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BIVARIATE λ- BERNSTEIN TYPE OPERATORS VIA (p,q)-CALCULUS

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Abstract. In this paper we have established an extension of the bivariate generalization of the (p, q)-Bernstein type operators involving parameter λ. We have gave some inequalities for the operators by means of partial and full modulus of continuity and obtain a Lipschitz type theorem.

1. Introduction

Let $h \in C(S)$ with $S = [0, 1]$, $\lambda \in [-1, 1]$ and $m_1 \in \mathbb{N}$. In 2018, Cai et al. [16] proposed a new generalization of Bernstein operators based on a fixed real parameter $\lambda \in [-1, 1]$ as

$$\mathcal{B}^{\lambda}_{m_1}(h; y_2) = \sum_{k=0}^{m_1} \overline{\Omega}^{(\lambda)}_{m_1,k}(y_2) h\left(\frac{k}{m_1}\right), \quad x \in S \tag{1.1}$$

where the basis functions $\overline{\Omega}^{(\lambda)}_{m_1,k}(y_2)$ are defined as:

$$\begin{aligned}
\overline{\Omega}^{(\lambda)}_{m_1,0}(y_2) &= \Omega_{m_1,0}(y_2) - \frac{\lambda}{m_1+1}\Omega_{m_1+1,1}(y_2)\\
\overline{\Omega}^{(\lambda)}_{m_1,k}(y_2) &= \Omega_{m_1,k}(y_2) + \lambda\left(\frac{m_1-2j+1}{m_1^2-1}\Omega_{m_1+1,k}(y_2) - \frac{m_1-2j-1}{m_1^2-1}\Omega_{m_1+1,k+1}(y_2)\right),\\
&\quad 1 \le k \le m_1 - 1\\
\overline{\Omega}^{(\lambda)}_{m_1,m_1}(y_2) &= \Omega_{m_1,m_1}(y_2) - \frac{\lambda}{m_1+1}\Omega_{m_1+1,m_1}(y_2),
\end{aligned} \tag{1.2}$$

The authors have studied the established of some Korovkin type approximation properties and the degree of approximation by means of the modulus of continuity,

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