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Evolution of Vortex Dipole Disturbances in Channel Flow ANTHONY LEONARD, Graduate Aerospace Laboratories, Caltech — The initial-value problem for the linearized Navier-Stokes equations for channel flow with mean velocity and mean vorticity given by $\mathbf{U} = (\mathbf{U(y), 0, 0})$ and $\Omega = (0, 0, -dU(y)/dy)$ is investigated for initial disturbances consisting of vortex dipoles. Approximate analytical solutions to the resulting Orr-Sommerfeld (OS)/ Squire equations are found in terms of special functions, thus avoiding the need of large-scale computation. Under the assumption of linearity, the initial vortex dipole merely travels downstream with the local mean velocity $U(y)$ as a diffusive scalar. However, additional disturbances are produced continually because the quantity $U''(y)\partial v/\partial x$ appears in the OS equation as a source for transported quantity $\nabla^2 v$. In turn, $-U'(y)\partial v/\partial z$ is the source term in the Squire equation for the transported quantity ω_y. We find it particularly effective to represent this additional v field as an expansion in terms of eigenfunctions of the OS equation with complex values of $k_\perp$ ($k_\perp^2 = k_x^2 + k_z^2$). For the inviscid case, e.g., these solutions satisfy

$$\frac{d^2 v_j}{dy^2} - \frac{U''(y) v_j}{U(y) - c} = k_{\perp j}^2 v_j \tag{1}$$

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