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NEW HANDBOOK ON ORTHOGONAL FUNCTIONS OF EXPONENTIAL TYPE AND ITS APPLICATIONS TO CREATE SMALL MEMORY PROGRAMS IN MOBILE TECHNOLOGIES

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At this time we release the first part of a book on basic orthogonal functions and its applications [1]. This paper has specific thing for specific readers such as applied mathematicians and programmers to create adequate models, effective algorithms, and source code adapted for small memory programming [2] to minimize computational costs. Nevertheless, the handbook includes new results related to theory of orthogonal polynomials and theory of Fourier series and has a profound academic interest. For this reason we hope that this book will be interested by wider audience.

There are plenty of handbooks that are devoted a special functions and orthogonal polynomials. The best known are: I.S. Gradshteyn, I.M. Ryzhik “Table of Integrals, Series, and Products” (2007); Y.A. Brychkov “Handbook of Special Functions: Derivatives, Integrals, Series and Other Formulas” (2008); NIST Handbook of mathematical functions (2010). However, this book presents some new definitions and concepts to extend theory of orthogonal functions in practical aspects.

The classical orthogonal polynomials [3] Laguerre $L_k^{(\alpha)}(\tau, \gamma)$ and orthogonal polynomials Jacobi $P_k^{(\alpha, \beta)}(\tau, \gamma)$, which are given on $\tau \in [0, \infty)$ by means of variable change of exponential type $\tau = f(x, \gamma)$, where γ is a scale parameter, we will call as basic orthogonal functions of exponential type. In this book we consider some new and well-known mathematical aspects of classical orthogonal functions as well. Basic advantage of the orthogonal functions is an approximation of functions on infinity that can provide very accurate results.

The effective algorithms included in the handbook presented as the following sections:

- 1) an analytical representation in time domain;
- 2) basic and extended orthogonality relations in time domain;
- 3) phase representations;
- 4) integral representations;
- 5) an analytical representation in frequency domain;
- 6) basic and extended orthogonality relations in frequency domain;
- 7) recurrence relations;
- 8) interrelations between basis functions;



- 9) generalized characteristics of functions;
- 10) an uncertainty principle.

Each of these sections includes the following points:

- basic concepts;
- sequence of numbered formulas;
- special cases;
- the plots for given function parameters.

As a result, the formulas that presented in the handbook was adapted as lightweight algorithms [4] and was tested to create mathematical models in Data Mining computer systems and small memory mobile applications based on Android, iOS as well. It should be noted that mobile version of the handbook was created to test computational costs of the lightweight algorithms [4] and was registered as certificates of software registration in Federal Institute for Industrial Property [5].

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THE COMPARATIVE ANALYSIS OF ORTHOGONAL MODELS CREATION RESULTS IN CASE OF DIFFERENT APPROACH APPLICATIONS TO THE ASSESSMENT OF CORRELATIVE SPECTRAL CHARACTERISTICS IN DIFFERENT ORTHOGONAL BASES

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The results of orthogonal models of correlative spectral characteristics creation are brought and analyzed in case of approximate and analytics-numerical approach