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Paraproducts via H^∞-functional calculus

Dorothee Frey

(Submitted on 21 Jul 2011)

Let X be a space of homogeneous type and let L be a sectorial operator with bounded holomorphic functional calculus on $L^2(X)$. We assume that the semigroup $\{e^{-tL}\}_{t>0}$ satisfies Davies-Gaffney estimates. In this paper, we introduce a new type of paraproduct operators that is constructed via certain approximations of the identity associated to L. We show various boundedness properties on $L^p(X)$ and the recently developed Hardy and BMO spaces $H^p_L(X)$ and $BMO_L(X)$. In generalization of standard paraproducts constructed via convolution operators, we show $L^2(X)$ off-diagonal estimates as a substitute for Calderón-Zygmund kernel estimates. As an application, we study differentiability properties of paraproducts in terms of fractional powers of the operator L. The results of this paper are fundamental for the proof of a T(1)-Theorem for operators beyond Calderón-Zygmund theory, which will be the subject of a forthcoming paper.

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