ASYMPTOTIC LIBERATION IN FREE PROBABILITY VIA GRAPH SUMS

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Last year, G. Anderson and B. Farrel presented the notion of asymptotically liberating sequences of families of random unitary matrices and showed that under certain conditions such sequences delivers asymptotic freeness when used for conjugation. Should be mention that asymptotic freeness is one of the nicest properties that a sequence of random matrices can have from the point of view of free probability. G. Anderson and B. Farrel, applying the Fibonacci-Whitle inequality and some combinatorial manipulations, also established sufficient conditions on a sequence of families of random unitary matrices in order to be asymptotically liberating.

On the other hand, a theorem by J. Mingo and R. Speicher states that given a finite graph $G = (E, V, s, r)$ with $V = \{1, 2, \ldots, m\}$ there exists an optimal rational number $\mathfrak{r}_G$ depending only on the graph structure of G such that for any integer $n \in \mathbb{N}$ and any collection of n-by-n complex matrices $\{A_e = (a_e(i,j))_{n\times n} \mid e \in E\}$ we have

$$\left| \sum_{i_1, i_2, \ldots i_m = 1}^{n} \left(\prod_{e\in E} a_e(i_{s(e)}, i_{r(e)}) \right) \right| \leq n^{\mathfrak{r}_G} \prod_{e\in E} \|A_e\|$$

where $\|\cdot\|$ denotes the operator norm.

In this talk, we first give the notion of asymptotically liberating sequences of families of random unitary matrices. Then, we state the theorem by G. Anderson and B. Farrell regarding sufficient conditions for asymptotic liberation. Finally, we show how to use the latter inequality to prove such theorem.

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