

Hop, Jump and Stick; Robots Designed With Insect Instincts

ScienceDaily (June 24, 2010) — A swarm of flying robots soars into a blazing forest fire. With insect-like precision and agility, the machines land on tree trunks and bound over rough terrain before deploying crucial sensors and tools to track the inferno and its effects. This is a scenario that Mirko Kovac, from EPFL's Laboratory of Intelligent Systems, thinks may not be so far off.

Swarm robotics is offering innovative solutions to real-world problems by creating a new form of artificial intelligence based on insect-like instincts. Mirko Kovac, from EPFL's Laboratory of Intelligent Systems, is a young robotics engineer who has already made leaps forward in the field with his grasshopper-inspired jumping robot. He and his collaborators have created an innovative perching mechanism where the robot flies head first into the object, a tree for example -- without being destroyed -- and attaches to almost any type of surface using sharp prongs. It then detaches on command. The goal is to create robots that can travel in swarms over rough terrain to come to the aide of catastrophe victims.



Mirko Kovac with a model of his head-first perching mechanism for miniature robots. (Credit: Image courtesy of EPFL)

"We are not blindly imitating nature, but using the same principles to possibly improve on it," explains Kovac, who recently finished his doctoral studies at EPFL. "Simple behavioral laws such as jumping, flying and perching lead to complex control over movement without the need for high computational power."

Jumping, gliding and perching allow for mobility over rocky territory or destroyed urban areas. This new form of AI takes its inspiration from the insect world, but is more as an abstract reflection on their instincts and design principles than merely imitating their morphology. This simplicity allows for greater mobility since the robots are not bogged down with heavy batteries. Kovac imagines swarms of his robots equipped with different sensors and small cameras that could be deployed over devastated areas to transmit essential information back to rescue command centers.

The lab's most recent innovation, perching a robot, saves valuable energy by allowing the robot to rest like insects or birds do. Many previous perching mechanisms include a complicated swooping maneuver to decrease momentum and land on legs, often without the ability of detaching. The mechanism developed by Dr. Kovac and Jürg Markus Germann, recently published in the *Journal of*

Micro-Nano Mechatronics, avoids this problem by using two spring-loaded arms fitted with pins that dig into the surface, whether it is wood or concrete. The snapping of the arms creates a forward momentum, allowing for a soft deceleration of the glider and avoiding mechanical damage. A remotely controlled mini-motor then detracts the pins and allows the robot to continue on its way.

"I am fascinated by the creative process," says Kovac, "and how it is possible to use the sophistication found in nature to create something completely new." The perching mechanism can be easily adapted to other robots. His previous robot, a quarter-gram jumping robot that can achieve heights of up to four and a half feet, could now be fitted with the new perching mechanism as well as wings, thus creating a hybrid creature that gets around much like a flying grasshopper.

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