School of Mathematics and Statistics
Faculty of Science, Technology, Engineering and Mathematics

2024 PhD Projects

Project title	Inner functions and complex dynamics
Principal supervisor	Dr Vasiliki Evdoridou
Second supervisor	Prof Gwyneth Stallard
Discipline	Pure mathematics
Research area/keywords	complex analysis, iteration, inner functions
Suitable for	Full time applicants, Part time applicants

Project background and description

Complex dynamics concerns the iteration of analytic functions of the complex plane. When we iterate analytic functions there is a natural division of the complex plane into the Fatou (or stable) set and the Julia (or chaotic) set. An introduction to this theory can be found in [2].

The connected components of the Fatou set are called Fatou components. Fatou components can be periodic, preperiodic or wandering domains. The dynamics in Fatou components as well as the geometry of such components have been studied extensively. A tool that revolutionised the study of periodic Fatou components was the use of inner functions. Inner functions, which are analytic self-maps of the unit disc, can be naturally associated to Fatou components via Riemann maps. Recent results indicate that this relation is strong and it can be exploited further. More recently, inner functions were introduced in the study of wandering domains, and led to significant progress.

This PhD project will build on recent developments on the topic ([1], [3], [4]) and will look at properties of associated inner functions as well as the specific types of inner functions that can be associated to Fatou components.

Background reading/references

[1] K. Barański, N. Fagella, X. Jarque, and B. Karpińska. Accesses to infinity from Fatou components, Trans. Amer. Math. Soc., 369(3):1835–1867, 2017.

[2] W. Bergweiler, Iteration of meromorphic functions, Bull. Amer. Math. Soc., 29 (1993), 151–188.

[3] V. Evdoridou, N. Fagella, X. Jarque, and D. J. Sixsmith, Singularities of inner functions associated with hyperbolic maps, J. Math. Anal. Appl. 477 (2019), no. 1, 536–550.

[4] V. Evdoridou, L. Rempe, and D. J. Sixsmith, Fatou's associates, Arnold Math. J. 6 (2020), no. 3-4, 459–493.