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THE HEAT TRANSFORM AND ITS USE IN THERMAL IDENTIFICATION PROBLEMS FOR ELECTRONIC CIRCUITS*

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Abstract. We define and analyze a linear transformation – the heat transform – that allows to map solutions of hyperbolic equations to solutions of corresponding parabolic equations. The inversion of this mapping can be used to transform an inverse problem for the heat equation to a similar problem for the wave equation. This work is motivated by problems of finding interfaces, boundaries and associated heat conduction parameters in the thermal analysis of electronic circuits when transient data are available. Since the inversion of the transformation is ill-posed, we use a semi-smooth Newton scheme to regularize it enforcing sparsity of the solution. We present some numerical results of this procedure for simulated and measured data, which shows that heat conduction effects due to interfaces and boundaries can be found and classified by an inversion of the heat transform.

Key words. inverse problem, heat transform, sparsity, semi-smooth Newton method, electronic circuits

AMS subject classifications. 35R30, 35K15, 80A23, 44A15, 46F12

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