

## Annual report VISTA 2011- Spring

### Project title: Reservoir monitoring and dynamic reservoir characterization with electromagnetic data (projects 6339/6340) - Task 2 (project 6340)

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Project duration:	<u>01.01.07 – 15.12.11</u>
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Project number:	6340

### **Objectives**

The project is a part of the Improved Oil Recovery research area. Its main focus is on qualification of use of time-lapse (4-D) controlled source electromagnetic (CSEM) data for reservoir monitoring in an idealized setting, with application also to dynamic reservoir characterization. Sub-task (project 6340): Analysis and derivation of discretization methods on non-orthogonal grids in 3-D for Maxwell's equations.

### **Status:**

There is ongoing work on analysis of full Maxwell's equations with emphasis on development of robust and efficient discretization methods. This includes a study of basic properties for discrete subspaces of  $H(\text{curl})$ . Some work has been on the discrete subspaces of the slightly simpler but strongly related  $H(\text{div})$  space. There is published work on discretization on general meshes, with polygonal cells, this includes a study of edges based interpolation functions for  $H(\text{curl})$  and  $H(\text{div})$ . Currently the scholar is working on a project of efficient preconditioning on  $H(\text{curl})$ . This work is related to general principles for preconditioning in  $H(\text{curl})$ , and the relationship to  $H^1$ . This opens for examining the additions needed to expand existing preconditioning codes developed for the Laplace operator to work on Maxwell problems.

### **Publications, spring 2011:**

- R.A. Klausen and A.F. Stephansen: Convergence of multi-point flux approximation on general grids and media. Accepted for publications in IJNAM, special issue for Magne Espedal, 2011.
- R. A. Klausen, S. S. Mundal, and H. K. Dahle: Barycentric coordinate based mixed finite elements on quadrilateral/hexahedral mesh. Inter. J. of Num. Analysis and Modeling, V 8, No 4, pp 584-598, 2011.  
<http://www.math.ualberta.ca/ijnam/Volume-8-2011/No-4-11/2011-04-03>.