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The Lipschitz continuity of the distance function to the cut locus

Let M be a complete smooth Riemannian manifold and S_pM be the unit tangent space of $p \in M$. For each positive integer k and vector $v \in S_pM$, let a number $\lambda_k(v)$ denote the parameter value of γ_v, where γ_v denotes the geodesic frpm p with its initial direction v, such that $\gamma_v(\lambda_k(v))$ is the k-th conjugate point along γ_v with counting conjugate multiplicities. For each $v \in S_pM$, let $\rho(v)$ denote the distance from p to the cut point along γ_v.

Theorem A. *For each positive integer k and $v \in S_pM$ with $\lambda_k(v) < \infty$, λ_k is locally Lipschitz around v.*

Theorem B. *For each $v \in S_pM$ with $\rho(v) < \infty$, ρ is locally Lipschitz around v. In particular, if M is compact, then ρ is globally Lipschitz on S_pM.*