

## EXTRACT FROM OP-SF NET

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From: OP-SF NET Editors  
Subject: Book on q-Fractional Calculus and Applications

The following is from the web site  
<http://www.springer.com/mathematics/analysis/book/978-3-642-30897-0>

### **q-Fractional Calculus and Equations**

Series: Lecture Notes in Mathematics, Vol. 2056

Annaby, Mahmoud H., Mansour, Zeinab S.

2012, xix + 318 pp. 6 illus.

This nine-chapter monograph introduces a rigorous investigation of q-difference operators in standard and fractional settings. It starts with elementary calculus of q-differences and integration of Jackson's type before turning to q-difference equations. The existence and uniqueness theorems are derived using successive approximations, leading to systems of equations with retarded arguments. Regular q-Sturm–Liouville theory is also introduced; Green's function is constructed and the eigenfunction expansion theorem is given. The monograph also discusses some integral equations of Volterra and Abel type, as introductory material for the study of fractional q-calculi. Hence fractional q-calculi of the types Riemann–Liouville; Grünwald–Letnikov; Caputo; Erdélyi–Kober and Weyl are defined analytically. Fractional q-Leibniz rules with applications in q-series are also obtained with rigorous proofs of the formal results of Al-Salam-Verma, which remained unproved for decades. In working towards the investigation of q-fractional difference equations; families of q-Mittag-Leffler functions are defined and their properties are investigated, especially the q-Mellin–Barnes integral and Hankel contour integral representation of the q-Mittag-Leffler functions under consideration, the distribution, asymptotic and reality of their zeros, establishing q-counterparts of Wiman's results. Fractional q-difference equations are studied; existence and uniqueness theorems are given and classes of Cauchy-type problems are completely solved in terms of families of q-Mittag-Leffler functions. Among many q-analogs of classical results and concepts, q-Laplace, q-Mellin and  $q^2$ -Fourier transforms are studied and their applications are investigated.

Content Level » Research

Keywords » 33D15, 26A33, 30C15, 39A13, 39A70 - Basic Hypergeometric functions - One variable calculus - Zeros of analytics functions - q-difference equations

Related subjects » Analysis - Dynamical Systems & Differential Equations -  
Theoretical, Mathematical & Computational Physics