Wildfire, Snow, and, Panoramic Ray Tracing

André Stork, *Fraunhofer Institute for Computer Graphics Research IGD, 64283, Darmstadt, Germany*
Chi-Wing Fu, *The Chinese University of Hong Kong, Shatin, Hong Kong*

FROM THE EDITORS

Editor-in-Chief André Stork and Associate Editor-in-Chief Chi-Wing Fu outline the regular articles published in this queue issue.

The current issue features three articles from our regular queue that cover a range of topics in visualization, rendering, and mixed reality (MR), including interactive visual analytics, ray tracing, appearance rendering, and augmented reality (AR) and virtual reality (VR) technologies. These three articles complement the two articles that constitute the half Special Issue.

WILDFIRE

We are proud to present our 2022 IEEE Scientific Visualization Contest winner[A1] in this regular queue issue. As wildfires become an increasingly severe problem due to global warming, etc., the authors were seeking and found combinations of different visualization techniques supporting the analysis of root causes of wildfires and their evolution. They combine these techniques in an interactive visual tool allowing for comparing and exploring multiple simulation runs. To cite one of our reviewers, "This is a well written paper describing the winning submission to the 2022 IEEE Scientific Visualization Contest. I [. . .] am excited to see this in print." We could not agree more.

SNOW

What could fit better in this season than snow?

Snow is a challenging material to render, especially accounting for its appearance, its reflection, and different levels of detail. When light interacts with snow, interesting spectral effects appear—one of the aspects that makes snow fascinating. The authors Varsa and Baranoski[A2] present "an approach centered on the effective use of spectral transmittance data obtained using a first-principles light transport model for snow." The authors demonstrate the versatility of their method by synthesizing images with various illumination conditions. We like to point out two aspects very relevant to the computer graphics and rendering community by citing our reviewers. First, "the experiments show the characteristics of snow with different materials and the rendering effects of snow blocks. The results are nice, demonstrating the effectiveness of the proposed model," and, second, "it is the transmittance database of spectral curves and the relatively simple integration with ray tracers. It is nice that the authors agree to share the database with the community."

PANORAMIC RAY TRACING

As the "snow rendering method" integrates with ray tracing well, our regular article number three focuses on ray tracing[A3]. The authors present an interactive method to ray trace lighting and shadow effects for 360° videos when inserting virtual objects into the real scene. For handling mutual occlusion, the real environment is captured and its geometry is approximated. Noisy Monte Carlo images are generated by introducing an irradiance estimation channel. The final image of high quality is obtained by smoothening, interpolating, filtering, and, differential rendering. The authors generate visually realistic 360° RGBD videos with dynamic

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virtual objects in real time, "making the rendering results more natural and believable." To conclude, we also cite a review for this article commenting that it is "essential to various audiences working on ray tracing and AR/VR."

APPENDIX: RELATED ARTICLES

A1. G. Borrelli et al., "2022 IEEE scientific visualization contest winner: Multifield analysis of vorticity-driven lateral spread in wildfire ensembles," *IEEE Comput. Graph. Appl.*, vol. 44, no. 1, Jan./Feb. 2024.

A2. P. M. Varsa and G. V. G. Baranoski, "Rendering the bluish appearance of snow: When light transmission matters," *IEEE Comput. Graph. Appl.*, vol. 44, no. 1, Jan./Feb. 2024.

A3. J. Wu and L. Wang, "Panoramic ray tracing for interactive mixed reality rendering based on 360° RGBD video," *IEEE Comput. Graph. Appl.*, vol. 44, no. 1, Jan./Feb. 2024.