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The substrate reaction forces acting on a gecko's limbs responding to inclines

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Locomotion is essential character of animals and excellent moving ability results from the delicate sensing of the substrate reaction forces (SRF) acting on body and modulating the behavior to adapt the motion requirement. The inclined substrates present in habitats pose a number of functional challenges to locomotion. In order to effectively overcome these challenges, climbing geckos execute complex and accurate movements that involve both front and hind limbs. Few studies have examined gecko's SRF on steeper inclines of greater than 90°. To reveal how the SRFs acting on the front and hind limbs respond to angle incline changes, we obtained detailed measurements of the three-dimensional SRFs acting on the individual limbs of the Tokay gecko while it climbed on an inclined angle of 0°-180°. The fore-aft forces acting on the front and hind limbs show opposite trends on inverted inclines of greater than 120°, indicating propulsion mechanism changes in response to inclines. When the incline angles change, the forces exerted in the normal and fore-aft directions by the gecko's front and hind limbs are reassigned to take full advantage of the limbs' different roles in overcoming resistance and in propelling locomotion. This also ensures that weight acts in the angle range between the forces generated by the front and hind limbs. The change in the distribution of SRF with a change in incline angle is directly linked to the favorable trade-off between locomotive maneuverability and stability.

Recent Publications

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Biography

Zhouyi Wang has completed his Degree of Doctor of Philosophy from Nanjing University of Aeronautics and Astronautics. His research areas include tribology, bionics, animal kinematics and dynamics.

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