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Equivariant Perfection and Kirwan Surjectivity in Real Symplectic Geometry

Let $(M, \omega, G, \mu, \sigma, \phi)$ be a real Hamiltonian system. In this case, the real subgroup $G_{\mathbb{R}} = G^{\phi}$ acts on the real locus $Q = M^{\sigma}$. Consider an invariant inner product on the Lie algebra $\mathfrak{g}$ and define the norm squared function $f = ||\mu||^2 : M \to \mathbb{R}$. We show that under certain conditions on pairs (G, ϕ) and (M, σ), the restricted map $f_Q : Q \to \mathbb{R}$ is $G_{\mathbb{R}}$-equivariantly perfect. In particular, when the action of G on the zero level set $M_0 = f^{-1}(0)$ is free, the real Kirwan map is surjective. As an application of these results, we compute the Betti numbers of the real reduction $Q//G_{\mathbb{R}}$ of the action of the unitary group on a product of complex Grassmannian.