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Section:

7. Lie Groups and Lie Algebras

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(K, M)-spherical submodules of the universal enveloping algebra of a real rank one semisimple Lie group $G_\circ$

Let $G_\circ$ be a connected, non-compact semisimple Lie group with finite center and let $K_\circ$ be a maximal compact subgroup of $G_\circ$. If $\mathfrak{k} \subset \mathfrak{g}$ denote the complexifications of the Lie algebras of $K_\circ$ and $G_\circ$ respectively, $U(\mathfrak{g})$ will be the universal enveloping algebra of $\mathfrak{g}$ and $U(\mathfrak{g})^K$ will denote the centralizer $\mathfrak{k}$ in $U(\mathfrak{g})$. In order to study the algebra $U(\mathfrak{g})^K$ B. Kostant suggested to study the injective homomorphism of algebras [1]

$$P : U(\mathfrak{g})^K \to U(\mathfrak{k})^M \otimes U(\mathfrak{a})$$

associated with an Iwasawa decomposition $G = KAN$. Here M is the centralizer of $\mathfrak{a}$ in K. It is well known that P is not surjective. In this work we present some transversality properties for the (K, M)-spherical submodules of $U(\mathfrak{k})$ which allows to complete the characterization of $P(U(\mathfrak{g})^K)$ for a real rank one Lie group. In addition we characterize the dominant weights of the (K, M)-spherical modules for the rank one case without using the Cartan classification.

Reference:

[1] J. Lepowsky, *Algebraic results on representations of semisimple Lie groups*, Trans. Amer. Math. Soc. 176 (1973), 1-44