

Recent Advances in Mechanics, Mechatronics and Civil, Chemical and Industrial Engineering

- **Proceedings of the 2015 International Conference on Civil Engineering (CIVILENG 2015)**
- **Proceedings of the 2015 International Conference on Continuum Mechanics (COME 2015)**
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Zakynthos Island, Greece, July 16-20, 2015

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Plenary Lecture 1

Efficient Jet Noise Simulations



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Abstract: Jet noise is an important issue concerns for people living or working in the vicinity of airports, stringent noise regulations, and military operational requirements. Processing speeds and memory limitations of existing supercomputers limit the faithfulness of these simulations. Thus the simulations are not accurate enough to allow design and testing of noise reduction strategies. In order to simulate realistic situations very fine grids (e.g. on the order of tens of billions of points) are sometimes needed, requiring significant computational resources. Thus very efficient algorithms are needed. An efficient, petascale code has been developed based on the large eddy simulation (LES) technique. The code is a high-order multi-block structured solver capable of simulating both subsonic jets and supersonic jets with shock waves. Recent advancements have targeted improved prediction accuracy by enabling inclusion of nozzle geometries in simulations. A digital filter-based approximate turbulent inflow boundary condition is used. A wall model is employed in the nozzle walls to save computational time. Finally, a ghost-point-based immersed boundary method is implemented to allow simulation of complex nozzle shapes that show promise of noise reduction, e. g. chevrons, lobed mixers, beveling, and corrugations. We will show validation efforts and summarize future research directions.

Brief Biography of the Speaker: Dr. Lyrintzis' primary research interests are in the area numerical methods with applications in aerodynamics and aeroacoustics. His research endeavors have been supported by NSF, NASA, ARO, the US Navy and other agencies and industries. He has co-authored more than 180 refereed articles and he has advised 18 Ph.D. students. It should be noted that 7 of Dr. Lyrintzis' advisees are Professors at Universities and one has received the NSF CAREER award. Dr. Lyrintzis is an AIAA Associate Fellow, an ASME Fellow, and a Boeing Welliver Fellow. He has been a member of the AIAA Aeroacoustics Technical Committee (vice-chair 05-07, chair 07-09), the AHS Acoustics Committee, and the ASME Coordinating Group for CFD. He has co-organized the 10th AIAA/CEAS Aeroacoustics Conference, Manchester, UK, as well as many Sessions and Forums in AIAA, ASME and AHS Conferences and he is currently an Associate editor for the AIAA Journal and the International Journal of Aeroacoustics. Finally, Dr. Lyrintzis has participated in the development of award-winning (American Helicopter Society, Howard Hughes Award, NASA Group Achievement Award) TRAC (TiltRotor Aeroacoustic Codes) system of codes from NASA Langley.