28th SUMMER SCHOOL-CONFERENCE ON DYNAMICAL SYSTEMS
AND COMPLEXITY, CHANIA, CRETE, 18 - 26 JULY 2022

Adapting the Fokas method to fractional-order PDEs

ARRAN FERNANDEZ

Department of Mathematics, Eastern Mediterranean University
99628 Famagusta, Northern Cyprus
arran.fernandez@emu.edu.tr • https://staff.emu.edu.tr/arranfernandez/en/

The Fokas method, or unified transform method, was developed in the late 1990s as a powerful method to solve PDEs by combining transforms with respect to both space and time, in a process which is sometimes called synthesis rather than separation of variables [1, 2]. It relies heavily on ideas from complex analysis, making use of Cauchy's theorem and Jordan's lemma to deform complex contours through regions of exponential decay.

Allowing derivatives of non-integer orders in a differential equation gives a so-called fractional differential equation. These have discovered applications in various fields, due to their nonlocality and intermediacy properties, and they are mathematically more challenging to solve: arguments based on polynomials no longer apply, and branch cuts in the complex plane must be taken into account. I will speak about one type of fractional PDE, linear in 1+1 dimensions and posed on the half-line, and examine how the Fokas method can be adapted to solve it. This talk will be based on the paper [3] which is joint work with Dumitru Baleanu and Athanassios Fokas.

References

[1] A. S. Fokas, "A unified transform method for solving linear and certain nonlinear PDEs", *Proceedings of the Royal Society of London A* 453 (1997), pp. 1411–1443.

[2] A. S. Fokas, *A Unified Approach to Boundary Value Problems*, Philadelphia: SIAM, 2008.

[3] A. Fernandez, D. Baleanu, A. S. Fokas, "Solving PDEs of fractional order using the unified transform method", *Applied Mathematics and Computation* 339C (2018), pp. 738–749.