

A complex analytic approach to some problems in fluid flows

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Abstract: In this talk we discuss several instances where methods from complex and harmonic analysis prove useful to specific problems arising in fluid mechanics.

We first consider irrotational periodic travelling waves and show the logarithmic convexity of certain flow quantities. As a by-product, we deduce, for instance, that the kinetic energy, the time-period of the particle paths, and the length of a streamline are larger near the surface and reduce with increasing depth.

We then proceed in a different direction of investigation and obtain a complete solution to the problem of classifying all two-dimensional ideal fluid flows with harmonic Lagrangian labelling maps.

Some of these results are joint work with Maria Jose Martin, respectively with Anna-Maria Persson.