an independent classification scheme for stiffness and hysteresis among all manufacturers to aid clinicians" ability to appropriately prescribe and fit prosthetic feet. Dynamic elastic response prosthetic feet are designed to store and return energy during the gait cycle to assist the amputee with limb advancement. In so doing, the structural ability of the feet ...

Decreasing foot stiffness can increase prosthesis range of motion, mid-stance energy storage and late-stance energy return, but the net contributions to forward propulsion and swing initiation may be limited as additional muscle activity to ...

Results: Stiffness and energy storage were highly non-linear in both the sagittal and coronal planes. Across all prosthetic feet, stiffness decreased with greater heel, forefoot, medial, and ...

variable stiffness energy storage assisted hip exoskeleton is designed, and a stiffness optimization modulation method is proposed to store most of the negative work done by the human hip joint ...

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In this paper, an analytical approach is presented to compare two important determinants in different stiffness adjustment mechanisms (SAMs); level of accessibility to the energy storage and force ...

Artificial structures called cellular materials have a network of internal spaces within a solid cell-like matrix. Their porous foam-like architecture combines advantages of low density with strength.

Considering the individualized demand of user"s walking aid, a variable stiffness energy storage mechanism is designed, which can be adjusted according to user"s height. Through EMG test, it is proved that the mechanism has a good effect of assisted walking. The energy storage mechanism of unpowered aided exoskeleton is mainly composed of ...

Results revealed that, independent of sex, all five regions in the fibulin-5 deficient mice manifested a marked increase in structural stiffness but also a marked decrease in elastic energy storage and typically an increase in energy dissipation, with all differences being most dramatic in the ascending and abdominal aortas.

Measuring Elastic Energy Storage. Measurements of elastic energy storage and recovery depend on measurements of the material properties of muscle and tendon in combination with measurements of their structural dimensions and the forces that a muscle-tendon complex transmits during a given activity.

Fig. 2. Experimental set up of the controllable-volume air spring within one compression-expansion cycle. (a-b) Atmospheric air is being compressed from equilibrium height z01 to the minimum height zmin while the air flow control valve is closed. (c) The piston is then returned to the equilibrium height z01 (Volume 1) with the valve closed. (d) Once the piston ...

The novel approach to stiffness modulation is mathematically described. Furthermore, we discuss how changing the initial equilibrium pressure of the mechanism affects the stiffness and ...

It is theoretically shown that the trade-off between stiffness range and energy storage capacity is not fundamental; it is possible to develop variable stiffness springs with simultaneously increasing stiffness and energystorage capacity. Theory suggests an inverse relation between the stiffness and the energy storage capacity for linear helical springs: ...

In addition to increasing the energy storage, the stiffness gradient accelerates the energy conversion process through an ~90% reduction in energy conversion duration, defined as the time from the ...