Evaluation of compressive and flexural properties of a fiber reinforced additive manufacturing technology as a design input for a novel foot-ankle device

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This research focused on the characterization of additive manufacturing technology based on composite filament fabrication (CFF) as a design input for a novel foot-ankle device. CFF utilizes a similar method of layer by layer printing as fused filament fabrication, but is also capable of reinforcing parts with layers of various continuous fibers into a polymer matrix. Due to the orthotropic characteristics of additive manufacturing based on fused filament fabrication, 3D printed parts may present different mechanical behaviour under different orientations of stress. Furthermore, technologies such as CFF allow a range of configurations to fabricate and reinforce the parts. In this study, mechanical characterization of polyamide 6 (PA6) reinforced with carbon fiber and fiberglass was conducted by design of experiment as a statistical method, to investigate the effect of reinforcement, print orientation and percentage of fiber on mechanical properties in compression and flexion. The results were considered as an input to design and validate a novel low-cost foot-ankle device by using CAD and CAE tools.

Speaker Biography

Miguel Araya-Calvo is currently working on a Master's degree thesis in Medical Device Engineering from the Instituto Tecnológico de Costa Rica, Costa Rica, related with a novel foot-ankle design implementing fiber-reinforced additive manufacturing technology. He is a researcher at the ergonomics and biomechanics laboratory and an Industrial Design Engineering professor at Instituto Tecnológico de Costa Rica. He has focused for more than 3 years on the implementation of 3D printing for low cost below-the-knee prosthetic solutions.

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