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Closedness of the Tangent Spaces to the Orbits of Proper Actions

We show that for any proper action of a Banach-Lie group G on a Banach manifold M, the corresponding tangent maps $\mathfrak{g} \to T_x(M)$ have closed range for each $x \in M$, i.e., the tangent spaces of the orbits are closed. As a consequence, for each free proper action on a Hilbert manifold, the quotient M/G carries a natural manifold structure.

Keywords: Banach Lie group, Banach manifold, proper action.

MSC: 22E65, 58B25, 57E20