Docket #: S12-428

Haptic Interface with Variable Stiffness and Deformable Geometry

Researchers in Prof. Allison Okamura's laboratory have patented a small, simple tactile display that can automatically control both its surface geometry and its mechanical properties. Most tactile displays cannot evoke multiple tactile sensations because of the electromechanical complexities. This novel, light-weight interface relies on air pressure and particle jamming to selectively deform, stiffen or soften an array of flat cells. This technology (called “Haptic Jamming”) was designed for medical simulations and as a haptic interface for virtual environments or mobile devices.

Prototype of Haptic Jamming array with four hexagonal cells.

Stage of Development- Prototype
The inventors have built prototypes and demonstrated the feasibility of deforming into a variety of surface geometries over a range of stiffnesses under automatic control.

Applications

- **Haptic interface** - combined cutaneous and kinesthetic display for:
  - Virtual or teleoperated environments
  - Medical simulators
  - Buttons on mobile devices

Advantages

- **Simultaneous, independent control of two features** (mechanical properties and surface geometry)
- **Simple** electromechanics
- **Lightweight** interface

Publications

- Stanley, A. A., Gwilliam, J. C., & Okamura, A. M. (2013, April). Haptic jamming: A deformable geometry, variable stiffness tactile display using pneumatics and particle jamming. In 2013 World Haptics Conference (WHC) (pp. 25-30). IEEE.
- Stanley, A. A., & Okamura, A. M. (2015). Controllable surface haptics via particle jamming and pneumatics. *IEEE transactions on haptics*, 8(1), 20-30.
- Stanley, A. A., Hata, K., & Okamura, A. M. (2016, May). Closed-loop shape control of a haptic jamming deformable surface. In *2016 IEEE International Conference on Robotics and Automation (ICRA)* (pp. 2718-2724). IEEE.
- Stanley, A. A., & Okamura, A. M. (2016). Deformable model-based methods for shape control of a haptic jamming surface.*IEEE transactions on visualization and computer graphics*, 23(2), 1029-1041.
- Gwilliam, J. C., Okamura, A. M., & Stanley, A. A. (2017). *U.S. Patent No. 9,646,469*. Washington, DC: U.S. Patent and Trademark Office.

Patents

- Published Application: WO2014164274
- Issued: 9,646,469 (USA)

Innovators

- Andrew Stanley
- James Gwilliam
- Allison Okamura

Licensing Contact

Chris Tagge

Technology Licensing Program Manager

Email