

Research on surface shadowing techniques of objects and applications

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Abstract: This study investigates surface shadowing techniques for three-dimensional objects and their practical applications in computer graphics and visualization. The research systematically analyzes fundamental shadow generation methods, including ray tracing, shadow mapping, and ambient occlusion, evaluating their computational efficiency and visual fidelity. A novel hybrid approach is proposed that combines the accuracy of ray-traced shadows with the real-time performance of shadow mapping, optimized through adaptive sampling algorithms. The technique effectively handles complex scenarios such as soft shadows, self-shadowing, and dynamic light sources. Experimental results demonstrate significant improvements in rendering quality while maintaining interactive frame rates. The practical applicability of the proposed method is validated through case studies in architectural visualization, virtual reality environments, and product design, where realistic shadowing enhances depth perception and spatial understanding. This work contributes to advancing realistic image synthesis and provides a robust framework for integrating high-quality shadow effects into various graphics applications.

Keywords: 3D rendering, surface shading, shadow mapping, computer graphics