A Novel Approach to Utilizing Collapsible Origami Structures in Weight Bearing Applications

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This study investigates the use of rescue device structures made with inspiration from origami as a viable replacement for modern day debris lifting rescue devices. The structure studied as a replacement to the current rescue devices is an origami spring, a collapsible paper toy mimicking the action of a genuine spring. The structure was redesigned for weight bearing efficiency with the use of interference detection and motion analysis in the Solidworks software. Cardstock paper was then bonded together with a 1:3 ratio of wood glue to water to create the ideal construction material. Additionally, the actuation mechanism for the device was realized using a unique composition of nitinol wire. Three complete structures were then created with the cardstock composite and bonded with duct tape. These structures were placed in a triangular formation, and were able to lift the weight of a 180lb human from a height of below 3 cm to a height of above 20cm. The results showed that the structure proved to be sufficient in lifting capability proportionally comparable to air bags. Additionally, utilizing interchangeable parts and low-cost materials allows for a viable scaling solution for more industrialized tasks. Furthermore, the stress experienced by the individual parts of the study device is proportionally less than that of a scissor lift suggesting it as a viable alternative to a wide range of conventional lifting mechanisms.