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Readers' Forum

Brief discussion of previous investigations in the aerospace sciences and technical comments on papers published in the AIAA Journal *are presented in this special department. Entries must be restricted to a maximum of 1000 words, or the equivalent of one* Journal *page including formulas and figures. A discussion will be published as quickly as possible after receipt of the manuscript. Neither the AIAA nor its editors are responsible for the opinions expressed by the correspondents. Authors will be invited to reply promptly.*

Comment on "Infrared Imaging of Large-Amplitude, Low-Frequency Disturbances on a Planar Jet"

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WE read with great interest the article of Ref. 1, where the lateral spread of a rectangular, cold air jet was investigated by measuring with infrared imaging the temperature distribution on a fibermesh screen placed along the jet's axis. The research purpose was to improve the understanding on indoor air quality and thermal comfort in air-conditioned buildings.

The 70% porous fibermesh screen, chosen by the investigators, was most likely a good choice for preventing interference with the lateral pressure distribution along the axis of the jet, i.e., perpendicular to the screen. At the same time, it is almost certain that the jet's lateral spread and velocity distribution, which are the subject of investigation, were affected by the viscous interaction between the screen and the flow.

A less intrusive method for such investigations is the heated wire technique,[2] which in addition to the jet spread information, can produce velocity information as well. It can also simplify the test setup and save the need to use cooled air, because the heated wire technique is capable of detecting isothermal air motion, through its convective cooling effects The original setup, slightly modified to meet the needs of the investigation under discussion, is depicted in Fig 1. A long, bare wire, of appropriate electrical resistance to generate Ohmic heating, is looped side-to-side on a frame, replacing the screen used in Ref. 1. The wire is electrically heated, and the IR system is used to measure the temperature distribution along the wire. The jet velocity distribution can be deduced from Nusselt number correlations. The radiative properties of the wire can be calibrated, either by convectively heating the wire with a heat gun to a known temperature,[2] or by driving the current with a constant-temperature anemometer (CTA) under no-flow conditions. The diameter of candidate wires for this application should be of the order of 0.1 mm and the overheat level of a few degrees Kelvin above ambient to limit the physical and thermal intrusion to the minimum. Furthermore, by vertically spacing the wires, say, 100 wire diameters apart, good resolution is achieved for mapping the axial jet development, whereas the effects of the thermal and velocity wakes of each wire on following downstream wires are minimized.

This concept can be easily adapted to particular needs. In addition to electrical heating and convective cooling, nonmetallic wires, having higher emittances, can be convectively cooled or heated, as long as the gas participation is negligible.

It is regretful that no previous aerodynamic investigations performed with IR imaging, that are relevant to this research, are discussed in Ref. 1. Reference 3, a review paper of 115 publications on this subject, can be an useful starting point for users of IR imaging in aerodynamic research.

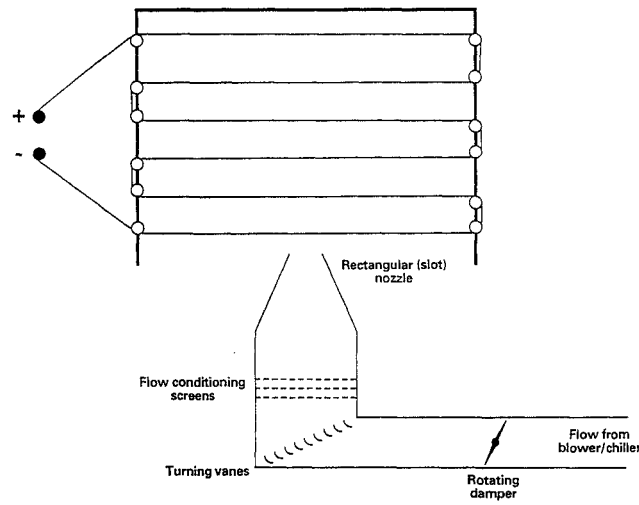

Fig. 1 Setup schematic,[1] modified for the heated wire technique[2] with original fibermesh screen replaced by a long electrically heated wire, looped side-to-side around a frame; spread of the jet, and possibly its velocity distribution, is inferred from the wires temperature distributions, measured with an IR imaging system.

References

[1]Farrington, R. B., and Claunch, S. D., "Infrared Imaging of Large-Amplitude, Low-Frequency Disturbances on a Planar Jet," *AIAA Journal*, Vol. 32, No. 2, 1994, pp. 317–323.

[2]Gartenberg, E., and Roberts, A. S., Jr., "Mapping Flowfields with a Heated Wire and an Infrared Imaging System," *Journal of Aircraft*, Vol. 28, No. 4, 1991, pp. 284–286.

[3]Gartenberg, E., and Roberts, A. S., Jr., "Twenty-Five Years of Aerodynamic Research with Infrared Imaging," *Journal of Aircraft*, Vol. 29, No. 2, 1992, pp. 161–171.

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THE authors wish to thank Gartenberg and Roberts[1] for their comments and suggested references. We examined a number of screens with different porosities and materials and found tha

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