Shape Memory Alloys for Controllable Compression Textiles and Garments
Technology #17392

Applications

- In healthcare: garments for management of diabetes; garments to improve blood circulation; garments for burn management; post-surgical compression garments to aid in recovery after a surgical procedure
- In athletics: garments for improvement of oxygen circulation
- In emergency medicine: garments to tourniquet active wounds
- In aeronautics/space: compressive space suits to provide required pressurization to an astronaut’s body; compressive garments to prevent orthostatic intolerance during high-g maneuvers (aeronautics) or to prevent post-spaceflight orthostatic intolerance (astronautics); loading garments to augment / enhance musculoskeletal conditioning
- In cosmetics: body shapewear

Problem Addressed

Functional textiles, such as compression textiles, hold significant promise for a variety of industries, including but not limited to, athletics, healthcare and space. Existing approaches towards implementation of compression textiles rely exclusively on the pneumatic bladders and tight-fitting passive materials. None of the existing technological solutions, though being advantageous in specific circumstances, allows for implementation of lightweight and well-fitted compression textiles that provide active control over the compression process.

Technology

This work presents the first kind of lightweight compression textiles that provide users with an active control over the compression process. The textiles consist of compression elements made in a form of springs that are woven into the fabrics. The actuators utilize the shape memory effect in order to produce compression motion and are fabricated using Nickel and Titanium materials. The springs are ‘trained’ to conform to a preprogrammed shape upon direct electrical stimulation and return to its original shape when stimulus is removed. Shape of the compression garments changes according to the way actuation springs are woven into the garments.

The invention includes a cartridge that spatially arranges actuators within textiles and locks them in a compressed state once they are actuated. The cartridge also provides customizable interfaces required for interaction of actuators with fabrics.

Advantages

- Active control over the process of compression
- Form-fitting ability
- Lightweight
- Electrically-driven compression
Unique textile architectures capable of producing compression in a variety of directions
Multipurpose compression garments with possibility to be used in a variety of applications

Categories For This Invention:

Materials
Fabrics, Fibers & Textiles
Micro & Nanotech
Shape Memory Alloy Structures
Robotics
Actuators
Shape-memory Effect Actuators

Intellectual Property:

Wearable, self-locking shape memory alloy (sma) actuator cartridge
PCT
2016-077150
Wearable, self-locking shape memory alloy (sma) actuator cartridge
US Patent Pending
2017-0304136

Inventors:

Dava Newman
Bradley Holschuh
Luca Levrino
Giacomo Gatto

Publications:

Two-spring Model for Active Compression Textiles with Integrated NiTi Coil Actuators
Smart Materials and Structures
2015
Low Spring Index NiTi Coil Actuators for Use in Active Compression Garments
SPIE MOEMS-MEMS
2014
Shrink-wrapping Spacesuits
MIT News
September 18, 2014
Morphing Compression Garments for Space Medicine and Extravehicular Activity Using Active Materials
Aerospace Medicine and Human Performance
2016

Image Gallery: