

## Summary of Projects Developed During 2006

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### **Simulation of Cross-Well and Borehole-to-Surface Measurements with One Cased Well .**

*D. Pardo, C. Torres-Verdin, I. Zhang, ,*

Using casing as a large source, we study via extensive numerical simulations the sensitivity of cross-well and borehole-to-surface measurements to the presence of oil layers in the formation.

**2006. Status: 100% completed**

Sponsors: Shell International E&P.

### **Integration of a Parallel (Distributed Memory) hp-Finite Element Code with a Self-Adaptive Goal-Oriented hp-Algorithm for Elliptic Problems .**

*M. Paszynski, D. Pardo, C. Torres-Verdin, L. Demkowicz ,*

The combination of a parallel (distributed memory) hp-FEM with a self-adaptive goal-oriented hp-algorithm for elliptic problems allow for large, accurate, and fast numerical simulations of relevant engineering applications.

**2006. Status: 100% completed**

Sponsors: Joint Industry Consortium on Formation Evaluation (C. Torres-Verdin).

### **Use of a Perfect Matched Layer for Simulation of 2D Through Casing Resistivity Logging Instruments with hp-Finite Elements .**

*D. Pardo, C. Torres-Verdin, L. Demkowicz, Ch. Michler ,*

In order to simulate 2D and 3D through casing resistivity tools, it is necessary to consider a large computational domain in the vertical direction. The size of the computational domain is drastically reduced (from 25000 m to 5 m) by using a perfect matched layer (PML).

**2006. Status: 100% completed**

Sponsors: Joint Industry Consortium on Formation Evaluation (C. Torres-Verdin).

### **Simulation of 3D Electrostatic Trough Casing Resistivity Logging Instruments in a Borehole Environment Using a Self-Adaptive Goal-Oriented hp-Finite Element Method .**

*D. Pardo, C. Torres-Verdin, L. Demkowicz, L. Tabarovsky ,*

In order to simulate 3D through casing resistivity tools (TCRT) at 0 frequency (electrostatic), it is necessary to resolve a partial differential equation with varying coefficients by up to 10 orders of magnitude. In addition, these problems contain several singularities, and they typically exhibit a large dynamic range (up to  $10^{13}$ ).

**2006. Status: 100% completed**

Sponsors: Baker-Atlas, Joint Industry Consortium on Formation Evaluation (C. Torres-Verdin).

### **Study, Design, and Implement a Goal-Oriented hp-Adaptive Algorithm for 3D Elliptic Problems .**

*D. Pardo, C. Torres-Verdin, L. Demkowicz, L. Tabarovsky ,*

For a number of electrostatic applications, an energy-norm based self-adaptive algorithm is not adequate. Frequently, the goal of our applications is not to minimize the energy-norm error.

Rather, we are interested in minimizing the error in a "quantity of interest". Thus, a goal-oriented self-adaptive algorithm has been developed for elliptic problems.

**2006. Status: 100% completed**

Sponsors: Joint Industry Consortium on Formation Evaluation (C. Torres-Verdin), Baker-Atlas.