

## **Model order reduction method based on improved sine cosine algorithm**

*Mohd Zaidi Mohd Tumari<sup>a</sup>, Mohd Ashraf Ahmad<sup>b</sup>, Mohd Helmi Suid<sup>b</sup>, Mohd Riduwan Ghazali<sup>b</sup>*

<sup>a</sup> Universiti Teknikal Malaysia Melaka, Faculty of Electrical & Electronics Engineering Technology, Melaka, Malaysia

<sup>b</sup> Universiti Malaysia Pahang, Faculty of Electrical & Electronics Engineering Technology, Pekan, Malaysia

### **ABSTRACT**

This paper presents an improved sine cosine algorithm (iSCA) for the reduction of high-order single-input single-output (SISO) systems. The proposed iSCA is adopted to solve the imbalance portion of the exploration and exploitation stages in the standard sine cosine algorithm (SCA). Specifically, a nonlinear decreasing updated gain is adopted to provide a proper balance of exploration and exploitation stages. The proposed iSCA is expected to yield a most accurate reduced-order model for a particular original high-order system by minimizing the integral square error (ISE) between their system output responses. The effectiveness of the proposed technique is evaluated by reducing a 6<sup>th</sup> order double pendulum overhead crane model. The obtained simulation results revealed that the proposed iSCA is highly effective and remarkably consistent in obtaining an ideal reduced-order model compared to its original version.

### **KEYWORDS**

Improved sine cosine algorithm (iSCA); Meta-heuristics algorithm; Model order reduction

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