# Chaotic fractal search algorithm for global optimization with application to control design

## ABSTRACT

This paper presents chaos-embedded optimization algorithms named as Chaotic Fractal Search (CFS). These algorithms are improved variance to original Stochastic Fractal Search (SFS) algorithm. The influence of two chaos maps which are Chebyshev map and Gauss/Mouse map on the convergence speed and fitness accuracy of the SFS are investigated in this study. Two well-known benchmark test functions with different dimension levels and landscapes were employed in order to evaluate the performance of proposed CFS algorithms in comparison to their predecessor algorithm. Furthermore, the proposed approach is implemented in the optimal tuning of conventional PID and PD-type fuzzy logic controllers for a twin rotor system (TRS) in hovering mode. The simulation study indicates that CFS algorithm with Gauss/Mouse chaotic map in both Diffusion and First Updating process outperforms other CFS algorithms and original SFS algorithm. In addition, PD-type fuzzy logic controller shows superiority over PID controller in twin rotor system control design.

**Keyword:** Chaos maps; Chaotic fractal search; Fuzzy logic; PID controller; Twin rotor system