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Class RSI and Scattering Theory of the Sturm-Liouville Operator

In this talk we will present a class of functions RSI, naturally arising in the study of overdetermined 2D systems, invariant in one direction. Elements of the class RSI are transfer functions of such systems. Some of their properties will be presented, and will be later used for developing the scattering theory on the line (half-line) of the Sturm-Liouville operator

$$-\frac{d^2}{dx^2} u(x) + q(x)u(x) = \lambda u(x),$$

where $q(x)$ is a (smooth enough) potential, and λ is the spectral parameter. In a special case (by choosing parameters of the class), we obtain that multiplication by a function in the class RSI maps solutions of one Sturm-Liouville equation to those of another. Such a transform is also called a Darboux or Backlund transformation. We will see how Jost solutions, tau function and Gelfand-Levitan-Marchenko formulas arise using the class RSI and how this may possibly be generalized.