Assignment

Digital content today remains focused on visual and auditory stimulation. Even in the realm of VR and AR, sight and sound remain paramount. In contrast, methods for delivering haptic (sense of touch) feedback in commercial media are significantly less advanced than graphical and auditory feedback. Yet without a sense of touch, experiences ultimately feel hollow, virtual realities feel false, and Human–Computer Interfaces become unintuitive.

To address these limitations, we want to integrate (i) pioneering ultrasonic "non-contact" haptic devices, (ii) state-of-the-art vibrotactile actuators, (iii) novel mathematical and tribological modelling of the skin with (iv) our experience in immersive VR and AR environments.

The result will be a sensory experience where digital 3D shapes and textures are made manifest in real space via modulated, focused, ultrasound, ready for the unthethered hand to feel, where next-generation wearable haptic rings provide directional vibrotactile stimulation, informing users of an object's dynamics, and where computational renderings of specific materials can be distinguished via their surface properties.

The Ph.D. project will proceed by developing three main key aspects:

- Interaction techniques for multi-modal contact/non-contact haptics. We will design high-level interaction techniques combining the capabilities of contact (wearable haptic rings) and non-contact (ultrasound systems) haptics in VR/AR environments. We will study solutions addressing the known limitations of the proposed system, e.g., under-actuation, limited range of forces, and potential visual occlusions (in an AR context).
- 2D surface interaction. We will develop and evaluate VR and AR applications to demonstrate the effectiveness of our haptic system in the rendering of mechanical properties of a virtual surface, e.g., shape, stiffness, texture.
- 3D object manipulation. We will develop and evaluate VR and AR applications to demonstrate the effectiveness of our haptic system in the rendering of 3-dimensional objects. Specifically, we will exploit the extreme wearability of our haptic system to inform users of an object's dynamics, and where computational renderings of specific materials can be distinguished via their surface properties.

Conditions for application

Please submit online: your resume, cover letter and letters of recommendation.

For further information, please contact Claudio Pacchierotti: claudio.pacchierotti@irisa.fr, Maud Marchal: Maud.Marchal@irisa.fr

Recruitment Policy:

As part of its diversity policy, all Inria positions are accessible to people with disabilities.
enable users to physically manipulate real and virtual objects concurrently, for instance while sitting at an augmented desk of real and virtual objects.

The PhD student will be required to develop novel rendering algorithms in VR/AR, design novel interaction techniques, and conduct of several user studies and experiments with human participants. We also plan exchanges and meetings with academic and industrial partners in different European countries, so the student should be ready to travel.

Main activities

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- Design high-level interaction techniques combining the capabilities of contact (wearable haptic rings) and non-contact (ultrasound systems) haptics in VR/AR environments.
- Develop and evaluate VR and AR applications to demonstrate the effectiveness of our haptic system in the rendering of mechanical properties of a virtual surface, e.g., shape, stiffness, texture.
- Develop and evaluate VR and AR applications to demonstrate the effectiveness of our haptic system in the rendering of 3-dimensional objects.

Additional activities:

- Write reports on the activities carried out.
- Present the results to international conferences and meetings.

Skills

We are looking for excellent, highly-motivated students interested in Mixed Reality and haptics, with a computer science background and previous experience in computer programming (C++). Experience in using VR/AR tools and systems (e.g., Unity 3D, ARToolkit, Oculus Rift, Hololens) is considered a plus.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration

Monthly gross salary amounting to 1982 euros for the first and second years and 2085 euros for the third year.