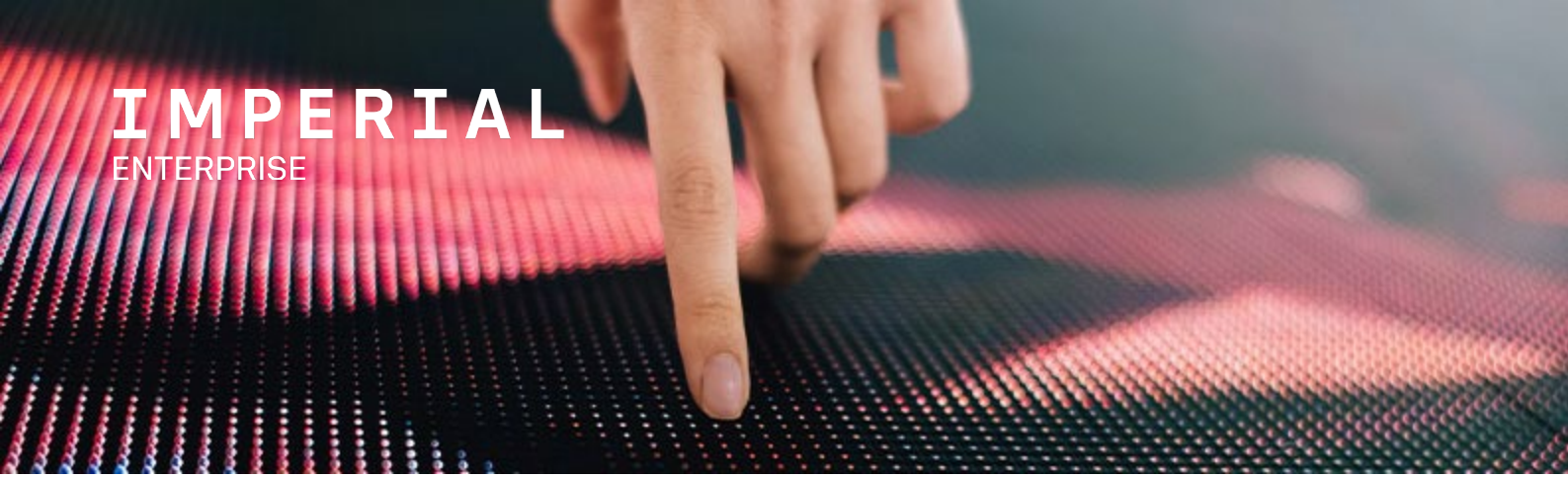

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Non-Pneumatic Particle Jamming for Low-Cost, Compact Haptic Feedback Devices

Alternative methods to pneumatic systems for particle jamming to generate simulated hardness in haptic devices. Utility in applications requiring tactile feedback, such as virtual/augmented reality (VR/AR), medical simulation, and robotics.

Proposed Use

- Enhance consumer haptic devices, particularly in VR/AR headsets, by offering cost-effective tactile feedback solutions.
- Improve medical training and teleoperated surgical systems by simulating tissue textures.
- Reduce manufacturing costs for haptic devices, with applications in gaming, training simulators, and robotic control.

Problem Addressed

Current haptic devices using pneumatic particle jamming are expensive, bulky, and noisy, limiting consumer accessibility and scalability. This invention addresses these issues by providing non-pneumatic methods, making haptic technology smaller, quieter, and more affordable, with approximate cost savings from £400 to £10 per unit.

Technology Overview

This invention introduces four non-pneumatic methods for actuating particle jamming in haptic devices, enabling cost-effective and compact solutions for tactile feedback. These approaches eliminate the need for traditional pneumatic systems, using mechanisms such as piston-driven compression, motor-driven twisting, magnetic field-based compaction, and electric current-induced particle jamming. Prototypes of the piston- and motor-driven methods have demonstrated effectiveness in creating variable hardness, while the magnetic and electric methods offer innovative potential for further exploration. By replacing bulky, noisy, and expensive pneumatic components, this technology significantly reduces the size, noise, and cost of haptic devices. It provides a scalable, versatile platform for applications in virtual reality, augmented reality, medical simulation, and robotics, paving the way for accessible and high-fidelity tactile feedback in consumer and professional settings.

Benefits

- **Cost-efficient:** Reduces unit cost significantly, enabling broader market adoption
- **Compact and lightweight:** Eliminates bulky pneumatic components, allowing integration into consumer devices.
- **Scalable:** Supports complex, multiplexed haptic grids with minimal additional cost.
- **Versatile applications:** Suitable for gaming, VR/AR, medical training, and robotics.
- **Quieter operation:** Eliminates noise associated with vacuum pumps.

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Intellectual property information

UK Priority Application - GB2404756.5 – Haptic Interface Apparatus

Link(s) to publications

Hardness changing tactile displays for simulating the feel of organic tissues, Brown & Bello 2024, Frontiers in Robotics and AI – DOI: 10.3389/frobt.2024.1404543

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