VALIATION METHODOLOGY:
REVIEW AND COMMENTS

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ABSTRACT

A definition is suggested for computational aeroacoustics, and the role of validation methodology is briefly discussed. Some brief remarks are made concerning the subject session. The question is raised as to why it is especially appropriate in 1992 to contemplate the initiation of major research efforts in computational acoustics, and a list of possible reasons is given.

1. Introduction

Each session chairman participated in a panel discussion at the end of the Workshop and was asked to summarize his or her session and to provide his or her own critical views on the general subject of computational aeroacoustics. The present author chaired the session on Validation Methodology, which included seven papers.

2. A Definition of Computational Aeroacoustics

The advance announcements sent out by the conveners of this workshop, along with their selections of invited speakers and the manner in which they organized the program, suggest the following definition:

Computational aeroacoustics is the direct simulation of acoustic fields generated by flow and of the interaction of acoustic fields with flows. The phrase "direct simulation" is understood to imply that results are obtained by computation and that the methodology proceeds directly from fundamental physical principles without reliance on empirical results or heuristic conjectures. The scientific discipline of computational aeroacoustics includes the interpretation and application of such simulations.
The term "aeroacoustics" has been in widespread use for at least three decades and is used to refer to: (i) those aspects of acoustics associated with aerodynamics, (ii) the generation of sound generated by flow (alternately referred to as aerodynamic sound), or (iii) all acoustical topics (including those sometimes referred to as hydroacoustics) that simultaneously involve both flow and sound. In recent years, there has been a trend to prefix the adjective "computational" to any scientific discipline (e.g., computational fluid dynamics, computational mechanics, computational physics, computational acoustics) to distinguish any aspect of the discipline that either pertains or relies substantially on the use of computers. Within the context of the workshop, however, a more restricted definition, along the lines of that articulated above, seems appropriate. The reason for this is that a substantially new approach to aeroacoustics research is now becoming possible and we need to take stock of its prospects and its critical issues, and we need a short phase to distinguish this approach from other approaches. This new approach is that which conforms to the definition given above.

3. The Validation Methodology Session

A general concern is that, should direct simulation of aeracoustic phenomena become feasible, one be able to assess the extent to which such simulations are correct and realistic. Thus one needs a validation methodology. Because computational aeroacoustics, in the sense as defined above, is an embryonic discipline, the development of appropriate validation methodologies has not yet been given much attention. The seven papers in the subject session were presumably solicited with the intent that they collectively give some insight into the possible current options for validating direct simulation algorithms and of the possible directions for parallel research on validation methodology.

The diverse scope of the session is indicated by the following abbreviated mnemonic phrases which came to the chairman's mind after a cursory hearing of each of the seven talks: (i) three line vortices near a solid surface (Comte-Bellot), (ii) sound transmission out a duct through an elastic window (Courtier-Arnoux), (iii) noise from