

# SOBOLEV ORTHOGONALITY AND BOUNDARY VALUE PROBLEMS

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Sobolev inner products appear in a natural way when we consider the variational formulation of a boundary value problem for the harmonic oscillator. For a given potential, we study the sequences of Sobolev orthogonal polynomials with respect to such an inner product. Next, these Sobolev orthogonal polynomials are related with classical orthogonal polynomials and we deduce an algorithm to generate them in a recursive way. The outer relative asymptotics between Sobolev orthogonal polynomials and classical polynomials is obtained. An approximate solution of the boundary value problem is obtained from a spectral method based on Sobolev polynomials. Finally, we provide several numerical tests concerning the reliability and accuracy of the Sobolev spectral method.