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Recent advances in geometric analysis and differential geometry, specifically in the development of powerful techniques in 3D Ricci flow (for example to solve the Poincare conjecture by Perelman), together with the increasing demand for digital geometric processing in real-life applications have inspired our work in numerical conformal geometry.

Here, we explore efficient digital geometry processing methods based on Ricci flow, especially isometric mapping algorithms, to register, match surfaces, and measure the geometric characteristics of the surfaces. Then we apply the algorithms to establish the quantitative relationship between the geometric characteristics of material and their performance. We illustrate our approach with practical engineering problems. (Received December 22, 2007)