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Solutions to the Navier-Stokes Equation in the complex plane JONATHAN MESTEL, FLORENCIA BOSHIER, Imperial College London — A Stokes series is a theoretically attractive approach to solving the Navier-Stokes equations. Essentially the solution is expressed as a power series in the Reynolds number, R_e. At each order, a linear problem needs to be solved, providing a series representation of the solution for all R_e. This method was pioneered by Van Dyke in the 1970s. However, typically this series has a finite radius of convergence, and the solution has singularities at complex values of R_e. The behaviour of the series can be enhanced using a generalsied Padé approximant technique. This method also predicts complex solution branches, and identifies bifurcation points to multiple solutions. Solutions branches for complex R_e can be followed back onto the real R_e-axis. It is shown that in general the Navier-Stokes equations have more than one complex solution even for low (real) R_e. The intricate structure of complex solutions is followed in detail for Dean flows, and new branches are presented.

Jonathan Mestel
Imperial College London

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