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Jiaoyang Huang* (jiaoyang@mit.edu), 3 Ames Street, Building 62, Room W302, Cambridge, MA 02139. *Asymptotic Expansion of Spherical Integral*.

In this paper we consider the expansion of the spherical integral

$$I_N^{(\beta)}(A_N, B_N) = \int \exp\{N\text{Tr}(A_N U^* B_N U)\} dm_N^{(\beta)}(U), \quad (1)$$

where $m_N^{(\beta)}$ is the Haar measure on orthogonal group $O(N)$ if $\beta = 1$, on unitary group $U(N)$ if $\beta = 2$, and A_N, B_N are deterministic $N \times N$ real symmetric or Hermitian matrices, that we can assume diagonal without loss of generality. We follow the work of Alice Guionnet and Mylène Maïda, investigate the asymptotics of the spherical integrals under the case $A_N = \text{diag}(\theta, 0, 0, 0, 0 \cdots 0)$:

$$I_N^{(\beta)}(A_N, B_N) = I_N^{(\beta)}(\theta, B_N) = \int \exp\{\theta N(e_1^* B_N e_1)\} dm_N^{(\beta)}(U), \quad (2)$$

where e_1 is the first column of U .

In this case the spherical integral provides a finite dimensional analogue of the R -transform in free probability. The main result of the paper is proof of the existence of the full asymptotic expansions of these spherical integrals and derive the first and the second term in the asymptotic expansion. (Received February 03, 2014)