

**Title:** Mathematical Challenges in Computing PDE Sensitivities

**Principal Investigators:**

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**Motivation:** Optimization in PDE-constrained systems has many applications in the oil and gas industry. PDE-constrained problems are usually characterized by very costly simulations. When embedded in an optimization framework, the cost and size of such systems often renders the optimization process intractable. The use of derivative-based methods (known for their relative efficiency compared to derivative-free methods) is critical in solving those challenging problems. Constructing sensitivities/derivatives in the context of PDE-constrained problems pose some mathematical and computational challenges.

**Objective:** The purpose of this research effort is to investigate the mathematical challenges related to computing sensitivities for a class of optimization and inverse problems related to reservoir simulation.

**Desired Background:** Mathematics, Petroleum Engineering, and Mechanical Engineering. Exposure to the analysis of partial differential equations is highly desired. Familiarity with derivative-based optimization methods would be useful.