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Varying Sobolev type orthogonal polynomials: the Laguerre case[†]

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Abstract

In this paper we introduce some new results about Mehler–Heine type asymptotics of Sobolev type orthogonal polynomials with respect to a varying nonstandard inner product related to the Laguerre weight. As a consequence, the asymptotic behaviour of the zeros of these polynomials is provided. The results are illustrated with some numerical examples.

Keywords: Sobolev type orthogonal polynomials, Laguerre polynomials, Mehler–Heine type formulae.

MSC: Primary 33C47; Secondary 42C05.

§1. Introduction

In the 90s of the last century, Koekoek and Meijer (see [6]) introduced the Laguerre–Sobolev type inner product

$$(f, g) = \frac{1}{\Gamma(\alpha + 1)} \int_0^\infty f(x)g(x)x^\alpha e^{-x} dx + Mf(0)g(0) + Nf'(0)g'(0), \quad (1.1)$$

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