We certainly concur that the power efficiency is at present not indicative of a self-contained vehicle, a problem to be considered subsequent to efficiency improvements on the "corona-wind" process.

Reference

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Structures, Structural Dynamics, and Holography

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THE purpose of this Comment is to inform AIAA members of the existence of a new and potentially powerful experimental technique for determining static and dynamic deformation characteristics of structures. It is based on the electro-optical technique known as holography,[1] which has become one of the most active, publicized, and fascinating technical developments of this decade.

Holography involves the illumination of a two-dimensional photographic plate, called a hologram, with a coherent light source, such as a laser, to produce a three-dimensional image of the object recorded on the hologram. The image has all the appearances of the actual object, including parallax relations between near and far points on the object. Holography is truly lensless, three-dimensional photography.

The hologram is made by illuminating the object with laser light. The light or wavefront reflected from the object is recorded on the photographic plate and contains both amplitude and phase information of the light waves.

The experimental technique with which experimentalists in structures and structural dynamics should become familiar is called holographic interferometry.[2] It also has exciting possibilities in experimental fluid mechanics, such as three-dimensional flow visualization of shock waves; one such application produced a holographic interferogram of the shock waves generated by a 22-caliber bullet.[2] The technique involves double or multiple exposures of the photographic plate. One exposure constitutes the comparison beam of a conventional interferometer. The second exposure is the test scene. Interference fringes due to changes in optical path length between the exposures are then visible on the image produced by illuminating the hologram. These fringes are directly related to the deformation history of the object between exposures.

Thus, in the case of double exposures, static structural deformations due to applied load can be determined.[3] By making a hologram before loading, then applying load and re-exposing the plate, the image formed from the doubly exposed hologram will contain interference fringes from which the three-dimensional structural deflections can be determined with accuracy on the order of a fraction of a wavelength of light; that is, fractions of a micron. The number of fringes between any two points together with the focal position of the fringes determine the deflections.

By using a continuum of multiple exposures, vibration characteristics of structures can be determined as the result of time-averaged holographic interferometry.[4,5] The photographic plate is exposed with the object at rest. Then the object is set in sinusoidal vibration and the plate continuously exposed during the vibration. When the resulting hologram is viewed, the interference fringes observed represent contours of constant amplitude. They display not only the over-all three-dimensional modal and nodal patterns but also allow the amplitude at each point to be determined accurately to within a fraction of the wavelength of light. These results are obtained without the need for placing any measuring device on the vibrating structure or otherwise disturbing it.

Holographic interferometry produces three-dimensional virtual images of the original scene, superimposed upon which is the complete record of the interference phenomena. These three-dimensional interferograms constitute an accurate record of optical path-length changes over a broad range of directions. The interference fringes can be examined from different directions and with different focal positions in order to measure path-length differences along various viewing paths and thus determine three-dimensional structural deformation characteristics under static and dynamic loads. The significance of this new tool to experimentalists in structures and structural dynamics is of revolutionary importance, in the opinion of this writer.

Received March 4, 1968.
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[2] Heflinger, L. O., Wuerker, R. F., and Brooks, R. E., "Holographic Interferometry," *Journal of Applied Physics*, Vol. 37, No. 2, Feb. 1966, pp. 642–649.

[3] Haines, K. A. and Hildebrand, B. P., "Surface-Deformation Measurement Using the Wavefront Reconstruction Technique," *Applied Optics*, Vol. 5, No. 4, April 1966, pp. 595–602.

[4] Powell, R. L. and Stetson, K. A., "Interferometric Vibration Analysis by Wavefront Reconstruction," *Journal of the Optical Society of America*, Vol. 55, No. 12, Dec. 1965, pp. 1593–1598.

[5] Stetson, K. A. and Powell, R. L., "Interferometric Hologram Evaluation and Real-Time Vibration Analysis of Diffuse Objects," *Journal of the Optical Society of America*, Vol. 55, No. 12, Dec. 1965, pp. 1694–1695.

Errata: "Boundary-Layer Flows with Large Injection and Heat Transfer"

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[AIAA J. **6,** 22–29 (1968)]

THE following errors have been discovered in the aforementioned article:

1) Equation (26a) should read

$$(d^2Z_1/df^2) + f(dZ_1/df) + 2\beta(G_1 - Z_1) = 0$$

2) Equation (27) should read

$$Z_1(f) - G_1(f) = [\exp(-f^2/4)][\ldots$$

where it is to be noted that $G_1(f) \to 0$ exponentially as $f \to +\infty$.

3) Equation (41) should read

$$Z^{-1/2} \simeq \tilde{Z}_0{}^{-1/2} + Z_0{}^{1/2} - \ldots$$

4) Equation (47) should read

$$\delta_0 = c^{-1}\int_{-c}^{0} (\tilde{Z}_0{}^{-1/2} - 1)df = \ldots$$

Received January 25, 1968; revision received March 6, 1968. The authors are indebted to J. Aroesty and J. W. Ellinwood for pointing out some of these errors.
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5) Equation (51) should read

$$\theta_1 = -\int_{-\infty}^{0} (Z_0^{1/2} - g_w^{1/2})df + \ldots$$

6) Equation (A2) should read

$$--- - 2\beta\} + fF'(2) = \ldots$$

7) The expressions given in Eqs. (44–46) are valid as defined in the article only if $\beta < 1$. For $\beta \geq 1$, the last term in these expressions is of higher-order than that which would appear due to the next-order term in the inner solution $\tilde{Z}_1$. The first two terms in (44–46) are unchanged.

Errata: "Flow near the Intersection of a Wall and a Dividing Streamline"

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[AIAA J. **6**, 549-550 (1968)]

THE solution presented in this Note† is only partially correct. For all values of α, the velocities will asymptotically behave as r^2. The solutions corresponding to eigenvalues less than 3 cannot be allowed since they permit the fluid to slip along the dividing streamline. It also must be pointed out that this problem has been considered by Dean.[1] The author would like to thank M. Van Dyke for pointing out the errors in the original note.

Received March 14, 1968.

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† The nomenclature is that of the subject paper.

Reference

[1] Dean, W. R., "Note on the Motion of Liquid Near a Position of Separation," *Proceedings of the Cambridge Philosophical Society*, Vol. 46, April 1950, pp. 293–306.

Erratum: "Heat Transfer to Wavy Wall in Hypersonic Flow"

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[AIAA J. **5**, 1760–1773 (1967)]

THE following correction should be made to the above article: In Figs. 6 and 10, the scale for $N_{St,\infty}$ should be decreased by a factor of 10. The authors regret that this error was made.

Received February 26, 1968.