ABSTRACT

The thesis concerns the derivation and subsequent error analysis of interpolation formulae that arise in the processing of electrical and optical signals. In one direction, we extend some of the complex analytic results obtained by Paley & Wiener, [42], and later Levinson, [34], on nonharmonic Fourier series and on gap and density theorems in order to derive stable nonuniform sampling expansions (see chapters II and III of the thesis). One such expansion is related to the $J_k$-Bessel sampling method, [27]; the other is related to the derviative sampling method, [35]. In another direction, we use the real analytic approach of Kramer, [32], in conjunction with the notions of generalized convolution and generalized translation as defined recently by Jerri, [27], in order to derive selftruncating Bessel-type sampling expansions for bandlimited functions as well as bandlimited distributions (see chapter IV). An upper bound of the truncation error of the expansions is derived. In another direction, we obtain upper bounds on the aliasing error of these Bessel-type selftruncating expansions.

In addition, we use methods in Hankel transform analysis to derive some interesting closed-form summation formulae which result from our Bessel-type sampling methods. Some of these involve primitive characters (cf. [2]).

In attacking the problem of obtaining an upper bound on the truncation error of Bessel-type expansions, the tangential problem arises of finding a tractable global lower bound for $|J_\nu|$ in the complex plane.
We have been partially successful in that we have obtained an interesting global lower bound in the case where $\nu=0$, and almost global lower bounds in the case where $\nu>0$.



**Key Words:** sampling expansion, Hankel transform, nonharmonic series, nonuniform sampling, B-spline, entire function, generalized convolution product, generalized translation, generalized function (distribution), bandlimited function, truncation error, aliasing error, primitive character mod p, Riesz basis, complete/closed set of functions in a Lebesgue space.