Adaptive Curvature-Based Grid Generation for 3D Web Graphics

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The graphics team for the NIST Digital Library of Mathematical Functions (DLMF) (https://dlmf.nist.gov/) launched in 2010 created close to 600 graphical representations of complex mathematical functions with more than 200 rendered as interactive 3D surface visualizations [1]. Our primary goal was to quickly design plots that accurately captured key function features such as zeros, poles and branch cuts. While the quality of most of the visualizations is quite good, in some cases color maps and surface regions around key features could be enhanced by improving the underlying grids. We designed the original grids using simple structured techniques like transfinite blending function interpolation, or variational methods with tensor product B-splines, but the grids were generated separately from the function data. Ideally, the grids should be adapted to curvature and gradient information gleaned from the function data. The challenge of achieving this is exacerbated by the fact that the most reliable software for computing a particular function may only be available in a specific language or package. We will demonstrate our current results and make suggestions for future work.

Joint work with: Bruce Miller, Brian Antonishek.

References

[1] B. Schneider, B. Miller, B. Saunders. NIST's Digital Library of Mathematical Functions. *Physics Today*, 71(2):48–53, 2018.