

SEMINARIO

MECANICA MATEMÁTICA

EXPOSITOR

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TITULO

DIMENSIONALLY ADAPTIVE METHODS (DAM) FOR THE SIMULATION AND INVERSION OF ELECTROMAGNETIC GEOPHYSICAL MEASUREMENTS

ABSTRACT

A number of three dimensional (3D) simulators of geophysical logging measurements have been developed during the last two decades for oil-industry applications. These simulators have been successfully used to study and quantify different physical effects occurring in 3D geometries. Despite such recent advances, there are still many 3D effects for which reliable simulations are not available. Furthermore, in most of the existing results, only partial validations have been reported, typically obtained by comparing solutions of simplified model problems against the corresponding solutions calculated with a lower dimensional (2D or 1D) numerical method. The lack of 3D simulation results (as opposed to 2D results) is due to major difficulties encountered when solving geometrically challenging problems. Namely, for mesh-based methods (Finite Elements, Finite Differences, Boundary Elements, etc.), the size of the system of linear equations becomes excessively large to be solved in real time.

When solving inverse geophysical problems (as opposed to forward simulation problems), the cost of computations dramatically increase, making the use of 3D simulators impractical. Often, even 2D simulators cannot be afforded due to their elevated computational cost.

In this presentation, we first explain how oil companies record different types of electromagnetic geophysical measurements. Then, we explain the main mathematical and computational difficulties associated to the simulation and inversion of such measurements. Subsequently, we analyze a number of mathematical features that a numerical method should possess in order to overcome the above challenges. Finally, we present a family of dimensionally adaptive methods that we are employing for solving such simulation and inversion problems.

One of the main objectives of this presentation is to raise the awareness and interest of the applied mathematics community on the topic, since its expertise is necessary in order

to solve several mathematical problems that still remain open in the area.

Keywords: computational electromagnetics, resistivity geophysical measurements, fast inversion.

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Jueves 22 de enero a las 16:00 hrs, Sala de Seminarios DIM, quinto piso, Beauchef 851, Torre Norte.