# Stochastic Optimization of the Geological Sequestration of Carbon Dioxide

Brent Cody[1], Ana González-Nicolás, Domenico Baù
Department of Civil and Environmental Engineering, Colorado State University

**Abstract.** Geological sequestration has been identified as having potential to reduce increasing atmospheric concentrations of carbon dioxide ($CO_2$). However, a global impact will only be achieved if this technology is implemented on a massive scale. This work presents a methodology for finding optimal operational schemes for potential sequestration sites having uncertain physical parameters. This tool uses a semi-analytical algorithm to estimate leakage rather than a calibrated numerical model enabling application to potential sites having vastly different domain characteristics. A genetic algorithm is used to heuristically determine non-dominated solutions between the following competing objectives: 1) minimize project cost, 2) minimize risk, and 3) maximize mass of $CO_2$ sequestered. Parallel processing and archiving are employed to reduce computational cost. This framework has been developed into an application (*COSMOS: $CO_2$ sequestration simulation and multi-objective optimization software*) to visually display domain characteristics, pressure pulse and $CO_2$ plume propagation during simulation, and pareto-optimal tradeoff solutions. Due to the large set of assumptions made by the semi-analytical $CO_2$ leakage algorithm, this framework may only be used for initial site planning and characterization. Once full developed, this tool has the potential for initial screening and ranking of large sets of potential geological sequestration sites.

[1] Groundwater Hydrology Division
Civil Engineering Department
Colorado State University
Fort Collins, CO 80523-1372
e-mail: codybm@engr.colostate.edu