

Statement of Significance

Insects such as flies or beetles have the ability to walk on any surface against gravity. It was previously shown that these insects possess a dense array of micrometer sized hairs on their legs. These hairy legs are responsible for the insect's strong adhesion to surfaces by resisting contact failure due to micro-roughness or defects on the surface. In this work, we theoretically show that, a hairy design of the leg not only provides strong adhesion, but can also allow easy detachment from a surface. This is achieved simply by modulating the leg's tilt relative to the surface with the aid of its leg joint or claws. Such a design can thus inspire artificial adhesives with switchable adhesion properties.