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International Doctoral Program in Civil and Environmental Engineering

SEMINAR

Can the spider hear the position of the prey?

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Location:

Aula Magna
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Abstract

Daily experience shows that a spider that stays in the center of an orb web is able to orient itself immediately toward the prey, and capture it, by testing the web at the contact points of its eight legs. Although this is one of the key aspects in the study of spider behavior, the prey catching problem still remains a mystery to a large extent, and progress has been limited by the lack of two-dimensional models of wave propagation in the orb web.

Here, we formulate the catching problem as the inverse problem of identifying the region of prey's impact in a continuous membrane model of orb web from dynamic measurements that mimic those made in Nature by a spider. We provide a mathematically-founded answer to this inverse problem by discussing the uniqueness issue and creating a reconstruction algorithm for the determination of the impact prey's region. We find that the amount of information typically assumed to be available by the spider is enough for an accurate identification of the position of the prey, for different prey and orb web characteristics.



Antonino Morassi serves as professor of Mechanics of Solids and Structures at the University of Udine, Italy. In his scientific activity he has treated theoretical and applied inverse problems in elasticity and structural identification.

On these topics he has developed an extensive experimental activity on the use of dynamic methods, with applications to medium-scale models and to full-scale structures, such as buildings, chimneys, bridges and water reservoirs.

His most recent research interests concern the modelling of complex vibrating systems, such as nanostructures and spider orb webs, and the identification of their mechanical properties using dynamic data.

