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Syzygies in equivariant cohomology for non-abelian Lie groups

We extend the work of Allday-Franz-Puppe on syzygies in equivariant cohomology from tori to arbitrary compact connected Lie groups G. In particular, we show that for a compact orientable G-manifold X the analogue of the Chang-Skjelbred sequence is exact if and only if the equivariant cohomology of X is reflexive, if and only if the equivariant Poincaré pairing for X is perfect. A crucial step of the proof is to show that the equivariant cohomology modules arising from the orbit filtration of X are Cohen-Macaulay. We also discuss how syzygies behave with respect to restriction of the action to and induction from a maximal torus. Big polygon spaces lead again to important examples.