On the Numerical Solution of Parabolic Cauchy Problems via Integral Equations Approach

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In this talk we consider Cauchy problems for the parabolic heat equation in bounded and unbounded planar domains, which consist in determining function values on a part of the boundary of the solution domain from the given Cauchy data specified on the remaining part of the boundary. We study different types of non-smooth domains containing cuts and having boundaries with corner points. The numerical solution is based on an iterative regularization procedure with the calculations being performed only on the boundary of the domain. At each iteration step, mixed Dirichlet-Neumann problems for the parabolic heat equation are solved. Using Rothe's method with respect to the time variable and special potential representations for corresponding elliptic problems these mixed problems are reduced to a sequence of boundary integral equations. These integral equations contain various types of singularities in the densities and in the kernels. Special techniques are employed to handle each of these singularities and analysis is performed in corresponding weighted spaces. Full discretization is realized by a trigonometrical quadrature method. The numerical examples that will be presented show that the proposed regularizing procedure gives stable and accurate approximations.