My name is James Mingo and I am a Professor in the Department of Mathematics and Statistics at Queen's University.

My research focuses on methods coming from random matrix theory and combinatorics to study problems in free probability. In particular these are some of the problems I would like to solve.

Problem 1 If one has a polynomial, p, with real roots, then the derivative, p' also has real roots, and these roots interlace those of p. We get a similar phenomenon with principal minors of matrices. Namely let A be a self-adjoint $n \times n$ matrix and B be the $(n-1) \times (n-1)$ minor obtained by deleting the last row and the last column. Then the eigenvalues of B interlace those of A. When the entries of A are suitably random there is a connection between these two phenomena, but there is much more to do here using the concept of free independence.

Problem 2 Every permutation has a genus, which is a non-negative integer describing the genus of a surface on which one can draw the cycles of the permutation in a non-crossing way. One can lower the genus by punching a hole. This has only been explored at small genera. More information here would have a big impact on free probability.

Problem 3 The two questions above have interpretations involving analytic functions of several variables. Most of the current work involves only formal power series. Fonding domains where there was convergence would be very beneficial.

If you find any of these problems interesting or would like to hear more about my research, do not hesitate to contact me at james.mingo@queensu.ca