Optimization of Source Identification Algorithm Derived from Moth-Inspired Plume Tracing Strategies

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Abstract - This paper presents a method of designing and optimizing a single chemical sensor-based source identification algorithm, derived from moth-inspired chemical plume tracing (CPT) strategies. In doing it, we define a source identification zone (SIZ) using last chemical detection points (LCDPs). Then, we optimize the proposed algorithm using a simulated plume with significant meander and filament intermittency by considering dynamics of a REMUS vehicle. The simulation studies show that for 1000 test runs the optimized algorithm achieves a success rate of over 90% in identifying source locations, an average identification time of 3-4 minutes, and an average error of identified source locations 1~2 meters in an operation area with length scales of 100 meters. In addition, we discuss an extension of the moth-inspired strategies to trace a plume and identify the odor source with static location in a three-dimensional space.

Index Terms - Autonomous underwater vehicles, odor source identification, chemical plume tracing, behavior-based control.