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Comment on "Potential Flow Analysis of Multielement Airfoils Using Conformal Mapping"

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THE purpose of this Comment is twofold. The first is to congratulate N. D. Halsey on his important contribution and ingenious approach.[1] The second is to point out very modern and nonclassical applications of the conformal mapping technique where Halsey's methodology could probably yield considerable simplicity and efficiency, at least, in some instances, when constructing the mapping function.

Ives recently developed several important conformal mapping concepts.[2] His most significant concept is the introduction of a new class of transformation, of which the von Kármán-Trefftz transformation is a special case. Ives, in his very interesting paper, is mainly concerned with the numerical solution of the transonic flow equations in two dimensions.

Classical applications of conformal mapping to many stationary problems of mathematical physics go back over a century and continue to the present. These applications deal, in general, with solutions of Laplace's equations which remains invariant if the real plane is subjected to a conformal transformation.

On the other hand, the conformal mapping technique has been successfully applied in several fields of technology and applied science to problems governed by the wave equation, diffusion models, etc., where the governing equations are not invariant under transformation. Reference 3 presents a survey of "nonclassical" applications of conformal mapping to different fields: electromagnetic theory, flow and heat transfer in ducts of arbitrary shape, heat conduction problems, drying performance, ion optics, supersonic flows, unsteady laminar flows, solidification problems, propagation in acoustical wave guides, plate theory (static problems, determination of collapse loads and vibrations and elastic stability situations), and vibrations of solid propellant rocket motors.

It is interesting to list some recent applications not contained in Ref. 3. Akao and Miyazaki[4] have studied the electromagnetic field excited at a bend in a circular wave guide by an incident TE_{01} wave using a conformal mapping approach.

Miyazaki[5] has analyzed the behavior of optical modes in the thin film fiber with convex surface by means of a conformal mapping technique. In particular he considers the case of single material fibers such as pure fused silica.

An important application of the theory of conformal transformation to the diffraction of electromagnetic waves is due to Neviere et al.[6]

Rosenthal and Gordon have successfully applied conformal transformation in a fundamental problem of chemical physics.[7] On the other hand, Connor and Marcus have applied it to the solution fo the Schrödinger equation in the case of a bimolecular exchange reaction with all three atoms lying on a line.[8]

Berger has obtained a numerical solution for the transient vibration of an arbitrary shell of revolution, surrounded by an acoustic medium.[9] The region external to the shell's generating curve is mapped conformally onto the region external to the unit circle.

The conformal mapping technique has been applied when determining the fundamental frequency of vibration of plates of complicated boundary shape carrying concentrated masses.[10,11]

Transient heat conduction in orthotropic two-dimensional media has been successfully studied by conformally transforming the given, complicated geometry onto a unit circle.[12] Applications to composite media, taking into account heat generation effects, have been presented in Ref. 13.

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