ORTHOGONAL FUNCTIONS AND HYBRID APPROXIMATIONS FOR VARIATIONAL PROBLEMS

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ABSTRACT

The available sets of orthogonal functions can be divided into three classes. The first class includes sets of piecewise constant basis functions (e.g., block-pulse, Haar, Walsh, etc.). The second class consists of sets of orthogonal polynomials (e.g., Chebyshev, Laguerre, Legendre, etc.). The third class is the set of sine-cosine functions in the Fourier series. While orthogonal polynomials and sine-cosine functions together form a class of continuous basis functions, piecewise constant basis functions have inherent discontinuities or jumps. Signals frequently have mixed features of continuity and jumps. In such situations, neither the continuous basis functions, nor piecewise basis functions taken alone would form an efficient basis in the representation of such signals. In recent years, the hybrid functions consisting of the combination of block-pulse functions with Chebyshev polynomials, Legendre polynomials, Bernoulli polynomials, or Taylor series have been shown to be a mathematical power tool for discretization of selected problems.

In this talk, we present the hybrid functions of block-pulse with Legendre polynomials and block-pulse with Bernoulli polynomials and their applications for variational problems. Numerical examples are included to demonstrate the applicability and the accuracy of the proposed method and comparisons are made with the existing results.

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