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Mohammed Mesk, Mohammed Brahim Zahaf

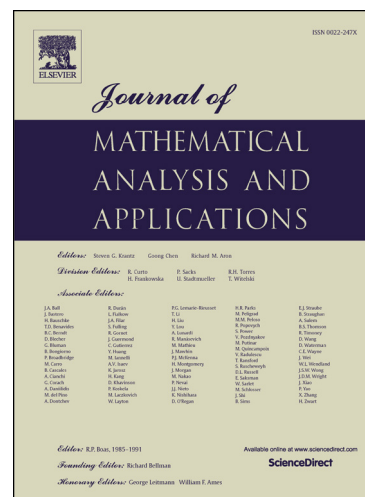
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# A new characterization of ultraspherical, Hermite, and Chebyshev polynomials of the first kind

Mohammed Mesk<sup>a</sup>, Mohammed Brahim Zahaf<sup>b,c,\*</sup>

<sup>a</sup>*Laboratoire d'Analyse Non Linéaire et Mathématiques Appliquées, Université de Tlemcen, BP 119, 13000-Tlemcen, Algérie*

<sup>b</sup>*Département de Mathématiques, Faculté des sciences, Université de Tlemcen, BP 119, 13000-Tlemcen, Algérie*

<sup>c</sup>*Laboratoire de Physique Quantique de la Matière et Modélisations Mathématiques (LPQ3M), Université de Mascara, 29000-Mascara, Algérie.*

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## Abstract

We show that the only polynomial sets with a generating function of the form  $F(xt - R(t))$  and satisfying a three-term recursion relation are the monomial set and the rescaled ultraspherical, Hermite, and Chebyshev polynomials of the first kind.

*Keywords:* Orthogonal polynomials; generating functions; recurrence relations; ultraspherical polynomials; Chebyshev polynomials; Hermite polynomials.

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## 1. Introduction and main result

The problem of describing all or just orthogonal polynomials generated by a specific generating function has been investigated by many authors (see for example [1, 2, 3, 4, 5, 6, 7, 8, 9]). For the special case, where the generating function has the form  $F(xt - \alpha t^2)$ , the authors in [2], [5] and [10] used different methods to show that the orthogonal polynomials are Hermite and ultraspherical polynomials. Recently in [4], the author gave a motivation of this question

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\*Corresponding author

*Email addresses:* [m\\_mesk@yahoo.fr](mailto:m_mesk@yahoo.fr) (Mohammed Mesk), [m\\_b\\_zahaf@yahoo.fr](mailto:m_b_zahaf@yahoo.fr) (Mohammed Brahim Zahaf)

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