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Integral and derivative operators of functional order on generalized Besov and Triebel-Lizorkin spaces in the setting of spaces of homogeneous type

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Abstract: In the setting of spaces of homogeneous-type, we define the Integral, I_ϕ , and Derivative, D_ϕ , operators of order ϕ , where ϕ is a function of positive lower type and upper type less than 1, and show that I_ϕ and D_ϕ are bounded from Lipschitz spaces Λ^ξ to $\Lambda^{\xi\phi}$ and $\Lambda^{\xi/\phi}$ respectively, with suitable restrictions on the quasi-increasing function ξ in each case. We also prove that I_ϕ and D_ϕ are bounded from the generalized Besov $\dot{B}_p^{\psi,q}$, with $1 \leq p, q < \infty$, and Triebel-Lizorkin spaces $\dot{F}_p^{\psi,q}$, with $1 < p, q < \infty$, of order ψ to those of order $\phi\psi$ and ψ/ϕ respectively, where ψ is the quotient of two quasi-increasing functions of adequate upper types.

Keywords: integral and derivative operators of functional order, fractional integral operator, fractional derivative operator, spaces of homogeneous type, Besov spaces, Triebel-Lizorkin spaces

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