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Steady viscous axisymmetric flows associated with rotating discs

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The Navier-Stokes equations for steady viscous incompressable axisymmetric flow can be reduced to a set of ordinary differential equations if the flows are assumed to satisfy a certain set of similarity relations first used by von Karman in 1921. These flows which are called self-similar are studied from a mathematical viewpoint and their connection with flows which are not completely self-similar is explored.

In the first part of the thesis self-similar flows in domains of infinite extent are considered. The study of self-similar flows in a domain bounded by two infinite coaxial disks rotating in two parallel planes a finite distance apart forms the second part. The main emphasis is on flow at high values of the Reynolds number. In most rotating flows of physical interest, the velocity components must satisfy some boundary conditions at a finite value of the radial coordinate, so these flows cannot be completely self-similar. In the final part of the thesis the flow between two finite rotating disks contained in a rotating cylinder is considered as an example of such physical flow problems.

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