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A Parseval equation and a generalized finite Hankel transformation

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Abstract: In this paper, we study the finite Hankel transformation on spaces of generalized functions by developing a new procedure. We consider two Hankel type integral transformations h_μ and h_μ^* connected by the Parseval equation

$$\sum_{n=0}^{\infty} (h_\mu f)(n) (h_\mu^* \varphi)(n) = \int_0^1 f(x) \varphi(x) dx.$$

A space S_μ of functions and a space L_μ of complex sequences are introduced. h_μ^* is an isomorphism from S_μ onto L_μ when $\mu \geq -\frac{1}{2}$. We propose to define the generalized finite Hankel transform $h'_\mu f$ of $f \in S'_\mu$ by

$$\langle (h'_\mu f), ((h_\mu^* \varphi)(n))_{n=0}^{\infty} \rangle = \langle f, \varphi \rangle, \quad \text{for } \varphi \in S_\mu.$$

Keywords: finite Hankel transformation, distribution, Parseval equation

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