Journal of Fluids Engineering

Editorial

Guidelines for Use of Commercial Software and Diagnostics in Articles for the Journal of Fluids Engineering

1 Introduction

This document seeks to supplement, but not replace, existing Journal of Fluids Engineering (JFE) author guidance for numerical accuracy and experimental uncertainty that may be found at (1) and provide helpful guidance to authors about how to judge the archival value and present their results from commercial software and diagnostics.

The past 10 years has seen a dramatic increase in the quality and usability of commercial software and diagnostics that were formally considered as topics of research. In particular, the advent of commercial computational fluid dynamics (CFD) [1–5] and software/hardware for particle image velocimetry (PIV) are two examples that have practically revolutionized the way fluids engineering is being performed. The question that this article attempts to address is "when does commercially available software or diagnostics no longer become of intrinsic "archival" value and how should they be used to generate archival information?" For example, using a commercial CFD code as a "black box" to produce engineering design results does not mean that the results are of archival value; however, using a commercial CFD code to explore new fluid physics or discover new fluid flow processes or phenomena when properly justified (i.e., the limitations of the approach are well understood by the authors) may indeed have archival value.

2 Discussion

Since much of this article depends on the meaning of the word archival, it is useful to explain what the word means in the context of a published journal article. Specifically, archival is the term used for a document (e.g., journal article) that contains unique information of reference value or new knowledge. The intent is that the information should have long term value and as such should be archived, hence archival, for others to access and reference. This definition does not mean that the information will not become superseded or perhaps be determined at a later date to be inaccurate, but rather that the information has an urgency of new and/or importance that makes it worthy of long term storage and dissemination. Perhaps, we can illustrate the archival concept with positive and negative examples.

Examples of archival information are as follows:

1. the discovery of a new gene
2. the development of a new algorithm or method to solve an important unsolved problem
3. the discovery of new fluid mixing processes or dynamics
4. the explanation of a complex process that has formerly remained unexplained
5. the formulation of a new correlation or formula that substantially improves (must be explained) over existing work
6. production of new novel design using existing or process data

Examples of "nonarchival" information are as follows:

1. use of computer software or a diagnostic to produce data, but then not provide explanation of the data, why it is important, and what the impact might be (e.g., solution to a long standing problem, an increased efficiency, or the development of unique new opportunities)
2. use of computer software or a diagnostic to produce new results, but then not explain why the diagnostic is correct (is it being used in its appropriate operating regime and are there corroborating experimental, computational, or theoretical results)
3. the production of engineering data for design purposes (as is often reported in the form of a "report" with little detailed discussion of any depth)

3 Guidelines

It is not reasonable to provide specific guidelines for use of every possible commercial software or diagnostic, so instead the focus is on CFD and PIV as current examples with the guidelines below being appropriate for both.

1. Details of the computational method may not be necessary when using a commercial CFD package, but details such as physical models, numerical methods, numerical accuracy, calculation details, and grid independence are necessary—simply running the code as a black box is not acceptable.
2. A reader must be convinced that any "new" results are, in fact, correct and do not suffer from misuse issues. This can be very problematical for a would-be author, but can be addressed by comparison with experimental data, verification test problems, previous work, and careful discussion—all might be needed (and also may apply to a noncommercial CFD code). Without this foundation, there is no reason to believe that the results are correct or archival.
3. Providing complex figures may be nice for a presentation to an audience or sponsor, but are often not scientific or quantitative (unless great care is taken in their presentation/discussion or they illustrate a novel aspect of the work), and rarely provide much detailed insight into the problem under consideration. The usual x-y plots are often more illuminating, but also require the author to spend more time thinking about what is important and why (which helps make the article more archival).
4. Simply reporting one parameter when, in fact, there are multiple parameters that self-interact suggests that the author does not understand the diagnostic, or its proper use, and also the basic elements of the flow itself (e.g., simply reporting pressure, and not associated velocity fields, might indicate a lack of basic understanding). The article should include a detailed description of the results, their consequences, and their importance (i.e., simply stating values or shapes does not warrant archival).
5. Nondimensional parameters serve not only to collapse data but they demonstrate an understanding of the basic parameters that control the processes of interest and form the basis

of generality that can underlie resulting archival value formulas. Not expressing results in nondimensional form substantially weakens the archival value, suggests that the author does not understand the fundamental flow physics, and also suggests that the results have no generality or archival value.

6. It is crucial to provide the applicable parameter ranges for the commercial software or diagnostic and ensure that they are met in the current application (e.g., this might mean answering the question about an appropriate use of a turbulence model, the Reynolds number range of the experiment, or the Stokes relaxation time of particle in the flow relative to the time scale of interest in the flow).
7. One small archival nugget might be appropriate for a conference paper, but an archival journal article needs more substance (i.e., several results of archival value or a result of major significance across a broad range of engineering or scientific communities).

4 Closure

We close by re-emphasizing that the development of commercial software and diagnostics has been a great boon for fluids research and engineering, but it brings with it an author responsibility to assess if their work is truly archival or more simply an engineering design study that may have only local (a company or client) interest with little broad based, long term, value.

However, we hope that the discussion provided herein, and the guidelines above, will help potential authors with their assessments, and perhaps the production of research results that will have archival value suitable for publication in a journal such as the ASME Journal of Fluids Engineering.

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