

3D models and some 3D modeling techniques in simulation

Nguyen Thi Hang

Abstract: This thesis explores the development and application of 3D models and advanced 3D modeling techniques within the context of simulation environments. It systematically examines the fundamental principles of constructing digital three-dimensional representations, focusing on the methodologies that enhance realism, accuracy, and computational efficiency. Key techniques analyzed include polygonal modeling, NURBS (Non-Uniform Rational B-Splines) surface modeling, and procedural generation, with a specific emphasis on their suitability for real-time and physics-based simulations. The study evaluates the trade-offs between geometric fidelity and performance, addressing challenges such as texture mapping, level-of-detail management, and collision detection optimization. Through practical case studies, the research demonstrates how these modeling approaches facilitate the creation of immersive virtual environments for training, engineering analysis, and interactive visualization. The findings contribute to a deeper understanding of how to effectively integrate 3D modeling workflows into simulation pipelines, offering guidelines for selecting appropriate techniques based on specific simulation requirements and hardware constraints.

Keywords: 3D modeling, simulation, 3D techniques, virtual modeling