Boundary kernels for dissipative systems

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In this talk we will present a study on the kernel functions of the Dirichlet-Neumann maps for dissipative systems in a half space. We start from the consideration of the Greens function for an initial-boundary value problems for linear dissipative systems. With the fundamental solutions of the dissipative systems, one can reduce the initial-boundary value problems into boundary value problems so that the well-posedness of the system gives linear algebraic systems over the polynomials in the Fourier and Laplace variables for the Dirichlet-Neumann datum at the boundary, where Fourier variables are in the directions of boundary, and the Laplace is for the time variable. In order to invert the Dirichlet-Neumann map from the transformation variables to the space-time variables we introduce a path, which contains the spectral information of the systems, in the complex plan for the time Laplace variable. On this path, the Laplace-Fourier variables can be recombined, through the Cauchys complex contour integral, into a form resemble to that for a whole space problem. Thus, the classical results for the whole space problem can be used to obtain the pointwise spae-time structure for long wave components of the kernel function of the Dirichlet-Neumann map for points within a finite Mach region. We also apply direct energy estimates to yield the pointwise structure of the kernel functions in any high Mach number region. Finally, we have obtained exponentially sharp estimates for the kernel function in the space-time variables. For example, the kernel functions for both DAlermbert wave equation with dissipation and a linearized compressible Navier-Stokes equation can be expressed explicitly in space-time variables with errors which decay exponentially in both space-time variables. This gives a globally quantitative and qualitative wave propagations at boundary.