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LIMITING SPECTRAL DISTRIBUTIONS OF SUMS OF PRODUCTS OF NON-HERMITIAN RANDOM MATRICES

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Abstract: For fixed $l \geq 0$ and $m \geq 1$, let $\mathbf{X}_n^{(0)}, \mathbf{X}_n^{(1)}, \ldots, \mathbf{X}_n^{(l)}$ be independent random $n \times n$ matrices with independent entries, let $\mathbf{F}_n^{(0)} := \mathbf{X}_n^{(0)}(\mathbf{X}_n^{(1)})^{-1} \ldots (\mathbf{X}_n^{(l)})^{-1}$, and let $\mathbf{F}_n^{(1)}, \ldots, \mathbf{F}_n^{(m)}$ be independent random matrices of the same form as $\mathbf{F}_n^{(0)}$. We show that as $n \to \infty$, the matrices $\mathbf{F}_n^{(0)}$ and $m^{-(l+1)/2}(\mathbf{F}_n^{(1)} + \ldots + \mathbf{F}_n^{(m)})$ have the same limiting eigenvalue distribution.

To obtain our results, we apply the general framework recently introduced in Götze, Kösters, and Tikhomirov (2015) to sums of products of independent random matrices and their inverses. We establish the universality of the limiting singular value and eigenvalue distributions, and we provide a closer description of the limiting distributions in terms of free probability theory.

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