11th. World Congress on Computational Mechanics (WCCM2014)
5th. European Conference on Computational Mechanics (ECCM V)
6th. European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

ADVANCES IN COMPUTATIONAL METHODS FOR INVERSE PROBLEMS

PAUL E. BARBONE[*], DAN GIVOLI[†] AND ASSAD OBERAI[ᵡ]

[*] Dept. of Mechanical Engineering, Boston University
730 Commonwealth Avenue, EMA 221, Boston, MA, USA
barbone@bu.edu , http://www.bu.edu/me/people/faculty/ae/barbone/

[†] Dept. of Aerospace Engineering, Technion
Haifa 32000, Israel
givolid@aerodyne.technion.ac.il , http://ae-www.technion.ac.il/staff/pages/11

[ᵡ] SCOREC, Rensselaer Polytechnic Institute
CII 4015, Mail Stop CII 6015, 110 8th Street, Troy, NY 12180
oberaa@rpi.edu , http://homepages.rpi.edu/~oberaa/

Key words: Inverse Problems, Identification, Imaging, Bio-Medical Imaging, Non-Destructive Testing, Health Monitoring, Solid Earth Geophysics.

ABSTRACT

Inverse problems have been studied by members of the computational mechanics community for many years. However, in recent years computational methods for inverse problems have become more mature, and are starting to be employed in various real-world applications. These applications include biomedical imaging, where the goal is to quantify the spatial distribution of physical properties of tissue in the human body; imaging and identification in solid earth geophysics, with earthquake seismology and oil exploration being the two major examples; non-destructive testing (NDT), for the purpose of identifying flaws in structures (health monitoring); acoustical source (noise) identification; thermal source identification; and more.

The computational treatment of inverse problems presents unique challenges. Inverse problems are almost always ill-posed, and this fact has major consequences numerically. In addition, the computational effort associated with the numerical solution of an inverse problem is typically larger by an order of magnitude than that of the corresponding "forward" problem. Recently, some new and promising directions have been proposed for the solution of inverse problems, which have the potential of enhancing the tools available for real-life applications.

In this multi-session minisymposium, experts in computational techniques for inverse problems will discuss recent advances in the field. Although the presentation of work in diverse fields of application is welcome, an emphasis will be put on the general principles and on the computational aspects of the techniques discussed.