Alfaro, M.; **Pérez, T. E.**; **Piñar, M. A.**; **Rezola, M. L.**
Sobolev orthogonal polynomials: The discrete-continuous case. (English) Zbl 0980.42017
Methods Appl. Anal. 6, No. 4, 593-616 (1999).

If a sequence of polynomials is orthogonal with respect to a bilinear form involving derivatives, these are known as Sobolev orthogonal polynomials. In this paper, a particular case of the bilinear form is considered, called the discrete-continuous one, such as that it involves up to $N \in \mathbb{N}$ derivatives of the functions, but the first $N-1$ appear evaluated only at a fixed point $c \in \mathbb{R}$.

The authors accomplish a thorough study of the algebraic and differential properties of the corresponding Sobolev orthogonal polynomials and of their connection with the standard orthogonal polynomials. In particular, a new characterization of classical polynomials (as the only orthogonal polynomials that for some $N \in \mathbb{N}$ have an N-th primitive satisfying a three-term recurrence relation) is given.

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MSC:

42C05 Orthogonal functions and polynomials, general theory of nontrigonometric harmonic analysis
33C45 Orthogonal polynomials and functions of hypergeometric type (Jacobi, Laguerre, Hermite, Askey scheme, etc.)

Keywords:

Sobolev orthogonal polynomials; classical orthogonal polynomials; Sobolev bilinear form; second order differential equation; recurrence relation

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