On singular and Marcinkiewicz integral operators

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Singular integral operators and Marcinkiewicz integral operators have been an active research topic since their appearance in the works of Littlewood, Paley, Zygmund, Marcinkiewicz, and Stein. In recent years, the theory of such operators has attracted the attention of many mathematicians. In this paper, we discuss the L^p mapping properties of various classes of Singular integral operators and Marcinkiewicz integral operators. In particular, we shall derive a multiplier formula characterizing the L^2 boundedness of Hrmander's parametric Marcinkiewicz integral operator. As a consequence, we prove the optimality of the kernel size condition $L(\log L)^{1/2}(\mathbf{S}^{n-1})$ as well as the optimality of the Block size condition. Furthermore, by the aid of such multiplier formula, we shall show the strong relation between the class of Marcinkiewicz integral operators and the corresponding class of Caldern- Zygmund singular integral operators.