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A New Geometric Modeling for Woven Fabric Based on Frenet Frame and Spiral Equation

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Abstract

Realistic woven fabric appearance is very important for computer graphics applications. The appearance of a particular woven fabric is determined by multi-scale geometric structure and light directional reflectance. Accurately modeling structural detail of the fabric can produce realistic rendering effects of fabric appearance. But modeling these complex geometric details of woven fabrics is challenging. In this paper, a novel geometric method of modeling structural detail of woven fabric is presented based on the image. According to a single micro image, we propose efficient image processing techniques to capture the fine-scale detail geometric characters of fabric structure, which results in the highly efficient modeling advantage of our method over existing methods. Then considering the composite structure characters of fiber and yarn, the Frenet Frame is used to model the yarn geometric structure and the Spiral Equation is used to present the helix twisting structure of fiber on the yarn. Based on this geometric model, the woven fabric's detail structure can be visualized realistically. Compared with the original fabric image, our method can model the fabric's 3D geometric structure, and obtain high-quality rendering effects.

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