K3 Quasi-Periodic Structure in the Turbulent Wake of a Disk. V. KIBENS and M. DE COSTER, Univ. of Mich.—An experimental method has been devised to examine the coherent structure of the near wake of a disk at a Reynold's number of 12,500 based on the disk diameter. The Strouhal frequency observed was .13. The periodic part of the velocity signal contains as much as 25% of the turbulent energy. A P.A.R. waveform-eductor was used to sample the flow field. Eduction was triggered by an analog circuit at those times when the signal from a second stationary probe in the flow field satisfied fixed "periodicity" conditions. The periodic structure develops in the first four diameters downstream from the disk and decays faster than the turbulence. The vorticity patterns associated with the periodicity, convect downstream at the free-stream velocity and move radially at a rate faster than that of the turbulent wake growth. The coherent structure of the near wake has sufficiently rigid periodicity and intensity to suggest that it may play a significant role in determining the shape and structure of the turbulent-non-turbulent interface in the far wake.

K4 Search for the Final Period of the Axisymmetric Turbulent Wake. P. FREYMUTH, U. of Colorado.--Intensity, dissipation, and intermittency of velocity and temperature fluctuations in the wake of an unheated as well as a heated sphere have been measured in the low Reynolds number range 400-2400 at distances 80-1600 sphere diameters downstream. The measurements show strong dependence of the results on Reynolds number but they do not indicate the attainment of the final period of decay which has been explored theoretically by Phillips[1] and by O'Brien.[2] Lowest Reynolds number of turbulence obtained was of order $R_\lambda = 3$. Other strategies for reaching the final period of decay will be discussed.

[1] O. M. Phillips, Proc. Camb. Phil. Soc. 52, 135 (1955).
[2] E. E. O'Brien, to be published in J. Fluid Mech. (1973).

K5 Turbulent Magneto-Fluid-Mechanic Vortex Streets.* D. PAPAILIOU**Martin Marietta--The influence of a magnetic field was studied, on the geometry and the shedding frequency of a turbulent vortex street, formed behind a cylinder moving in mercury. The magnetic field was parallel to the axis of the cylinder. The Reynolds numbers were between 1000 and 5,200. The values of the Interaction parameter, N (≈ Ponderomotive force/inertia force) were between 2×10^{-2} and 4. Hot film measurements showed no change of the shedding frequency due to the magnetic field. Observed photographs indicated a suppression of turbulence and vorticity in the street with increasing magnetic fields, resulting to a final laminar pattern of two parallel rows of vortices. A magneto-fluid-mechanic, turbulent, 2-dimensional vorticity equation was used to explain the experimental results. A damping factor was introduced in the eddy viscosity model to represent the effect of the magnetic field on turbulence. A similar experiment in an open channel with mercury flowing over a stationary cylinder, indicated that when vorticity is present in the free stream, the shedding frequency was influenced by the magnetic field.

*Submitted by P. S. LYKOUDIS
**Research completed at Purdue University

K6 Acoustic Wave Phase Modulation By A Turbulent Shear Flow.* HO, CHIH-MING, and LESLIE S. G. KOVASZNAY, The Johns Hopkins U.--A collimated monochromatic acoustic beam (3 kHz-90 kHz) was directed across a plane turbulent jet and the propagation parameters (statistical parameters of amplitude and phase) were obtained as functions of carrier frequency. Results on the amplitude modulation were presented earlier.[1] Two point correlations of the phase modulation show different behavior at different ranges of the carrier frequency; when the acoustic wavelength is larger than the microscale of the turbulence, wave diffraction effects play an important role; when the acoustic wavelength is smaller than the microscale of the turbulence, geometrical acoustics becomes a good approximation. The phase modulation "correlation map" shows the average Fresnel diffraction pattern.

[1] Leslie S. G. Kovasznay and Ho, Chih-ming, Bulletin of American Physical Society, Nov. 1972, p. 1102.
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K7 Turbulent Wakes of a Towed Slender Body in Stratified and Nonstratified Fluids: Analysis and Flow Visualizations*. YIH-HO PAO and JUNG-TAI LIN, Flow Research, Inc.--Similarity analysis of the turbulent wake in a nonstratified fluid indicates that the width or height of the wake grows as $x^{1/3}$. This prediction is supported by flow visualization results. Flow visualization experiments of a slender body (fineness ratio=11.75) in stratified fluid with constant density gradients have been conducted at internal Froude number F_D=19, 31, 61, 103, 280, and 338 where $F_D=U(ND)^{-1}$, U is the body speed, N is the Brunt-Vaisala frequency in cycle/sec,. and D is the body diameter and at Reynolds number $R_D=UD/\nu$=30100. However, several runs have been made at R_D=60200, 15000, and 7500. Results from these experiments indicate that the turbulent wakes of a towed slender body in a stratified fluid do not collapse and vortices are formed far downstream. The wake can be divided into four regions: (i) growth region, (ii) modulation and spreading region, (iii) meandering region and (iv) vortex region.

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K8. Turbulent Wakes of a Self-Propelled Slender Body in Stratified and Nonstratified Fluids: Analysis and Flow Visualizations*. JUNG-TAI LIN and YIH-HO PAO, Flow Research, Inc.--Similarity analysis of the turbulent wake of a self-propelled axisymmetric body in a nonstratified fluid indicates that the wake height grows as $x^{1/4}$. This prediction is supported by flow visualization. This growth rate is slower than the $x^{1/3}$ wake growth rate of a towed body. Flow visualization experiments of a self-propelled slender body (fineness ratio=11.75) in stratified fluids with constant-density gradients have been made at Froude number F_D=19, 31, 65, 103, 314, and 565. $F_D=U\ (ND)^{-1}$ where U is body speed, N is Brunt-Vaisala frequency in cycle/sec., and D is body diameter. Results indicate that turbulence in the wake of a self-propelled body in a stratified fluid decays much faster than that of a towed body, and the vortices formed far downstream are not nearly as strong. The turbulent wake exhibits four distinct regions: (i) growth region, (ii) modulation and spreading region, (iii) relaminarization region, and (iv) vortex region.

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