Technical Comments

Comment on "Does the Center of Flexure Depend on Poisson's Ratio?"

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DOES the center of flexure depend on Poisson's ratio? In his recent Note Leko[1] concludes that it does not, but a more accurate conclusion is that it all depends on how the center of flexure is defined. If the definition adopted by such authorities as Goodier,[2] Timoshenko,[3] and Sokolnikoff[4] is used, then the center of flexure definitely does depend on Poisson's ratio. This is evident from example calculations in the well-known treatises of Timoshenko[3] and Sokolnikoff.[4] On the other hand if Trefftz's[5] definition is used the center of flexure is independent of Poisson's ratio, as Trefftz pointed out in 1935. It is important to recognize that the Note under discussion is based on Leko's own definition of center of flexure, which is radically different from previous proposals.

Leko fixes the position of the center of flexure by introducing the requirement that "the resultant moment due to horizontal shear stresses is zero." This requirement differs sharply from traditional thinking in the classic problem of the center of flexure of a channel section. It is probably futile to argue about definitions, and interested readers will have to decide for themselves which of the various definitions of center of flexure is most natural or useful.

References

[1] Leko, T., "Does the Center of Flexure Depend on Poisson's Ratio?" *AIAA Journal*, Vol. 7, No. 6, June 1969, pp. 1187–1188.

[2] Goodier, J. N., "A Theorem on the Shearing Stress in Beams with Applications to Multicellular Sections," *Journal of the Aeronautical Sciences*, Vol. 11, No. 3, July 1944, pp. 272–280.

[3] Timoshenko, S. P. and Goodier, J. N., *Theory of Elasticity*, 2nd ed., McGraw-Hill, New York, 1951.

[4] Sokolnikoff, I. S., *Mathematical Theory of Elasticity*, 2nd ed., McGraw-Hill, New York, 1956, pp. 204–209 and p. 239.

[5] Trefftz, E., "Über den Schubmittelpunkt in einem durch ein Einzellast gebogenen Balken," *Zeitschrift fuer Angewandte Math. und Mech.*, Vol. 15, No. 4, 1935, pp. 220–225.

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Reply by Author to G. R. Cowper

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WESTERGAARD wrote on the subject of the center of shear, "One might surmise that all the simple laws in mechanics of materials that deal with the bending of beams had been discovered before the end of the nineteenth century. Yet one matter had been overlooked, and the principle involved was not discovered and clarified until the 1920's which is strangely late."

However, as we know now, the precise determination of the center of flexure has not been resolved up to this date and there are a great number of recent publications that identify the location of the center of flexure with many different points of the cross section of the beam, so that further investigation is still desirable.

Reference

[1] Westergaard, H. M. *Theory of Elasticity*, Dover, New York, 1964, p. 22.

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Comment on "Vortex-Shedding from Circular Cylinders in Sheared Flow"

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Nomenclature

- f = shedding frequency from one side of the cylinder
- D = cylinder diameter
- U = local mean velocity
- U_c = center-line velocity
- y = ordinate measured from the center-line
- H = height of the test section
- λ = shear parameter = $(U - U_c)/(y/H)$
- S = Strouhal number = fD/U
- R = Reynolds number = UD/ν
- ν = kinematic viscosity

CHEN and Mangione[1] recently presented a correlation of local Strouhal number with local Reynolds number for sheared flows which agreed within ±10% with Roshko's correlation, viz.

$$S = 0.212 - (4.5/R)$$

Because they obtained agreement with Roshko's[2] data in the absence of their shear-generating grid, they attributed the scatter in their data to the turbulence intensity (4%) generated by this grid.

In the course of our study of the influence of the free-stream turbulence parameters on local heat transfer from cylinders in cross-flow,[3] we studied the effect of freestream turbulence level on the Strouhal number of both circular and square cylinders. The study was conducted in the 11 in. × 11 in. test section of a low-speed wind tunnel. Smooth Plexiglass cylinders ranging in diameter from $\frac{1}{4}$ in. to 1 in. were used to obtain a Reynolds number range of 4000 to 10,000. In the test section, the oncoming velocity profile was found to be flat. The shedding frequency was measured by placing a hot-wire probe in the near wake (about 2 diameters downstream and 0.5 diameter off the axis) and auto-

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