

Haptic Perception of Macro Texture

Tao Zeng, Wenjing Chen, Nan Li, Liangzong He and Lantao Huang

Abstract The studies of texture perception focused mainly on displaying the textures with interior space gap in the millimeter level and below. We could call this kind of texture “fine texture”. In contrast, the “macro texture” has space gap in centimeters and above, and it is considered as the special texture with tiny texture pattern covered on curved surface. Macro texture contains richer surface information, including both roughness and curvature. This paper introduces a haptic device which could represent sinusoidal macro texture through active and dynamic touch with bare finger.

Keywords Macro texture perception · Haptic device · Curvature perception · Active and dynamic touch

1 Introduction

Haptic texture perception was well studied over the years, and most of the textures to be rendered have their interior space gap in the millimeter and below. We could call them “fine texture”. On contract, the “macro texture” has interior space gap in centimeter and above (Fig. 1a). Form the point of view of geometric properties, the macro texture can be seen as tiny texture pattern (Fig. 1b) covering on curved surface (Fig. 1c). It includes both texture and curvature information.

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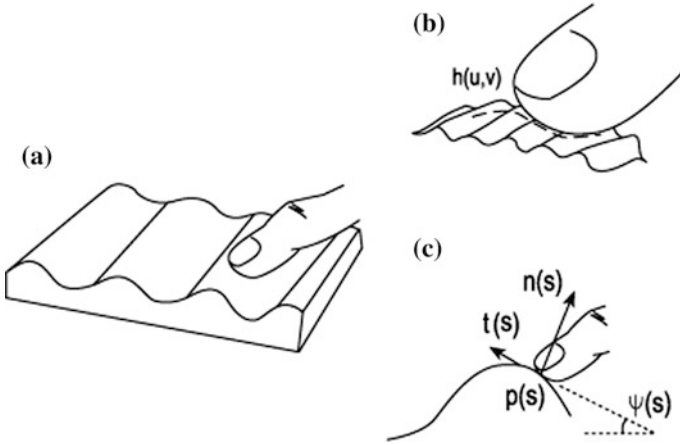


Fig. 1 Haptic perception of macro texture. **a** The finger explores the macro texture; **b** perception of fine texture pattern; **c** perception of curvature

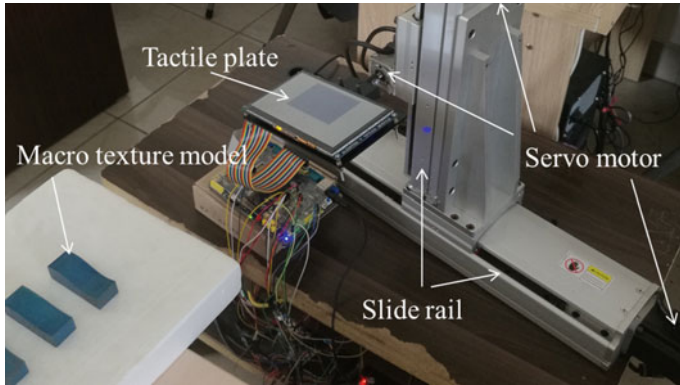


Fig. 2 The haptic device for macro texture perception

2 The Haptic Device and Control Method

The device has three degree of freedom: x-axis, z-axis and rotation about y-axis (Fig. 2). It can independently orient, elevate, and translate the end-effector, making sure that the end-effector is always kept tangential to a virtual macro texture at the contact point during manual exploration to respect the dominant cue for curvature perception [1]. In consideration of the perception of fine texture and curvature simultaneously, the fine texture rendering plate will be used as the end-effector. Its hard and successive surface could display the fine texture based on film squeeze effect, and the curvature based on the reproduction of local contact trajectory. Furthermore, its capacitive touch screen could sensor the position of the finger and

then uses it as the input of the whole control system. This platform can meet the requirement of active and dynamic touch. The finger is free to move forward and backward along the surface of the plate.

Acknowledgements This study was supported by the National Nature Science Foundations of China (No. 61403320), and the open funding project of State Key Laboratory of Virtual Reality Technology and Systems, Beihang University (Grant No. BUAA-VR-15KF-01).

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Haptic Interaction

Science, Engineering and Design

Hasegawa, S.; Konyo, M.; Kyung, K.-U.; Nojima, T.;

Kajimoto, H. (Eds.)

2018, XIV, 503 p. 292 illus., 245 illus. in color.,

Hardcover

ISBN: 978-981-10-4156-3