Technical Comments

Comment on "Thermal Instability of a Viscosity Stratified Fluid Layer Heated from Below"

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THE paper by Chandra[1] is misleading in two respects. First, the author concludes that "if δ is positive, i.e., the viscosity is increasing upwards, the critical Rayleigh number is increased," which might lead the reader to think that some sort of stabilization process is involved. In fact, the author's results imply that the criterion for instability is unchanged, if the Rayleigh number is defined in terms of the mean viscosity (rather than the viscosity at the lower boundary).

The paper is also misleading in its neglect of virtually all of the literature on this subject published since 1955. Particularly pertinent here are the papers by Palm[2] and Jenssen,[3] who have carried out a calculation to a higher order of approximation than that found in Chandra's work, and have shown that variation of viscosity leads to a reduction in the critical Rayleigh number based on the mean viscosity.

In fact, the more interesting effects due to variation in viscosity are not brought out by linear stability analysis, but require nonlinear analysis. For a discussion of these effects, the reader is referred to Sec. 77 of the work by Joseph,[4] the paper by Booker,[5] and the references contained herein.

References

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[3] Jenssen, O., "Note on the Influence of Variable Viscosity on the Critical Rayleigh Number," *Acta Polytechnica Scandinavica*, Ph 24, 1963, pp. 1-12.

[4] Joseph, D. D., *Stability of Fluid Motions II*, Springer Verlag, Berlin, 1976.

[5] Booker, J. R., "Thermal Convection with Strongly Temperature-Dependent Viscosity," *Journal of Fluid Mechanics*, Vol. 76, Aug. 1976, pp. 741-754.

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Comment on "Extensions of Dual-Plate Holography Interferometry"

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THE authors[1] describe the application of dual-plate holographic interferometry to the flow over a cone. Figure 3 of their paper illustrates the comparison between analytical and experimental results. The agreement provides confidence in quantitative capability of holographic interferometry.

Similar accuracy was obtained ten years ago without the complexity of dual-plate holography. One example is reported in the Note by Holds and Fuhs[2]; this example is for a gas having $\gamma = 1.67$. Another example is reported in the paper by Fuhs.[3] The flow was in air at Mach 2.7 with a 40 deg cone.

For simple flow geometries such as conical flow, the complexity of dual-plate holography may not be necessary. However, for flows with more structure, e.g., Figs. 4 and 5 of Ref. 1, dual-plate holography offers distinct advantages.

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References

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[2] Holds, J. H. and Fuhs, A. E., "A Refined Analysis of a Holographic Interferogram," *Journal of Applied Physics*, Vol. 38, 1967, pp. 5408-5409.

[3] Fuhs, A. E., "Plasma Diagnostic Techniques," Paper 7-1 in AGARD *Conference Proceedings*, No. 38, Technivision Services, Slough, Bucks, England, 1970; also presented at the 1967 PEP AGARD Meeting.

Reply by Authors to A. E. Fuhs

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FUHS is correct in stating that "for simple flow geometries such as conical flow, the complexity of dual-plate holography may not be necessary." We would like to restate from Ref. 1 what we believe to be the key to the necessity for dual-plate (i.e., movable fringe) capability. "One of the main problems in quantitative production applications of interferometry is the basic lack of continuous data in conventional interferometric images. In any given image, only a limited number of fringes cross any line along which quantitative data are desired. The ideal situation would be the generation of a data curve giving fringe shift as a continuous function of position in the flow, but the number of data points in any single image precludes this possibility."

In the strictest sense this is not always true because, for very special flow cases (i.e., conical flows, etc.), fringe shift data from an entire image can be plotted on one curve due to the similarity of fringe shape as well as flowfield. Reference 2 demonstrates this "similar" property of fringe shape by plotting g/l (fringe shift function normalized by axial length at station of measurement) against R/r_c (radial position in flowfield, at axial station of measurement, normalized by body radius, at axial station of measurement). By employing this scaling, the fringe shift data from an entire conical flowfield can be plotted on one curve. In point of fact, Ref. 3,

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