Fast conformal slit maps

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Abstracts. Conformal slit maps have several applications to problems in physics, engineering, and mathematics. In this talk, we review the author's method for approximating the conformal mappings from multiply connected domains of finite connectivity onto more than forty canonical slit domains. The method is based on a boundary integral equation with the generalized Neumann kernel with only the right-hand side of the integral equation is different from one canonical domain to another. For domains of connectivity $m + 1$, the Nysröm method with the trapezoidal rule using n nodes in each boundary component yield a dense and nonsymmetric $(m + 1)n \times (m + 1)n$ linear system which is solved by a combination of the GMRES and FMM in $O((m + 1)n \ln n)$ operations. The obtained numerical results illustrate that the presented method has the ability to handle efficiently and accurately domains of very high connectivity, domains with piecewise smooth boundaries, domains with close-to-touching boundaries, and domains of real world problems.

Keywords. Numerical conformal mapping, generalized Neumann kernel, Nyström method, fast multipole method, GMRES.

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