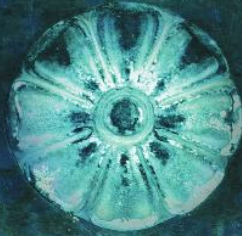


IEEE Computer Graphics AND APPLICATIONS

May/June 2016



SCIENTIFIC VISUALIZATION



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Feature Articles

22 **WarpIV: In Situ Visualization and Analysis of Ion Accelerator Simulations**

Oliver Rübel, Burlen Loring, Jean-Luc Vay, David P. Grote, Remi Lehe, Stepan Bulanov, Henri Vincenti, and E. Wes Bethel

The Warp In situ Visualization Toolkit (WarpIV) supports large-scale, parallel, in situ visualization and analysis and facilitates query- and feature-based analytics, enabling for the first time high-performance analysis of large-scale, high-fidelity particle accelerator simulations while the data is being generated by the Warp simulation suite.



Cover Art: Moon Flower, © 2014 Alvaro Ocampo.

36 **Visualizing Volcanic Clouds in the Atmosphere and Their Impact on Air Traffic**

Tobias Günther, Maik Schulze, Anke Friederici, and Holger Theisel

Using data from three volcanic eruptions that occurred in the span of approximately three weeks, the authors study the agreement of the complementary satellite data, reconstruct sulfate aerosol and volcanic ash clouds, visualize endangered flight routes, minimize occlusion in particle trajectory visualizations, and focus on the main pathways of sulfate aerosol into the stratosphere.

48 **VTK-m: Accelerating the Visualization Toolkit for Massively Threaded Architectures**

Kenneth Moreland, Christopher Sewell, William Usher, Li-ta Lo, Jeremy Meredith, David Pugmire, James Kress, Hendrik Schroots, Kwan-Liu Ma, Hank Childs, Matthew Larsen, Chun-Ming Chen, Robert Maynard, and Berk Geveci

Traditional scientific visualization software approaches do not fare well in massively threaded environments. To address the needs of the high-performance computing community, the VTK-m framework fills the gaps in functionality by bringing together the most recent research.

60 **Evaluating Shape Alignment via Ensemble Visualization**

Mukund Raj, Mahsa Mirzargar, J. Samuel Preston, Robert M. Kirby, and Ross T. Whitaker

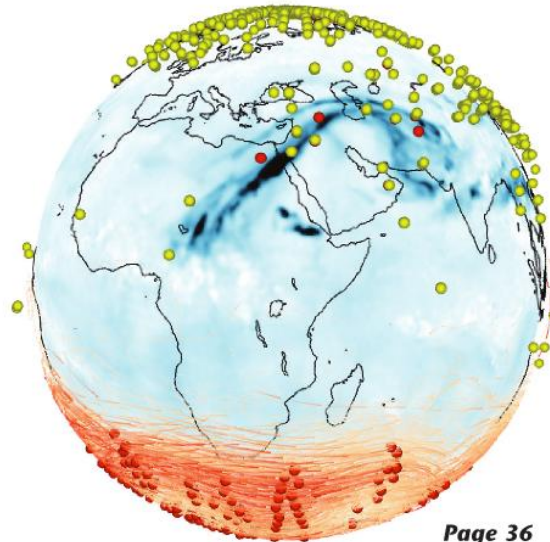
Visualizing variability in surfaces embedded in 3D provides a means of understanding the underlying distribution of a collection of surfaces. An expert-based evaluation of various ensemble visualization techniques demonstrates the efficacy of using a 3D contour boxplot ensemble visualization technique to analyze shape alignment and variability in atlas construction and analysis.



72 Knowledge-Assisted Ranking: A Visual Analytic Application for Sports Event Data

David H.S. Chung, Matthew L. Parry, Iwan W. Griffiths, Robert S. Laramee, Rhodri Bown, Philip A. Legg, and Min Chen

Organizing sports video data for performance analysis can be challenging in cases with multiple attributes, and when sorting frequently changes depending on the user's task. The proposed visual analytic system allows interactive data sorting by learning a user's sort requirement dynamically through a knowledge-assisted process.



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