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Straightening Banach-Lie-Group-Valued Almost-Cocycles

For a compact group $\mathbb{G}$ acting continuously on a Banach Lie group $\mathbb{U}$, we prove that maps $\mathbb{G} \to \mathbb{U}$ close to being 1-cocycles for the action can be deformed analytically into actual 1-cocycles. This recovers Hyers-Ulam stability results of Grove-Karcher-Ruh (trivial $\mathbb{G}$-action, compact Lie $\mathbb{G}$ and $\mathbb{U}$) and de la Harpe-Karoubi (trivial $\mathbb{G}$-action, $\mathbb{U}$:=invertible elements of a Banach algebra). The obvious analogues for higher cocycles also hold for abelian $\mathbb{U}$.

Keywords: Banach Lie group, cocycle, coboundary, Haar measure, averaging, almost-morphism, Baker-Campbell-Hausdorff, Hyers-Ulam-Rassias stability.

MSC: 22E65, 22C05, 58B25, 46E50, 20J06, 58C15, 22E66, 22D12, 39B82, 46G20, 22E41.