World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:9, No:12, 2015

Using Scilab® as New Introductory Method in Numerical Calculations and Programming for Computational Fluid Dynamics (CFD)

Authors : Nicoly Coelho, Eduardo Vieira Vilas Boas, Paulo Orestes Formigoni

Abstract : Faced with the remarkable developments in the various segments of modern engineering, provided by the increasing technological development, professionals of all educational areas need to overcome the difficulties generated due to the good understanding of those who are starting their academic journey. Aiming to overcome these difficulties, this article aims at an introduction to the basic study of numerical methods applied to fluid mechanics and thermodynamics, demonstrating the modeling and simulations with its substance, and a detailed explanation of the fundamental numerical solution for the use of finite difference method, using SCILAB, a free software easily accessible as it is free and can be used for any research center or university, anywhere, both in developed and developing countries. It is known that the Computational Fluid Dynamics (CFD) is a necessary tool for engineers and professionals who study fluid mechanics, however, the teaching of this area of knowledge in undergraduate programs faced some difficulties due to software costs and the degree of difficulty of mathematical problems involved in this way the matter is treated only in postgraduate courses. This work aims to bring the use of DFC low cost in teaching Transport Phenomena for graduation analyzing a small classic case of fundamental thermodynamics with Scilab® program. The study starts from the basic theory involving the equation the partial differential equation governing heat transfer problem, implies the need for mastery of students, discretization processes that include the basic principles of series expansion Taylor responsible for generating a system capable of convergence check equations using the concepts of Sassenfeld, finally coming to be solved by Gauss-Seidel method. In this work we demonstrated processes involving both simple problems solved manually, as well as the complex problems that required computer implementation, for which we use a small algorithm with less than 200 lines in Scilab® in heat transfer study of a heated plate in rectangular shape on four sides with different temperatures on either side, producing a two-dimensional transport with colored graphic simulation. With the spread of computer technology, numerous programs have emerged requiring great researcher programming skills. Thinking that this ability to program DFC is the main problem to be overcome, both by students and by researchers, we present in this article a hint of use of programs with less complex interface, thus enabling less difficulty in producing graphical modeling and simulation for DFC with an extension of the programming area of experience for undergraduates.

Keywords : numerical methods, finite difference method, heat transfer, Scilab
Conference Title : ICFMT 2015 : International Conference on Fluid Mechanics and Thermodynamics
Conference Location : Sydney, Australia
Conference Dates : December 10-11, 2015