Matsushita, H.; Kurokawa, H.; Kousaka, T.

**Saddle-node bifurcation parameter detection strategy with nested-layer particle swarm optimization.** (English) Zbl 1448.65270

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Summary: Nested-layer particle swarm optimization (NLPSO) detects bifurcation parameters in discrete-time dynamical systems. Previous studies have proven the effectiveness of NLPSO for period-doubling bifurcations, but not for other bifurcation phenomena. This paper demonstrates that NLPSO can effectively detect saddle-node bifurcations. Problems in detecting saddle-node bifurcation parameters by conventional NLPSO are clarified, and are solved by imposing a simple condition on the NLPSO objective function. Under this conditional objective function, the NLPSO accurately detected both saddle-node and period-doubling bifurcation parameters regardless of their stability, without requiring careful initialization, exact calculations or Lyapunov exponents.

**MSC:**

- 65P30 Numerical bifurcation problems
- 65K10 Numerical optimization and variational techniques
- 37M20 Computational methods for bifurcation problems in dynamical systems
- 37G10 Bifurcations of singular points in dynamical systems

**Keywords:**

- bifurcation point detection; bifurcation analysis; initial value setup problem; discrete-time dynamical systems; particle swarm optimization (PSO)

**Full Text:** DOI

**References:**


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