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Direct and inverse theorems of rational approximation in Bergman space

For positive numbers p and μ denote by $A_{p,\mu}$ the Bergman space of analytical functions in a half-plane $\Pi := \{z \in \mathbb{C} : \operatorname{Im} z > 0\}$. $R_n\left(f\right)_{p,\mu}$ is called the best approximation $f \in A_{p,\mu}$ by rational functions of degree at most n. Suppose $\alpha \in \mathbb{R}$ and $\tau > 0$ such that $\alpha + \mu = \frac{1}{\tau} - \frac{1}{p} > 0$ and $\frac{1}{p} + \mu \notin \mathbb{N}$. We prove that a function $f \in A_{p,\mu}$ satisfies the condition

$$\sum_{n=1}^{\infty} \frac{1}{n} \left(n^{\alpha+\mu} R_n\left(f\right)_{p,\mu}\right)^{\tau} < \infty$$

if and only if $f \in B_{\tau}^{\alpha}$, where B_{τ}^{α} is the Besov space of analytic functions in Π.