Jumping robot energy storage

How does a jumping robot improve energy storage & stability?
The uniqueness of this study is that it creatively integrated the jumping mechanisms of two animals to achieve the robot's jumping ability, thereby significantly enhancing the energy storage and stability of the robot.

How do jumping robots achieve better jumping performance?
After a detailed analysis to actuators and energy storage devices and a comprehensive summarization to functional and soft materials commonly applied in jumping robots, different control methods and strategies adopted to achieve better jumping performance are reviewed and analyzed, from self-righting, driving control to path planning.

How to optimize the energy density of a jumping robot?
It is especially serious in jumping robots with the property of high energy density. In general,increasing stored energy and reducing energy dissipationare the two ways of energy optimization. For example,JumpRoACH tried to combine linear spring and torsional spring to increase the total stored energy.

How do robots store energy?
The second choice is using a special springas the energy storage medium,under which circumstance,the miniature robot employs two symmetrical transmutable carbon fiber strips to store and release energy [7]. The soft robot uses a shape memory alloy to store and release energy for jumping and the same goes for a Tribot [8].

How much energy is stored for jumping?
A total energy of 7.019 Jis stored for jumping throughout the entire energy-storage process. The elastic energy-storage bracket not only provides structural strength for the robot but also serves as an essential component for storing energy during jumping.

How a jumping robot works?
Because of high energy density characteristic of jumping robot, most application of actuators is accompanied by energy storing and releasing. Only a few jumping robots are driven by electric motors or hydraulic system directly, and ordinarily, jump is often utilized as an auxiliary locomotion in this kind of mobile robots , .

These include the co-contraction and semilunar process in locusts, 1-3 the energy storage and release mechanism in fleas, 4-8 and the coxal and femoral protrusions-based locking mechanism in froghoppers. 9-13 Drawing inspiration from these jumping insects, various robots have been developed to enhance their locomotion range, thereby overcoming ...

the energy changes of the quadruped robot during the jumping process, validating, and quantifying the energy storage effect of the elastic energy storage components. The remainder of this article is organized as follows.

Sect. 2 introduces the overall energy storage structure design and control system construction of the quadruped robot.

The jumper component of the robot provides energy for the robot to jump. An increase in the robot"s mass will result in a reduction in the height of its jumping, hence the need to minimize the mass as much as possible. ... (2.9 J) and the load in the whole robot was 156.8 g. (C) The storage energy was the largest (2.9 J), where the load in ...

o Jumping is the most efficient way of travelling over very rough terrain o Jumping robots are able to store energy recovered from the environment by compressing an elastic mechanism that can quickly release all the energy in one jump o Many natural organisms use jumping to traverse rough terrain Possible Problems:

and more appropriate for autonomous robots [4,7,17]. Besides actuators, energy storage also plays a significant role in the per-formance of hopping robots. All of the existing jumping mecha-nisms rely on the instant release of the stored energy to realize jumping [7], and there are several approaches to achieve the re-quired energy storage .

A shape-memory-alloy coil spring actuator enables the mimicking of the flea"s catapult mechanism and can be used not only for jumping robots but also for other small-sized robots to generate fast-releasing motion. Fleas have a unique catapult mechanism with a special muscle configuration. Energy is stored in an elastic material, resilin, and the extensor muscle. ...

The elastic-kinetic energy conversion efficiency in spring-driven jumping robots was first explored in detail by [10] while designing a prismatic jumper for planetary exploration propelled by a linear spring (obeying Hooke"s law). A critical issue cited was that during the acceleration phase the robot foot disengaged from the ground before the leg was fully ...

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.

The water-jumping robot"s energy storage size is the key to improving the jumping performance. Materials with high energy density and large deformability are chosen as robotic energy storage elements, and the storage energy size of water jumping robots can be increased. We design an energy storage mechanism with latex and carbon composite ...

bouncing leg energy storage autonomous movement is designed to realize periodic jumping. The robot combines the spring energy storage process and the jump release process and uses the missing gear to achieve the ability of the jumping robot to complete a periodic stable jump. At the same time, it has long-term battery life, allowing it to ...

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REBOund, an untethered origami jumping robot with tunable jump height based on geometric parameters; an experimentally-veried pseudo-rigid-body model that captures the effect of geometry on its force-displacement relationship and potential energy storage; a strategy for manipulating fold pattern geometry for jump height control; and

Engineers have built a jumping robot that far surpasses any living jumper (video, left). Ratchets and springs enable the robot to store energy gradually, then release it all at once, sending the robot to a record-breaking height of over 32 meters (right). ... Alien life might also have muscles that work differently, perhaps with their own ...

"By integrating the robot skeleton with the energy storage mechanism, we can effectively improve the energy density of the robot during the jumping process," he said. Taher Saif, an engineering professor at the Grainger College of Engineering in Urbana, Illinois, who was not involved in the study, said the work seems to represent an ...

The energy storage and jumping process of robot is shown in Supplementary Materials. It can be seen that the jumping pose of the robot was very similar to the dual-mass SLIP model. The robot reached a maximum jumping height of 45 mm in 0.29 s, and the time from jumping to landing was 0.45 s after unlocking. ...

arXiv:2311.02188v1 [cs.RO] 3 Nov 2023 Elastic energy storage of spring-driven jumping robots John Loa,*, Ben Parslewa,b aDepartment of Fluid and Environment, The University of Manchester, Manchester, M13 9PL, United Kingdom bInternational School of Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, 10330, Thailand Abstract ...

Concerning no-latch jumping robots, although the maximum stored energy is limited, this method offers better agility and manoeuvrability [23]. The transition from energy storage to launch is smooth, avoiding instantaneous impacts on the robot, facilitating jump speed adjustment, and enabling active landing cushioning [24].

Spring-driven jumping robots use an energised spring for propulsion, while the onboard motor only serves as a spring-charging source. A common mechanism in designing these robots is the rhomboidal linkage, which has been combined with linear springs (spring-linkage) to create a nonlinear spring, thereby increasing elastic energy storage and jump ...

One of the most challenging components in jumping robots is the actuation and energy-storage mechanism

due to the limitations of their size, weight, power transmission, and performance characteristics [12]. Moreover, jumping robots also need a rapid energy release mechanism. ... An incomplete gear mechanism was adopted for the jumping robot to ...

Drawing inspiration from the energy-storage jumping mechanism of jumping beetles, a tuneable multimodal jumping robot (Tumro) capable of executing multimodal movements including wheeled locomotion and ground-based jumping, which can achieve a jump height of up to 3 m and swiftly recover its wheeled crawling state without requiring posture ...

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