Dynamic Legged Robot: Shape Deposition Manufacturing

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Motivation
For a long time researchers have worked towards building a robot that can climb walls. The climbing dynamics of animals such as the gecko and squirrel have served as a basis for the design of these robots. These robots can climb walls relatively quickly, but they are limited to certain surfaces such as carpet. We want to create a robot that can climb quickly up a wall even on tough surfaces such as cinderblock or brick. The robotic platform chosen is the Bipedal Oscillating Robo (BOB).

One of the biggest challenges with vertical climbing is interface with the climbing surface. To achieve the desired interface, an array of appendages is used (shown to the right). This “toe” has been designed to maintain interface with the contact surface. One of the drawbacks to these toes is the slow manufacturing process. To speed up the manufacturing process and give many other benefits, Shape Deposition Manufacturing is implemented to fabricate these appendages. The emphasis of this project is on the development of SDM for manufacturing these appendages.

Shape Deposition Manufacturing
Shape Deposition Manufacturing (SDM) is a novel rapid prototyping process that involves alternating between material deposition and removal. This allows for the fabrication of the complexities that are an integral part of biomimetic designs.

Benefits
• Control internal geometry
• Change material properties
• Embed parts
• Repeatability

Manufacturing Process
Machine out general form
Embed hook using modeling clay
Fill with polyurethane polymer

Results

Future Work
In the future, I will be experimenting with elastomer machining as that is a weak point with the current appendages. Some possible solutions could be machining them cryogenically or using a material with a higher elastic modulus.