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Editorial Open Access

Benefit of an Open Access Fundamental Research in Turbulence for Aeronautical and Aerospace Industry

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A great deal of effort has been devoted to fundamental research in turbulence in fluid flows; the numerous publications in this area attest to the abundant results in this topic that benefits industry. If we consider only the area of canonical flows, the number of databases of experimental and numerical works is considerable. After many years of research on flows such as boundary layers and jets and homogeneous turbulent flows behind grids, there are still new publications and journals that continuously disseminate new results.

The experimental approach to turbulence in fluid flows has known real progress since the introduction of the Pitot tube H. Pitot. Hot and cold wire anemometry was developed to capture the motion of small scale structures and access quantities such as high order moments and dissipation. These quantities are key element in the study of turbulence theory [1,2]. Due to the need for more accurate experimental data without modifying the flow, non-intrusive techniques based on the progress of optical methods were developed. Among these techniques, Laser Doppler Velocimetry (LDV) and Particle Imaging Velocimetry (PIV) continue to produce valuable data and tend to capture the entire flow features in the entire turbulence cascade. If we consider only canonical flows, there is still a limitation of these techniques when the Reynolds number is high. Such flows are not easy to reproduce experimentally. Experiments in nature such as in the tidal channel between Vancouver Island and Canada's mainland were B. Stewart observed over several decades at $k^{-5/3}$ spectrum [3], are still not easy to perform. In flows such as turbulent jets, LDV is still the technique used by researchers to get highly resolved data particularly when high order moments are targeted. Since the work of George, it became clear that each database is intimately linked to the initial conditions used to produce it. This situation constrained the researcher in numerical simulations to have the same initial conditions.

Research in numerical simulations has benefited from the development of computers. In fact, solving the entire Navier-Stokes equations has become accessible either fully Direct Navier-Stokes Simulations (DNS) or partially Large Eddy Simulations (LES). High Reynolds number flows are still challenging when dissipative structures are very small compared to the large turbulence structures. Recent progress in LES has given new perspectives for canonical flows such as turbulent jets. Bogey and Bailly [4] used the experimental data of Panchapakesan and Lumley [5] for a jet at Re=1.1 × 104 and reproduced as much as possible the experimental initial conditions. They obtained very good agreement between their simulation and the experimental results for the budget equations for turbulent kinetic energy. A slight difference is noticeable in their dissipation term in the jet center line region. This difference leads to the question of: "how many initial conditions simulations are needed to be reproduced to ensure that comparison is adequate".

A large number of papers is published every year in scientific journals and made available to researchers via libraries. The research works published are often financed through public funds and funds from industry. Young faculty members are encouraged to publish in top journals. With the move of high level publishers to Open Access researchers will slowly get realize that Open Access does not mean second class publications. The benefit for researchers is that they can reach a large audience, have their work known by a greater number and be cited in more studies than they are presently with a limited number of readers.

What will be the benefit for the scientific community? If every publication is made available immediately to the entire scientific community in the field, it will reduce duplication and make available the real state of the art in fundamental research. This will allow researchers to be aware of the real issues and be more productive. The availability of good experimental databases to researchers in numerical simulation will create an environment for sound strong collaboration amongst researchers working in fundamental research. Social medial tools could also contribute to create scientific communities in addition to the ones that conferences generally create. Javier Jiménez quoted Theodor von Karman in his famous saying, "There is nothing more practical than a good theory" and added that modern analysis, simulation, and experiments are the tools that create a "good theory" [6].

Will industry benefit from the wide availability of publications to researcher? Considering that industry funds a part of the fundamental research in turbulence, it will benefit from the synergies that collaboration toward finding "good theories" creates. More efforts are probably needed to maintain interest in fundamental research in turbulence by encouraging and funding researchers. A good step forward is needed in developing new experimental tools and facilities and more adequate models and calculation power for numerical simulations.

Open Access fundamental research in turbulence for the aeronautical and aerospace industry can benefit from a wide dissemination of publications in the field and help the engineers to better design tomorrow's aircraft. In their efforts to reduce costs of building new machines by using more numerical simulations than experiment tools, fundamental knowledge in turbulence will lead to better models for simulating complex flows as found in aerodynamics and combustion. The benefit will be in reducing the costs in the design and fabrication processes but also in building efficient aircraft with reduced levels of pollution. An Open Access policy as the one promoted by OMICS Publishing Group and its Journal of Aeronautic and Aerospace Engineering contribute to the effort of attracting established

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researchers to share their work within the research community and peers. This will certainly help the aeronautical and aerospace industry in its effort to be cost effective and environmentally sound.

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