Berliner Colloquium für wissenschaftliche Visualisierung

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# Rational Rotation-Minimizing Frames on Space Curves: Theory, Algorithms, and Applications

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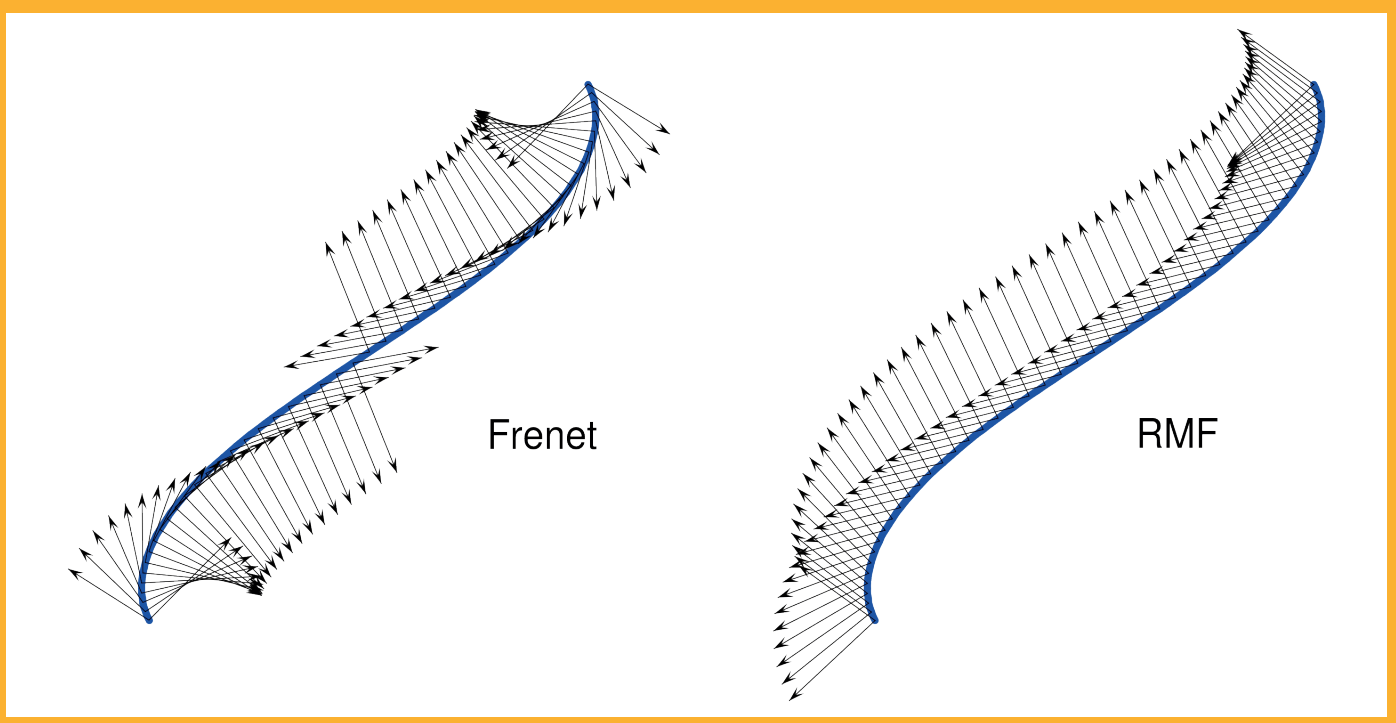
An adapted orthonormal frame along a space curve incorporates the curve tangent at each point as one basis vector, and the frame is said to be rotation-minimizing if its angular velocity maintains a zero component in the tangent direction, i.e., the two normal-plane vectors exhibit no instantaneous rotation about the tangent. Such frames are important in applications such as computer animation, swept surface constructions, path planning for robotics, and 5-axis CNC machining. The theory of polynomial space curves with rational rotation-minimizing adapted frames (which form a proper subset of the spatial Pythagorean-hodograph curves) is presented, together with algorithms for their construction and examples of their applications. Some generalizations to other types of rotation-minimizing frames are also briefly discussed.




Rida T. Farouki received the BA degree from Oxford University and the PhD degree from Cornell University. Before returning to the academic world, he worked in the research divisions of General Electric Company and IBM Corporation for several years. Currently, he is a Distinguished Professor in the Department of Mechanical and Aerospace Engineering at the University of California Davis, where he has served as Department Chair. His publications have appeared in diverse fields, including astrophysics, plasma physics, geometrical optics, numerical analysis,computer-aided geometric design, manufacturing, and real-time motion control. He is also author of the Springer book Pythagorean-Hodograph Curves: Algebra and Geometry Inseparable, and Co-Editor-in-Chief of the Elsevier journal Computer Aided Geometric Design.

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