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Equivariant multiplicities of Coxeter arrangements and invariant bases

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Let \mathcal{A} be an irreducible Coxeter arrangement and W be its Coxeter group. Then W naturally acts on \mathcal{A} . A multiplicity \mathbf{b} : $\mathcal{A} \rightarrow \mathbb{Z}$ is said to be equivariant when \mathbf{b} is constant on each W -orbit of \mathcal{A} . In this article, we prove that the multi-derivation module $D(\mathcal{A}, \mathbf{b})$ is a free module whenever \mathbf{b} is equivariant by explicitly constructing a basis, which generalizes the main theorem of [T02]. The main tool is a primitive derivation and its covariant derivative. Moreover, we show that the W -invariant part $D(\mathcal{A}, \mathbf{b})^W$ for any multiplicity \mathbf{b} is a free module over the W -invariant subring.

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