TECHNICAL SPECIFICATION

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Information technology — Computer graphics, image processing and environmental data representation — Material property and parameter representation for model-based haptic simulation of objects in virtual, mixed and augmented reality (VR/MAR)

Technologies de l'information — Infographie, traitement d'images et représentation des données environnementales — Propriété matérielle et représentation des paramètres pour la simulation haptique basée sur un modèle d'objets en réalité virtuelle, mixte et augmentée

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 24, *Computer graphics, image processing and environmental data representation*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

Both virtual reality (VR) and mixed and augmented reality (MAR) employ virtual, synthetic and computer-generated objects in their respective scenes, and they are rendered not only visually but in other modalities in order to provide rich user experience based on realism, presence and augmentation.

VR and MAR applications are increasingly using haptic feedback to allow the user to interact physically with the virtual or real objects and provide higher realism and elevated experience. That is, the input from and output to the user may be delivered kinaesthetically (i.e. force feedback) through physical simulation and the resulting force rendered through mechanical haptic devices. Note that the interacting virtual or real object may be situated in virtual reality (VR), augmented reality (AR) and augmented virtuality (AVR) – namely, across all types of MAR.

A correct and effective rendering of forces requires the relevant physical description of the materials of the objects involved in the physical interaction and simulation. In addition, depending on the needs of the application, different haptic rendering algorithms may be employed. Conventional standards for virtual and mixed reality have lacked constructs for expressing such material properties or algorithmic details and thereby supporting a comprehensive, faithful and flexible haptic rendering. For example, most current standard 3D graphic or virtual object representations can only describe material properties for visual rendering (e.g. for lighting effects and shading).

This document also provides definitions for terms related to material properties and physical simulation in the context of the haptic rendering and its algorithms.

The target audience of this document are mainly VR and MAR system developers and content designers interested in specifying and using haptic interaction. This document provides a basis for application standards for any VR and MAR applications and content representation that uses haptic modality for input and output.

However, this document establishes the information model. It does not promote or propose to use a specific language, file format, algorithm, device, implementation method or standard. The model is intended to be considered as the minimal basic model that can be extended for other purposes in actual implementation.

The content of this document is derived from ISO/IEC 18039, which, among other things, specifies the possible inclusion of haptic feedback (and associated devices) in experiential VR and MAR contents (and systems). The specification can be one important component in ISO/IEC 3721-1[1], whose purpose is to lay out and specify the information model for various essential MAR content components and their relationships. While ISO/IEC 3721-1 lays the foundation and overall framework, it does not go into all the details (e.g. material or haptic properties of an object). As haptic feedback may be used in purely virtual environments as well, this document also relates to ISO/IEC 19775-1.

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1 Scope

This document specifies:

— physical and material parameters of virtual or real objects expressed to support comprehensive haptic rendering methods, such as stiffness, friction and micro-textures;

— a flexible specification of the haptic rendering algorithm itself.

It supplements other standards that describe scene or content description and information models for virtual and mixed reality, such as ISO/IEC 19775 and ISO/IEC 3721-1.

2 Normative references

There are no normative references in this document.