Integral equations for inverse problems in corrosion detection

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We consider the inverse problem to recover a part Γ_c of the boundary of a simply connected planar domain D from a pair of Cauchy data of a harmonic function u in D on the remaining part $\partial D \setminus \Gamma_c$ when u satisfies a homogeneous impedance boundary condition on Γ_c. Our approach extends a method that has been suggested by Kress and Rundell (2005) for recovering the interior boundary curve of a doubly connected planar domain from a pair of Cauchy data on the exterior boundary curve and is based on a system of nonlinear integral equations. As a byproduct, these integral equations can also be used for the problem to extend incomplete Cauchy data and to solve the inverse problem to recover an impedance profile on a known boundary curve. We present the mathematical foundation of the method and illustrate its feasibility by numerical examples.