
Bio Inspired Exploration Robot for Enceladus

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One of the most promising places to find extraterrestrial life in our solar system is the ocean under the surface of Saturn's icy moon Enceladus. The Cassini-Huygens mission revealed some of the geologic activities ongoing within the icy moon and thereby excited the scientific community to learn more about this world. The observed vapor plumes ejecting from the moon, containing icy grains and complex organic molecules, raise questions about the geophysical and possible biological processes within the moon. Serving the scientific quest of searching for extraterrestrial life within our solar system, the Mechanical and Aerospace faculties of the TU Delft have initiated a project in which a novel exploration robot is developed. The moon's harsh environmental conditions require innovative bio-inspired solutions to new and complex engineering problems. Hence, our search for life will be enabled by solutions found by life itself. The project currently focuses on primary robotic systems including ice adhesion, locomotion, and life detection. The newly developed actuator employs the adhesive properties of ice to create temporary anchors on icy surfaces. Tensile tests indicate that the actuator can create strong adhesive bonds which sustain forces of more than 1300 N over a surface area of 12.6 cm² (1 MPa), surpassing the cohesive strength of ice itself. The life detection and locomotion of the exploration probe are still in preliminary stages. Future project plans include tackling additional challenges such as subglacial power and communication systems, complete probe integration and subsequent testing in the French Alps glacial environment.