

# Estimates for Compositions of Maximal Operators with Singular Integrals

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*Abstract.* We prove weak-type  $(1, 1)$  estimates for compositions of maximal operators with singular integrals. Our main object of interest is the operator  $\Delta^* \Psi$  where  $\Delta^*$  is Bourgain's maximal multiplier operator and  $\Psi$  is the sum of several modulated singular integrals; here our method yields a significantly improved bound for the  $L^q$  operator norm when  $1 < q < 2$ . We also consider associated variation-norm estimates.