ABSTRACT

THESIS: A Dynamical Sampling Scheme for Solving a Generalized Heat Equation.

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PAGE: 51

We study an initial value problem for a generalized version of the heat equation, involving time/space variant coefficients, and fairly unknown initial conditions. It is known that solving the classical heat equation, under appropriate assumptions is possible even when the initial conditions are unknown; one can compensate for the lack of knowledge of the initial conditions by adding scarce measurements made at later time instances. This problem of compensation via a time-space trade off between the initial measurements and the later time measurements has been recently observed in applications of sampling theory, and referred to as the dynamical sampling problem.

We give a general formulation of the initial value problem for a generalized version of the heat equation, and aim at producing a sequence of approximate solutions via a time-space trade off, which converges to the exact solution under appropriate assumptions. We study the correlation between the number

of measurements that are needed to recover the initial profile to a prescribed accuracy, give precise estimates for the time instances when these measurements need to occur, and provide an optimal reconstruction algorithm under the assumption that the initial profile is in a Sobolev class.