Dynamics of multi-point singular fifth-order Lane-Emden system with neuro-evolution heuristics

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July 5, 2020

Abstract

Aim of the presented study is to investigate the numerical solution of fifth-order nonlinear Lane-Emden (LE) based singular system at the origin with different shape factors developed on the analogous pattern of standard second order LE equations. The stochastic neuro-evolution computing is exploited for numerical outcomes by using the artificial neural networks (ANNs) for applicable mapping and learning of decision variables with integrated meta-heuristics of genetic algorithms (GAs) for global search aided with the rapid local search of active-set (AS) i.e., ANN-GA-AS algorithm. The designed numerical computing approach ANN-GA-AS implemented effectively for solving fifth-order nonlinear LE singular system and results of statistical assessments further authenticate the accuracy, convergence, and stability.

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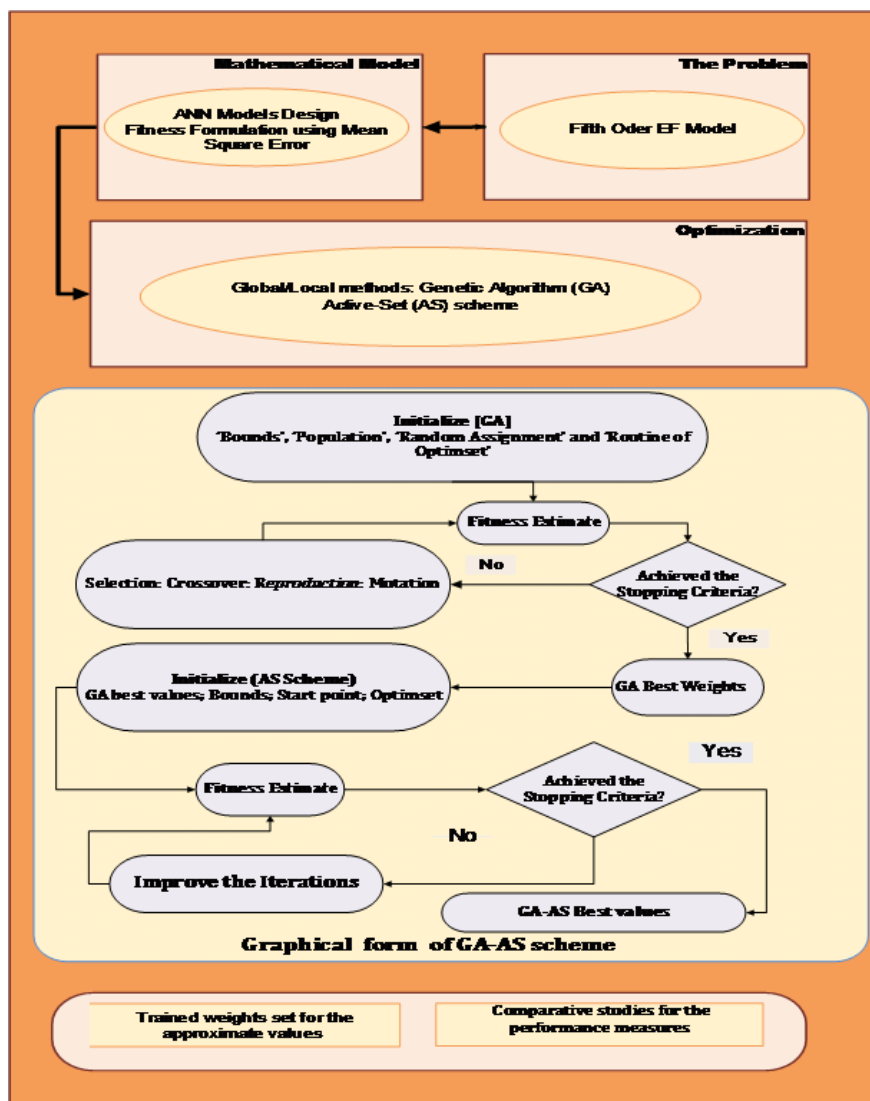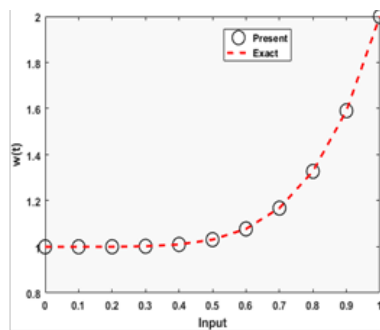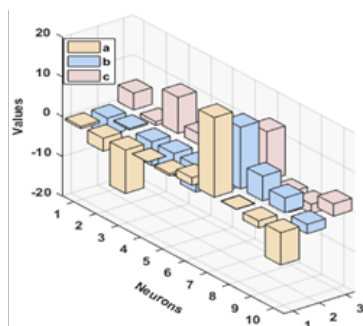
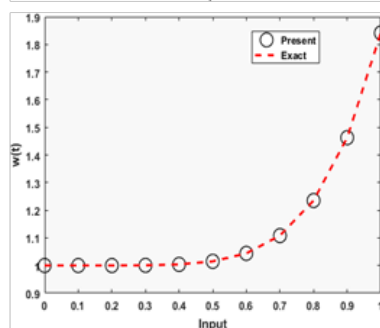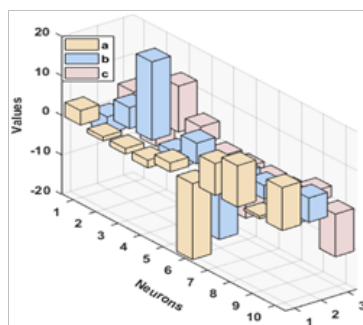**Fig 1:** Framework of the designed ANN–GA–AS scheme for solving the fifth-order EF model.

Fig .2. Set of weights and comparison of exact/proposed results for both the examples of fifth-order LE model of type 1.

(a) AE for both the examples of fifth-order LE model of type 1

(b) Performance indices for both the Examples of the type 1

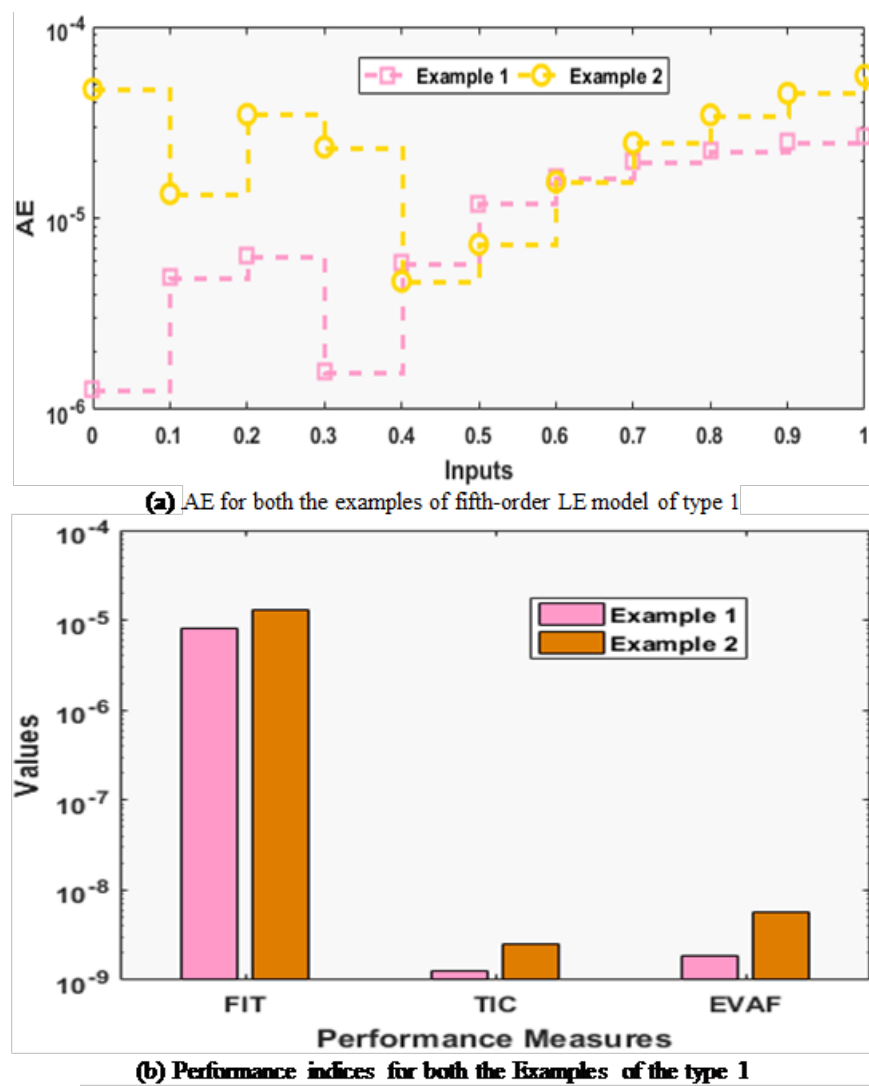**Fig .3.** AE and performance indices for both the examples of fifth-order LE model of type 1.