Spectral Theory and Applications

Polynomial orthogonality: entropy, complexity and entanglement

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Polynomial orthogonality of Shohat-Favard type (also called classical or hypergeometric in some contexts) has not only played a key role in the development of the theory of special functions, it has been instrumental in numerous scientific problems. In particular, it has allowed analytically calculate the exact solutions of quantum mechanical equation of non-relativistic motion (i.e., Schrödinger equation) of a reduced set of realistic physical systems , including hydrogen. This has recently enabled the determination of the theoretic-informational measures of such systems in terms of polynomial functionals of entropy and complexity kind. The meaning and mathematical calculation of the entropy and complexity measures of the hypergeometric polynomials will be addressed in this talk. The usefulness of these quantities will be illustrated in some non-relativistic quantum systems. The need for other types of polynomial orthogonality (e.g., matricial, multivariate) will be discussed to explain the relativistic and entanglement properties in quantum physics.