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8. Analysis

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Summability with speed and comparison of orders of approximation of Fourier expansions by different matrix methods of summability

A sequence $x = (x_k)$ is said to be *bounded with speed* $\lambda = (\lambda_k)$, $0 < \lambda_k \nearrow$, if $\exists \lim_k x_k = \xi$, and $l_k = \lambda_k(x_k - \xi) = O(1)$. If $\exists \lim_k l_k$, then x is said to be convergent with speed λ. Let m^λ and c^λ be the sets of λ-bounded and λ-convergent sequences, respectively and $A = (\alpha_{nk})$ be a matrix of real numbers. Let $m^\lambda_A = \{x \,|(A_n x) \in m^\lambda\}$ and $c^\lambda_A = \{x \,|(A_n x) \in c^\lambda\}$ where $A_n\, x = \sum_k \alpha_{nk} x_k$. We find necessary and sufficient conditions for a matrix M to transform m^λ_A into m^μ_B and c^λ_A into c^μ_B for a normal A, a triangular matrix B and $\mu = (\mu_k)$, $0 < \mu_k \nearrow$. As an application we shall find the relation between the orders of approximation of Fourier expansions by the method of Zygmund Z^r and the method $M^\varphi = (\varphi(\frac{k}{n+1}))$, generated by the continuous function $\varphi(t)$ on $[0, \infty]$ with $\varphi(0) = 1$ and $\varphi(t) = 0$, $t \geq 1$.