Docket #: S19-367

Soft Collapsible Hydraulic Shock Absorber

Stanford inventors have developed a rechargeable, fluid-based shock absorber material for use in space constrained environments. Foam is the most common form of shock absorption material, but its force exerted is proportional to the degree of displacement. They are also singular in their ideal force profiles making them incapable of adapting to different impact speeds. In applications such as football helmets or automobile safety, this can lead to more damage than the initial impact itself. This design utilizes an incompressible liquid contained within a fabric vessel, which is ejected upon impact as the vessel collapses into an outer elastic refill chamber. As the compression force is removed, the fluid returns to the fabric vessel ready for the next impact. Notably, use of the incompressible fluid allows for the force exerted by the shock absorber to scale with the impact energy making this a versatile mechanism. In the case of personal protective equipment, the force profile can be tuned by adjusting pad size and liquid amount to provide a personalized fit.

Related technology: S16-466 Ideal Damper for Concussion Protection

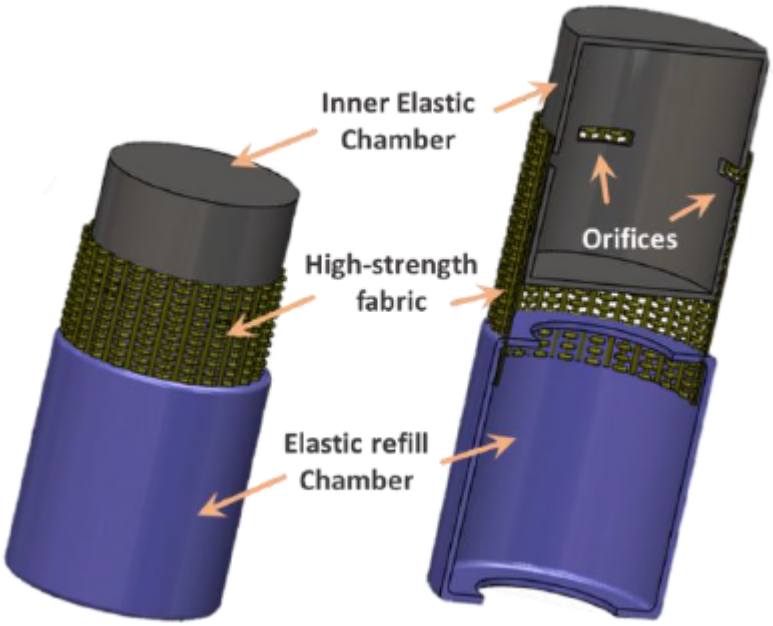


Photo description: Schematic of the shock absorber. Photo credit: inventors.

Stage of Research

- Prototype

Applications

- Helmet shock absorbers
- Automotive safety

Advantages

- Lightweight & compact
- Ideal for space constrained applications
- Shock absorber exertion force scales with impact energy
- Energy absorption at low force level

Publications

- Alizadeh, V. et al. "A computational study of liquid shock absorption for prevention of traumatic brain injury." *Journal of biomechanical engineering*

143.4 (2021): 041008.
- Alizadeh, V. et al "Collapsible fluid-filled fabric shock absorber with constant force."*Journal of Intelligent Material Systems and Structures*(2021): 1045389X211023578.

Patents

- Published Application: WO2021062352
- Published Application: 20220341480
- Issued: 12,013,010 (USA)

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