

BOOK REVIEW: “Applied Singular Integral Equations”
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This book is concerned with one-dimensional linear singular integral equations. Examples are Abel’s equation, equations with Cauchy principal-value integrals such as

$$(1) \quad \alpha u(x) + \int_a^b \frac{u(t)}{t-x} dt = f(x), \quad a < x < b,$$

including the airfoil equation (put $\alpha = 0$ in (1)), hypersingular equations (replace $t-x$ in the kernel of (1) by $(t-x)^2$ and use a finite-part interpretation of the integral), equations with simple logarithmic kernels such as

$$(2) \quad \int_a^b u(t) \log \left| \frac{t+x}{t-x} \right| dt = f(x), \quad a < x < b,$$

and related integro-differential equations (replace $\alpha u(x)$ in (1) by $\alpha u'(x)$). The first 150 pages describe various analytical methods for finding exact solutions. Simple numerical methods are developed and used in the remaining 100 pages. There is a bibliography of 104 items, 45 of which are by the authors and their students.

After an introductory chapter, Chapter 2 begins by solving Abel’s equation (stated incorrectly in (2.1.1)) and then mainly real-variable analytical techniques are used to solve (1) and (2). Chapter 3 gives an introduction to complex-variable methods, including the Poincaré-Bertrand formula for closed contours and reduction of (1), (2) and other integral equations to Riemann-Hilbert problems. Further “special methods” are given in Chapter 4, including methods in which u is expanded as a weight function multiplied by a series of Chebyshev polynomials, for example. Simple hypersingular equations are solved in Chapter 5.