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GENERATORS AND RELATIONS FOR KOSTANT-KUMAR MODULES AND APPLICATIONS TO SCHUR POSITIVITY TYPE PROBLEMS

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Let $\mathfrak{g}$ be a symmetrizable Kac-Moody Lie algebra over an algebraically closed field $\mathbb{F}$ of characteristic 0. Kostant-Kumar modules are cyclic submodules of the form $U(\mathfrak{g})(v_\lambda \otimes v_{w\mu})$ of the tensor product $V(\lambda)\otimes V(\mu)$ of two highest weight irreducible modules over $\mathfrak{g}$. A characterisation of the multiplicity of irreducibles is well known for the tensor product in the finite dimensional case. We first extend this to symmetrizable Kac-Moody Lie algebras using Kashiwara's Global Basis. Then, we generalise this characterisation to Kostant-Kumar modules. We also give a generators and relations description of Kostant-Kumar modules in the finite dimensional and symmetric Kac-Moody algebra case. As an application of these results, we obtain Schur-positivity type results for symmetric functions corresponding to Kostant-Kumar modules.

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