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*Some Applications of Non-Commutative Functions in Free Analysis*

Given two complex vector spaces,  $V$  and  $W$ , a non-commutative function is, briefly, a mapping from a certain class of subsets of that matrix space over  $V$  to the matrix space over  $W$ , satisfying some compatibility conditions: it has to respect direct sums and simultaneous similarities. Non-commutative functions have very strong regularity properties and they admit a very nice differential calculus, closely related to some QD-bialgebras arising in free probabilities. Such objects were considered before by J. L. Taylor in his groundbreaking work in on the noncommutative spectral theory, and more recently independently by D.-V. Voiculescu in free probability. Besides a brief introduction in the theory of non-commutative functions, the lecture will survey some applications of this theory in operator-valued non-commutative probability, such as non-commutative Levy-Hincine formulas, Bercovici-Pata bijection, operator-valued Cauchy and R-transforms, operator-valued semicircle, arcsine and Bernoulli laws. Most of results presented are joint work with V. Vinnikov and Serban Belinschi.