

Two-Layer Stagnation Point Flows

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Exact solutions of the Navier–Stokes equations are presented for orthogonal and oblique stagnation-point flow against a flat film resting on a plane wall. The viscosity and density of the fluid film and the superposed fluid are generally different. At zero Reynolds number, the solution may be written down in closed form. The solution for orthogonal flow at non-zero Reynolds numbers adopts a structure which is similar to that of the classical Hiemenz flow of a homogeneous fluid toward a plane wall. For oblique flow, the structure is similar to that for a single fluid presented by Stuart (1959) and Dorrepaal (1986). The problem reduces to solving a pair of partial differential equations involving one spatial coordinate and time, together with an evolution equation for the position of the interface. Only a minor modification is required to compute solutions for two-layer axisymmetric stagnation point flow.

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