Real-Time Generative Architecture for Mesh and Texture

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Abstract : In the evolving landscape of physics-based machine learning (PBML), particularly within fluid dynamics and its applications in electromechanical engineering, robot vision, and robot learning, achieving precision and alignment with researchers' specific needs presents a formidable challenge. In response, this work proposes a methodology that integrates neural transformation with a modified smoothed particle hydrodynamics model for generating transformed 3D fluid simulations. This approach is useful for nanoscale science, where the unique and complex behaviors of viscoelastic medium demand accurate neurally-transformed simulations for materials understanding and manipulation. In electromechanical engineering, the method enhances the design and functionality of fluid-operated systems, particularly microfluidic devices, contributing to advancements in nanomaterial design, drug delivery systems, and more. The proposed approach also aligns with the principles of PBML, offering advantages such as multi-fluid stylization and consistent particle attribute transfer. This capability is valuable in various fields where the interaction of multiple fluid components is significant. Moreover, the application of neurally-transformed hydrodynamical models extends to manufacturing processes, such as the production of microelectromechanical systems, enhancing efficiency and cost-effectiveness. The system's ability to perform neural transfer on 3D fluid scenes using a deep learning algorithm alongside physical models further adds a layer of flexibility, allowing researchers to tailor simulations to specific needs across scientific and engineering disciplines.

Keywords : physics-based machine learning, robot vision, robot learning, hydrodynamics
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