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The proceedings are the papers of students, undergraduates, doctoral students and young researchers on topical issues of natural and technical sciences and humanities.

В сборник вошли доклады студентов, магистрантов, докторантов и молодых ученых по актуальным вопросам естественно-технических и гуманитарных наук.

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where

$$\Delta_h^{\alpha}(f)=\sum_{\nu=0}^{\infty}(-1)^{\nu}\binom{\alpha}{\nu}f(x+(\alpha-\nu))$$

difference of the fractional order $\alpha, \alpha>0$, of the function $f\in L_p$ at a point x with step h.

We have obtained an Ulyanov-type inequality for moduli of smoothness of fractional order with MVBVS sequences.

Theorem 1. *Let* $f\in L_p$, $1<p<q<\infty, \theta=1/p-1/q$, $\rho>0$ *and* $\lambda=\{\lambda_n\}_{n=1}^{\infty}\in MVBVS$. *Then for any* $\alpha>0$,

$$\omega_{\alpha}\left(\varphi,\frac{1}{2^n}\right)_q\le C\left(\sum_{k=\frac{2^n}{\mu}}^{\infty}|\lambda_k|^q k^{\theta q-1}\omega_{\alpha+\theta+\rho}\left(f,\frac{1}{k}\right)_p\right)^{1/q}.$$

$$+2^{n(\theta+\rho)}\omega_{\alpha+\theta+\rho}\left(f,\frac{1}{2^n}\right)_p\max_{1\le l\le n}\sum_{k=\frac{2^l}{\mu}}^{\mu 2^l}\frac{|\lambda_k|}{k^{\rho+1}}$$

References

1. R. DeVore, G.G. Lorentz, Constructive Approximation, Berlin: Springer-Verlag, 1993, P. 449.

2. A.A.Jumabayeva Sharp Ulyanov inequalities for generalized Liouville–Weyl derivatives,// Analysis Math. Vol. 43, Is. 2, 2017, P. 279-302

3. Song Ping Zhou, Ping Zhou, and Dan Sheng Yu The Ultimate Condition to Generalize Monotonicity for Uniform Convergence of Trigonometric Series. [Электронный ресурс] режим доступа: https://arxiv.org/pdf/math/0611805.pdf.

4. A.S. Belov, M.I. Dyachenko, S. Yu. Tikhonov, Functtions with generalized monotonic Fourier coefficients,// UMN, Vol. 76, Is. 6, 2021,P. 3–70

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ON THE SOLUTION OF FRACTIONAL q-DIFFERENCE EQUATION

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First we recall some elements of q-calculus, for more information see e.g. the books [1] and [2]. Throughout this paper, we assume that $0<q<1$ and $0\le a<b<\infty$.

Let $\alpha\in\mathbb{R}$. Then a q-real number $[\alpha]_q$ is defined by

$$[\alpha]_q:=\frac{1-q^{\alpha}}{1-q},$$

where $\lim_{q\to 1}\frac{1-q^{\alpha}}{1-q}=\alpha$.

We introduce for $k \in \mathbb{N}$:

$(a;q)_0 = 1,\ (a;q)_n = \prod_{k=0}^{n} (1-q^k a),\ (q;a)_\infty = \lim_{n\to\infty} (a,q)_q^n,\ and\ (a;q)_\alpha = \frac{(a;q)_\infty}{(q^\alpha a;q)_\infty}$.

The q-analogue of the power function $(a-b)_q^\alpha$ is defined by

$$(a-b)_q^\alpha := a^\alpha \frac{(\frac{a}{b};q)_\infty}{(q^\alpha \frac{a}{b};q)_\infty}.$$

Notice that $(a-b)_q^\alpha = a^\alpha (\frac{a}{b};q)_\alpha$.

The q-analogue of the binomial coefficients $[n]_q!$ are defined by

$$[n]_q! := \begin{cases} 1, & \text{if } n=0, \\ [1]_q \times [2]_q \times \cdots \times [n]_q, & \text{if } n \in \mathrm{N}, \end{cases}$$

The gamma function $\Gamma_q(x)$ is defined by

$$\Gamma_q(x) := \frac{(q;q)_\infty}{(q^x;q)_\infty}(1-q)^{1-x},$$

for any $x > 0$. Moreover, it yields that

$$\Gamma_q(x)[x]_q = \Gamma_q(x+1).$$

Definition1. *The Riemann-Liouville q-fractional integrals $I_{a+}^\alpha f$ of order $\alpha > 0$ are defined by*

$$(I_{q,a+}^\alpha f)(x) := \frac{1}{\Gamma_q(\alpha)} \int_a^x (x-qt)_q^{\alpha-1} f(t) d_q t.$$

Definition 2. *The Riemann-Liouville fractional q-derivative $D_{q,a+}^\alpha f$ of order $\alpha > 0$ is defined by*

$$(D_{q,a+}^\alpha f)(x) := \left(D_{q,a+}^{[\alpha]} I_{q,a+}^{[\alpha]-\alpha} f\right)(x).$$

The q-analogue differential operator $D_q f(x)$ is

$$D_q f(x) := \frac{f(x)-f(qx)}{x(1-q)},$$

and the q-derivatives $D_q^n(f(x))$ of higher order are defined inductively as follows:

$$D_q^0(f(x)) := f(x), \quad D_q^n(f(x)) := D_q\left(D_q^{n-1} f(x)\right), (n = 1,2,3,\dots)$$

Our main result:

Theorem 3. Assume that the following conditions holds true.

C1. Assume that $f(t,u(t))$. In addition, assume that be increasing function respect to the second variable, means where $[0,1] \times [-\tilde{r},\ \infty)$.

C2. Let $0 < \lambda < 1$ be a constant and $0 < y < \tilde{r}$, then there exist $\varphi(\lambda) > \lambda$ such that

$$f(t, \lambda x + (\lambda-1)y) \geq \varphi(\lambda) f(t,x).$$

C3. Last condition is positivity of $f(t,0)$, means $f(t,0) > 0$, specifically $f(t,0) \neq 0$ for all possible $0 \leq t \leq 1$.

Then following q-fractional differential equation problem with given initial values has a unique solution. In addition, following sequence shows successive approximation approach for the solution.

$$\begin{cases} (D_q^\alpha u)(t) + f(t,u(t)) = b & t \in (0,1), \\ u(0) = (D_q u)(0) = 0 & (D_q u)(1) = \beta (D_q u)(\xi) \end{cases} \qquad \alpha \in (2,3)$$

$$v_n(t) = \int_0^1 G(t,qs) f(s, v_{n-1}(s)) d_q s + \frac{\beta t^{\alpha-1}}{(1-\beta\varsigma^{\alpha-2})([\alpha-1]_q)} \int_0^1 H(\varsigma - qs) f(s, v_{n-1}(s)) d_q s - r(t) \ .$$

References

1. T. Ernst, A new method of q-calculus, Doctoral thesis, Uppsala university, 2002.
2. M.H. Annaby and Z.S. Mansour, q-fractional calculus and equations. Springer, Heidelberg, 2012.

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AUTOMORPHISMS OF THE UNIVERSAL MULTIPLICATIVE ENVELOPING ALGEBRAS OF FINITE DIMENSIONAL DUAL LEIBNIZ ALGEBRAS WITH ZERO MULTIPLICATION

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Let K be an arbitrary field. An algebra A over K is called $dual\, Leibniz\, algebra$ if it satisfies the identity

$$(xy)z = x(yz) + x(zy). \quad (1)$$

In [1] J.-L. Loday proved that any dual Leibniz algebra with respect to multiplication

$$x \circ y = xy + yx$$

is an associative commutative algebra. A linear basis of free dual Leibniz algebras is also given in [1].

Let A be an arbitrary dual Leibniz algebra over K. Let

$$L_A = \{L_x | x \in A\}$$

and

$$R_A = \{R_x | x \in A\}$$

be two isomorphic copies of the vector space A with the fixed isomorphisms $A \to L_A (x \longmapsto L_x)$ and $A \to R_A (x \longmapsto R_x)$. The universal (multiplicative) enveloping algebra $U(A)$ is an associative algebra with the identity 1 generated by the two vector spaces L_A and R_A satisfying the defining relations

$$R_x R_y = R_{xy+yx},$$

(2)

$$R_x L_y = L_y R_x + L_x, \quad (3)$$

$$L_{xy} = L_x L_y + L_x R_y, \quad (4)$$

for all $x, y \in A$. Recall that every dual Leibniz A-bimodule M can be regarded as a left $U(A)$ −module with respect to the action

$$L_a m = am, R_a m = ma, a \in A, m \in M$$