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On high orders moduli of continuity generated by semigroups of operators

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Abstract

An inequality for k th-modulus of continuity generated by semigroups of operators is obtained. This inequality implies that not every k -majorant is a modulus of continuity of order k .

Keywords: Banach space, semigroup, operator, modulus of continuity, operator semigroups.

MSC: Primary 26A15; Secondary 47D03, 41A65.

§1. Introduction

Let X be a linear space, $\{T_h : h \geq 0\}$ be one-parameter family of linear operators $T_h : X \rightarrow X$, $h \geq 0$, that forms a semigroup, that is $T_0 = I$ is the unit operator and $T_{h_1+h_2} = T_{h_1}T_{h_2}$ for arbitrary $h_1 \geq 0$ and $h_2 \geq 0$. Let also $Y \subset X$ be a linear set equipped with the norm $\|\cdot\|$ and assume that for all $f \in X$ and $h \geq 0$ the following inclusion is true: $(T_h - I)f \in Y$ and $\|T_h f - f\| \rightarrow 0$, $h \rightarrow 0$. Suppose also that for each $h \geq 0$ the restriction of the operator T_h to the space Y , which we denote by \tilde{T}_h , is a continuous operator with norm $\|\tilde{T}_h\| \leq 1$.

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