A Version of Quaternionic Function Theory Related to Prolate Spheroidal Wave Signals

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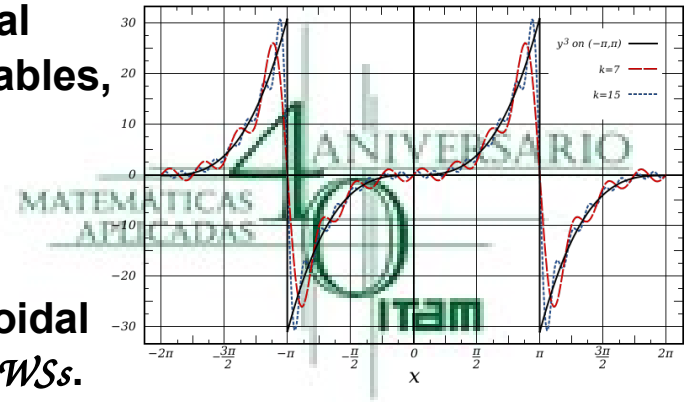
It is appeared recently that there exists a theory of Prolate Spheroidal Wave Signals ($\mathcal{PSWSs}$) with quaternionic values and of three real variables, which is determined by the Moisil-Theodorescu type operator with quaternionic variable coefficients, and that is intimately related to modified Sturm-Liouville operators and to the Chebyshev operator (we call it in this way, since its solutions are related to the classical Chebyshev polynomials). In this talk we introduce the Prolate Spheroidal Quaternionic Wave Signals ($\mathcal{PSQWSs}$), which refine and extend the $\mathcal{PSWSs}$.



The $\mathcal{PSQWSs}$ are ideally suited to study certain questions regarding the relationship between quaternionic functions and their Fourier transforms. We prove that the $\mathcal{PSQWSs}$ are orthogonal and complete over two different intervals: the space of square integrable functions over a finite interval and the three-dimensional Paley-Wiener space of bandlimited functions. No other system of classical generalized orthogonal functions is known to possess this unique property. We address all the above and explore some basic facts of the arising quaternionic function theory. To progress in this direction, we compute the hyperholomorphic prolate spheroidal functions (in the sense of the usual generalized Cauchy-Riemann operator) of any order explicitly, and study some of their fundamental properties. We show that these polynomial functions play an important role in defining and studying the hyperholomorphic Szegö kernel function in prolate spheroidal domains. In the applications part of this talk, we present some numerical examples that demonstrate the effectiveness of our approach.

Viernes 3 de Octubre 13:00-14:00 hrs Salón B4 / Río Hondo