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Classical invariant theory

The classical invariant theory of reflection groups was motivated in part by connections with Lie group cohomology. The field attracted growing attention in its own right as results highlighted an appealing pattern: When a real or complex reflection group acts on a set, the collection of invariant objects often exhibits the same algebraic structure as the original set. The Shephard-Todd-Chevalley Theorem is a first example of this phenomenon, but invariant differential forms and derivations provide more examples. Indeed, Louis Solomon realized the space of invariant differential forms as an exterior algebra in its own right in 1963. We extend Solomon's Theorem to mixed differential forms using techniques of Gutkin and Opdam on characters. These results resolve some combinatorial conjectures on Hilbert series motivated by W-Catalan combinatorics. It also connects with conjectures on Lie groups and work of Bazlov, Broer, Joseph, Reeder, and Stembridge, as well as more recent work of Deconcini, Papi, and Procesi. Joint with Vic Reiner.