Dragonfly shows simulated flight potential

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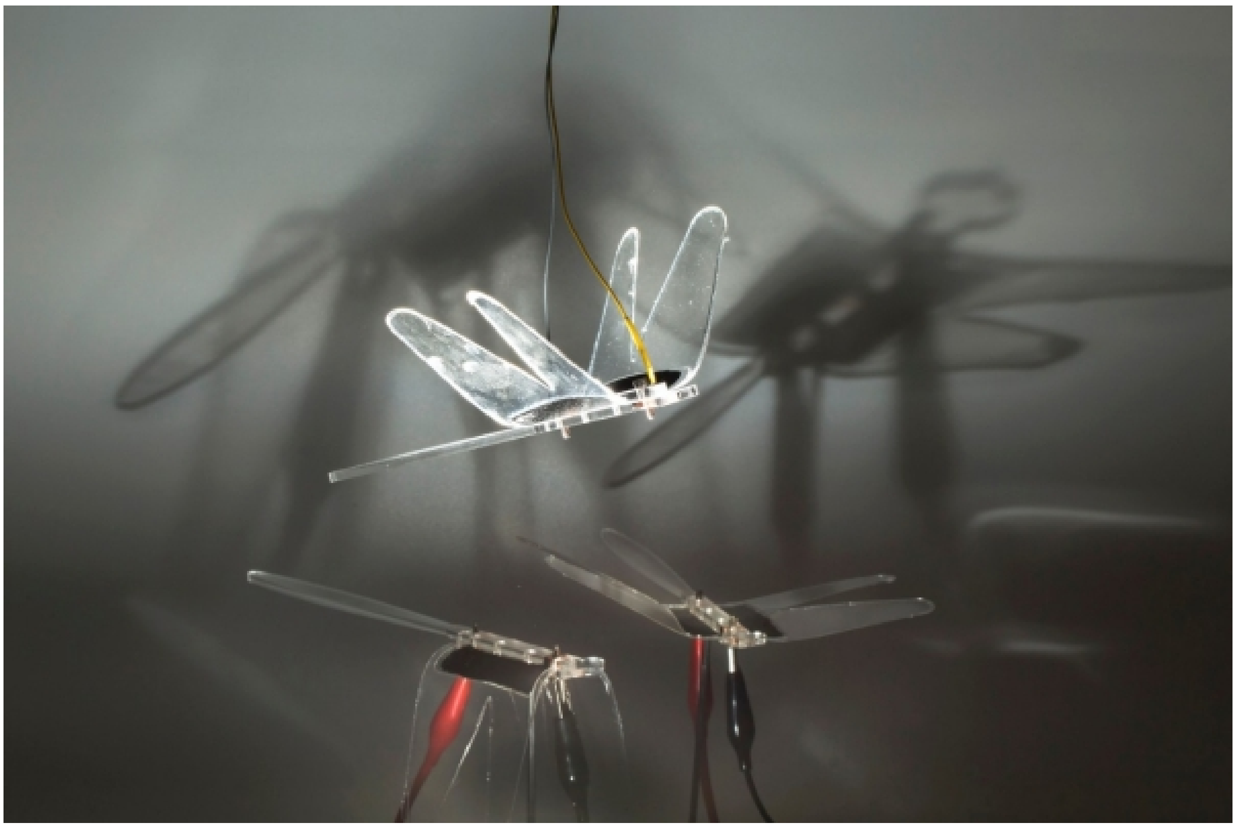

Jule dragonfly by Markus Henke . Credit: Biomimetic Lab, ABI

Futuristic dragonflies are flapping their wings in the Biomimetics Lab at the University of Auckland's Bioengineering Institute.

Soon they may be lifting off their podiums and taking to the air.

The research to create and develop them is led by Dr EF Markus Henke, a graduate in mechatronics from TU Dresden in Germany, who has come to Auckland to work with biomimetics expert and Biomimetics Lab director, Professor Iain Anderson.

"Jule" our first Dragonfly is a biomimetic dielectric elastomer minimum energy structure using electro-mechanical resonance effects to generate large strokes by small actuation for dielectric artificial muscles," says Dr Henke.

Dr Henke says the necessary high voltage driving signals to make the dragonfly flap its wings, can be generated by dielectric elastomer oscillators. These mimic the central pattern generators that control muscles.

They transform a DC input voltage into an oscillation high voltage signal that drives Jule's artificial muscles. The dielectric elastomer switches that are at the heart of the oscillators were invented at the Institute's Biomimetics Lab.

"Although the dragonfly is not able to fly yet, it shows the high potential of dielectric elastomer actuation and signal processing," says Dr Henke. "There is no need for moving mechanical parts or conventional stiff electronics in the soft robots of the future. The only things we need are strain, charge, carbon and polymers."

"Jule was developed because we wanted to show the potential of large actuation using dielectric elastomers at the SPIE Smart Structures conference in Las Vegas in March this year, and Iain [Professor Anderson], supported me with good ideas in several long discussions."

"The development of the Jule dragonfly to this stage is the outcome of a year-long continuous development of dielectric elastomer technology in the Biomimetics Lab, conducted by numerous people, passing on their knowledge," says Dr Henke.

He had been working on another biomimetic project, Trevor the caterpillar, but because the overall actuation of Trevor was very slow, he decided to combine a minimum energy structure and DE actuators in order to design a resonant dielectric elastomer minimum energy structure.

At the SPIE smart structures conference, a special session about minimum energy structure was announced before the conference, but none of the contributions were using resonance.

"I decided to make a stab at it, since I had learned a lot about DE application and design during the redesign of the new Trevor the caterpillar, and so the dragonfly project took off," says Dr Henke.

"It only took me about three days – and about 25 iterated wing shapes - to design the wings and drive the flapping motion using a DE signal processing unit (artificial central pattern generator)," he says.

"We are not yet sure, if the dragonfly itself will fly as designed now, but we believe we can learn a lot about similar structures and propulsion systems," he says.

Provided by University of Auckland

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