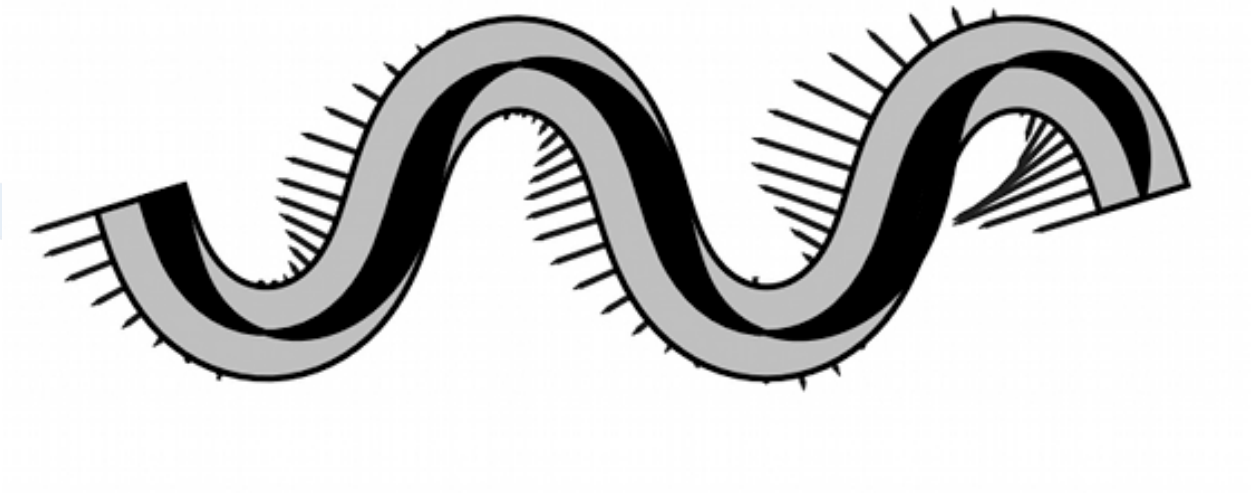
Snake gait



Science observes nature to invent new ways of moving

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Snake locomotion is a source of inspiration for technology: graceful, silent, adaptable and efficient, it can be implemented on devices designed for the most diverse applications, from space exploration to medicine. A study carried out by a SISSA research group, just published in the *Proceedings of the Royal Society A - Mathematical, Physical and Engineering Science*, adds to this line of research and proposes a detailed mathematical account of one of the characteristic types of movement adopted by this animal. The model could have applications in the biomedical field, for example to create "smart" scalpels able to slither into tissues causing only minimal damage.

It has no wheels or legs or anything to help itself along, and yet it is able to move and to move quite fast. In terms of mobility, the snake is a masterpiece of engineering, and it is no coincidence that it should be studied to uncover the physics underlying its locomotion. Giancarlo Cicconofri, SISSA research fellow, and Antonio DeSimone, SISSA professor and head of MathLab, the School's laboratory for mathematical modelling and scientific computing, have developed a mathematical model to describe in detail slithering, one of the characteristic ways in which snakes move by propagating lateral undulations along the body, and described in their model as "snake in a tube".

"Snake in a tube" refers to the way the animal moves when it does not travel sideways (without lateral movement or sideslipping) and limits itself to gliding along a sinuous "track". "Snakes can move by contracting and relaxing their musculature and exploiting their interaction with the environment", explains DeSimone. "We're not the first to devise a mathematical model for this movement, but we've done so with great precision. The main merit of our work is above all to provide a precise account of the lateral forces transmitted to the environment in which the movement occurs".

"To better understand, we can imagine one of the possible applications of our findings", continues Cicconofri, first author of the study. "In the field of surgery, one could design probes or scalpels able to slither through tissues to reach the site where their action is needed. Clearly, as they slither inside the body they should force as little as possible ~~o~~ the tissues they encounter. A model like ours ~~is~~ can be employed to calculate this aspect so as to optimize the movement of the probe", concludes Cicconofri.

USEFUL LINKS:

- **Original paper: http://rspa.royalsocietypublishing.org/content/471/2184/20150054**

IMAGES:

- **Credits: SISSA (Cicconofri/DeSimone)**

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