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Back calculation of source intensity and position based on a combined Genetic-Nelder Mead Simplex Algorithm

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In the pollutant control process, it is required to locate the source of pollution first, know the strength of the pollutant leakage source, in order to quickly and effectively prevent the further diffusion of pollution. Atmospheric diffusion model is widely used in traceability of pollutant leakage source. Through the inversion of this model, the source and intensity of leakage can be determined. However, it is always a challenging problem how to carry out reverse optimization quickly and accurately. No matter it is based on probability statistics theory or optimization theory, a single optimization method has its own unavoidable defects. In this study, the genetic algorithm and Nelder Mead simplex algorithm were combined. Firstly, the genetic algorithm was used to accurately narrow the search field, and then the Nelder Mead simplex algorithm was used to quickly obtain the optimal solution, effectively overcoming the defects of the slow convergence speed of the genetic algorithm and the poor convergence quality of the Nelder Mead simplex algorithm. Combined with the experimental data, it is found that the algorithm is fast and accurate in the traceability reverse calculation of the diffusion of pollutants in the atmosphere and the long-distance leakage of dangerous gases, which is not affected by the selection of initial values, and the optimization efficiency and robustness have been significantly improved.

Keywords: pollution control, atmospheric diffusion model, back calculation, genetic algorithm, Nelder Mead simplex algorithm

Biography:

Shiliang Zhang is Graduate student of Beijing University of Chemical Technology. He conducts research on Dangerous gas diffusion and pollution source traceability in Lab of Fluid Flow and Heat Transfer and IGCIT. His research fields include safety engineering, algorithm and Fluid mechanics.