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Experimental analysis for optimization of a Bernoulli principle based climbing robot adhesion system

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Climbing capability is a characteristic that robotic researchers have been intensely pursuing in the last decade for climbing robots. Emphasis has been on minimizing energy expenditure, increasing payload and traversing different wall materials. Using the Bernoulli principle as inspiration, important principles are revealed for reliable maneuvering on vertical structures. An experimental identification of a model for a Bernoulli principle-based holding force is described. To quantitatively evaluate requirements of a Bernoulli pad to achieve attachment on a wall, this paper presents the force analysis and conducts experimental verification for a commercially available Bernoulli pad. By designing and using a test bed, optimal holding force that ensures complete attachment of the pad is defined and experimentally verified. Factors that influence the holding force such as fluid media, frictional force, robot state, air speed, height of pad from surface and density variations are experimentally investigated and their causes and effects are established. The methods proposed in this study are valuable in guiding the design of pneumatics-based adhesion devices such as wall-climbing robots. The results from the experiments would then lead to the design of an adaptive force which would enable different fluid media to be used therefore increasing the versatility of the adhesion system. They would also enable optimization of the Bernoulli principle therefore increasing holding force and payload. The cause and effect of these parameters were confirmed through finite element analysis using ANSYS and simulation using Matlab.

Biography

Rujeko Masike is a PhD Scholar at Amity University in Gurgaon, Haryana, India. She is the Chairperson of the Industrial and Manufacturing Engineering department at Harare Institute of Technology. She has published more than five papers in reputed journals and has been conference chair for two international conferences of repute

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