

Further, Eq. (14) of Ref. 1 is incorrect; in fact, it should read as

$$\pi = \bar{\pi}_2 \exp(-C_1 \psi) \begin{bmatrix} -\rho_0 q_0 / (1 + M_{f0}^2)_0 \\ I \\ -I / (q_0 Q_0) \\ -\rho_0 q_0 M_{f0}^2 / (1 + M_{f0}^2)_0 \\ -\rho_0 q_0 / (c_0^2 (1 + M_{f0}^2)_0) \end{bmatrix}$$

where  $\bar{\pi}_2 = \lim_{\psi \rightarrow 0} \pi_2$ .

Further, Eq. (15) of Ref. 1 is incorrect; it should read as  $n_{\phi\psi} = -C_2 \pi_2$ , where

$$C_2 = [(2 - \gamma) q_0 M_{f0}^2 M_0^2 + c_0 M_0 (1 + M_{f0}^2)_0^{3/2} (2(1 + M_{f0}^2)_0 + M_0^2 (\gamma - 1))] / [2c_0^2 (1 + M_{f0}^2)_0^{3/2} (M^2 - M_{f0}^2 - 1)_0^{3/2}]$$

Since for real gases  $1 < \gamma < 2$ , it follows that  $C_2$  is positive.

Thus the behavior of the wave amplitude given by Eq. (19) of Ref. 1 depends critically on the sign of  $C_1$ . For instance:

1) When  $\text{sgn}(0) = -\text{sgn} C_2$ , then it follows that for  $C_1 > 0$ ,  $\lim_{s \rightarrow \infty} a(s) = 0$  (i.e., the wave damps out); and for  $C_1 < 0$ ,  $\lim_{s \rightarrow \infty} a(s) = C_1 / C_2$ , i.e., the wave ultimately takes a stable wave form.

2) When  $\text{sgn}(0) = \text{sgn} C_2$ , then i) for  $C_1 > 0$ , there exists a positive critical amplitude  $a_c$  given by  $a_c = C_1 / C_2$ , such that for  $a(0) < a_c$ ,  $a \rightarrow 0$  as  $s \rightarrow \infty$ ; for  $a(0) > a_c$ ,  $a \rightarrow \infty$  as  $s \rightarrow s_c$  (i.e., the wave culminates into a shock wave), where  $s_c$  is given by

$$s_c = \frac{1}{C_1} \ln \left( 1 - \frac{a_c}{a(0)} \right)^{-1}$$

and for  $a(0) = a_c$ ,  $a = a_c$ ; ii) for  $C_1 < 0$ , all waves, no matter how small be their initial amplitude, grow into shock waves at  $s = s_c$  (i.e.,  $a(s) \rightarrow \infty$  as  $s \rightarrow s_c$ ), where  $s_c$  is as given by

$$s_c = (1 / |C_1| (\ln 1 + (|C_1| / C_2) a(0)))$$

## References

- <sup>1</sup>Ram, R. and Pandey, B. D., "Propagation of Weak MHD Waves in Steady Hypersonic Flows with Radiation," *AIAA Journal*, Vol. 18, July 1980, pp. 855-857.
- <sup>2</sup>Jeffrey, A. and Taniuti, T., *Non-Linear Wave Propagation*, Academic Press, New York, 1964.

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## Comment on "Karman Vortex Shedding and the Effect on Body Motion"

P. K. Stansby\*

University of Manchester, Manchester, England

ERICSSON<sup>1</sup> refers to the writer's experimental investigation of the locking-on of vortex shedding due to the cross-stream vibration of a circular cylinder.<sup>2</sup> Locking-on

at submultiples of the cylinder frequency was reported and a physical explanation was given. However, Ericsson states that the locking-on at half the cylinder frequency (secondary locking-on), observed by the writer, was, in effect, an illusion. This is asserted because secondary locking-on was observed with an amplitude of vibration of 10% of a diameter but not with 29% of a diameter and locking-on had previously been shown to occur more readily with larger amplitudes. The term "locking-on" implies that cylinder motion controls the wake frequency and this definitely occurred (at the lower amplitude); the spectrum of the hot-wire signal outside the wake showed a narrow band at half the cylinder frequency and a marked increase in variance over a small range of cylinder frequencies. (Without locking-on the spectrum at the vortex shedding frequency shows a much wider band.) The mean base suction also showed a small but distinct increase.<sup>3</sup> That secondary locking-on was not observed at the larger amplitude was almost certainly because the frequency range for "stronger" tertiary locking-on (at one third of the cylinder frequency) had increased sufficiently to envelope the range for "weak" secondary locking-on.

## References

- <sup>1</sup>Ericsson, L. E., "Karman Vortex Shedding and the Effect on Body Motion," *AIAA Journal*, Vol. 18, Aug. 1980, pp. 935-944.
- <sup>2</sup>Stansby, P. K., "The Locking-On of Vortex Shedding Due to the Cross-Stream Vibration of Circular Cylinders in Uniform and Shear Flows," *Journal of Fluid Mechanics*, Vol. 74, April 1976, pp. 641-666.
- <sup>3</sup>Stansby, P. K., "Base Pressure of Oscillating Circular Cylinders," *Journal of Engineering Mechanics Division, ASCE*, Vol. 102, Aug. 1976, pp. 591-600.

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## Errata: Solution of the Three-Dimensional Navier-Stokes Equations on a Vector Processor

Lawrence W. Spradley,\* John F. Stalnaker,†  
and Alan W. Ratliff‡

Lockheed-Huntsville Research and Engineering Center,  
Huntsville, Ala.

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TWO page numbers in this article have inadvertently been switched. Page 1305 should be page 1306, and page 1306 is page 1305.

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\*Staff Engineer. Member AIAA.

†Scientist, Associate Research. Member AIAA.

‡Group Engineer.

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\*Simon Engineering Laboratories.