
The aim of this paper is to extend the results obtained in the second paper to the case of complex Grassmannians. More precisely, let $M = U/K$, where $U = SU(p + q)$ and $K = S(U(p) \times U(q))$, be the complex Grassmanian of a $p$-plane in $\mathbb{C}^{p+q}$, $p \geq q \geq 2$, $a_1, ..., a_r$ be $r$ points in $U$, and consider the convolution product $\nu_{a_1} \ast ... \ast \nu_{a_r}$ of the orbital measures $\nu_{a_1}, ..., \nu_{a_r}$ supported on $Ka_1K, ..., Ka_rK$. By a result of D. Ragozin [Zonal measure algebras on isotropy irreducible homogeneous spaces, J. Func. Anal. 17(4) (1974) 355–376], if $r \geq \text{dim } M$, then $\nu_{a_1} \ast ... \ast \nu_{a_r}$ is absolutely continuous with respect to the Haar measure of $U$. The aim of this paper is to investigate the $C^k$-regularity of the Radon-Nikodym derivative of $\nu_{a_1} \ast ... \ast \nu_{a_r}$ with respect to the Haar measure of $U$.

**Keywords:** Convolution of orbital measures, Grassmannians, spherical functions, Radon-Nikodym derivative.

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