1163-47-1557 **Meric L Augat*** (maugat@wustl.edu). *Differentiation and antidifferentiation in free analysis.*

In recent years, several classical theorems about analytic functions have been extended to the setting of free analysis e.g. the inverse function theorem has been generalized to matrix and operator settings. In particular, the free inverse function theorem has a stronger statement than its classical counterpart, partly due a remarkable property of differentiation in free analysis: the free derivative can be realized via point evaluation.

In this talk, we first discuss the free derivative, its remarkable properties and their consequences. Next, we investigate necessary and sufficient conditions for antidifferentiation of free functions. We generalize two classical theorems to free analysis; if F is a differentiable vector field equal to the gradient of some potential function, then F is curl free and conversely, if F is a curl free vector field on a simply connected domain, then F is the derivative of a potential function.

Our two main results are as follows: the derivative of an analytic free map must be free-curl free and when we are on a connected free domain, every free-curl free map can be antidifferentiated.

Recall that a free function in g freely noncommuting variables sends g-tuples of matrices (of the same size) to h-tuples of matrices (of the same size). (Received September 15, 2020)