Wang, Dinghuai; Zhou, Jiang; Teng, Zhidong
Sharp estimates for commutators of bilinear operators on Morrey type spaces. (English)

For the classical Calderon-Zygmund operator $T$, R. R. Coifman et al. [Ann. Math. (2) 103, 611–635 (1976; Zbl 0326.32011)] showed that the commutator $[b, T](f) = bT(f) - T(bf)$ is bounded on some $L^p$, $1 < p < \infty$, if and only if $b \in BMO$. A. Uchiyama [Tohoku Math. J. (2) 30, 163–171 (1978; Zbl 0384.47023)] found that the commutator to compactness requires the symbol of the commutator to be in $CMO$, that is the closure of $BMO$ of the space of $C^\infty$ functions with compact support.

In recent many papers with respect to the commutators to some integral operators with multilinear setting on some integral spaces, especially, Y. Ding and T. Mei [Potential Anal. 42, No. 3, 717–748 (2015; Zbl 1321.42028)] studied the compactness of the linear commutator of bilinear operators from the product of Morrey spaces to Morrey spaces. T. Iida et al. [Positivity 16, No. 2, 339–358 (2012; Zbl 1256.42037)] introduced the multi-Morrey norms as follows:

$$|| (f_1, f_2)||_{M^{p_0}_P} := \sup_Q |Q|^{1/p_0} \prod_{i=1}^2 \left( \frac{1}{|Q|} \int_Q |f(x)|^{p_i} dx \right)^{1/p_i} < \infty,$$

whose norm is strictly smaller than the 2-fold product of the Morrey spaces. In this paper, for $T$ and $I_\alpha$ the bilinear Calderón-Zygmund operators and bilinear fractional integrals, respectively, the authors prove that if $b_1, b_2 \in CMO$, $\prod b_i, I_\alpha$ $(\vec{b} = (b_1, b_2))$ are all compact operators from $M^{p_0}_P$ to $M^{q_0}_q$ for some suitable indices $p_0, p_1, p_2$ and $q_0, q$. Moreover, the authors show that if $b_1 = b_2$, then $b_1, b_2 \in CMO$ is necessary for the compactness of $\prod b_i, I_\alpha$ from $M^{p_0}_P$ to $M^{q_0}_q$ for some suitable indices $p_0, p_1, p_2$ and $q_0, q$.

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MSC:

42B20 Singular and oscillatory integrals (Calderón-Zygmund, etc.)
47B07 Linear operators defined by compactness properties
42B99 Harmonic analysis in several variables
47G99 Integral, integro-differential, and pseudodifferential operators
32A35 $H^p$-spaces, Nevanlinna spaces of functions in several complex variables

Keywords:

bilinear Calderón-Zygmund operator; bilinear fractional integral operator; characterization; compactness; commutator

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