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8. Analysis

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A distribution inequality on maximal and square functions on manifolds

Suppose M be a complete connected Riemannian manifold with nonnegative Ricci curvatures, $0 < \alpha, \beta < \infty$, $u(x,t) = P_t(f)(x)$ be the Poisson integral of f. The nontangential maximal function and the square function of f are defined by

$$S_\alpha(f)(x) = \left(\int_{\Gamma_\alpha(x)} |\nabla u(y,t)|^2 \, tV_x^{-1}(t) dt dy \right)^{1/2}$$

$$N_\beta(f)(x) = \sup \{ |u(y,t)| : (y,t) \in \Gamma_\beta(x) \} .$$

We proved that there is a positive number $c_0 = c(\alpha, \beta, n) \in (0,1)$ and $C = C(\alpha, \beta, n) > 1$, such that for $f \in C_c(M)$, $\dot\gamma_1$ and $\gamma_2 > 2$, $\lambda > 0$, we have

$$\left| \left\{ x : S_\alpha(f) > \gamma_1 \lambda, N_\alpha(\chi_{N_\beta(f) > \lambda/\gamma_2}) < c_0 \right\} \right| \le C e^{-(\gamma_1\gamma_2)^2 C^{-1}} \left| \{ x : S_\alpha(f) > \lambda \} \right| . \blacksquare$$

REFERENCE: C. Fefferman and E. M. Stein, H^p Spaces of Several Variables, Acta Math, 129(1972), 137–193.