

SPRING 2025

MINERVA FOUNDATION LECTURES

RAMA CONT
University of Oxford



Rough Calculus

The Ito calculus may be viewed as an extension of the Newton-Leibniz calculus to smooth functions of paths with non-zero quadratic variation. This analytical viewpoint is exploited to develop a calculus for smooth function(al)s of irregular paths with non-zero p -th variation for arbitrary $p > 1$. Although this “rough calculus” is strictly pathwise in nature and does not involve any probabilistic ingredient, it is applicable to stochastic processes with irregular paths.

We illustrate the concepts and results of this theory in the setting of the Ito-Föllmer calculus for smooth function(al)s of paths with finite quadratic variation. We will then show how these results may be extended to the more general setting of smooth functionals of paths with non-zero p -th variation for arbitrary $p > 1$, leading to a higher order Ito-type calculus. Finally, we will sketch some examples of applications to transport equations, optimal control and rough dynamics on manifolds.

Tuesdays @ 4:10 – 5:25 PM

Math Hall, Room 507

First lecture: Tuesday, January 21st