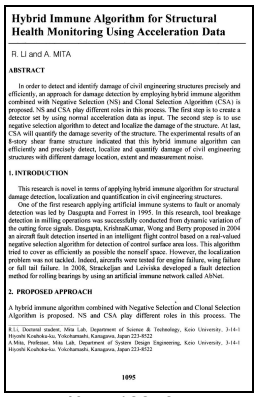

Hybrid Immune Algorithm for Structural Health Monitoring Using Acceleration Data

R. Li and A. MITA

ABSTRACT

In order to detect and identify damage of civil engineering structures precisely and efficiently, an approach for damage detection by employing hybrid immune algorithm combined with Negative Selection (NS) and Clonal Selection Algorithm (CSA) is proposed. NS and CSA play different roles in this process. The first step is to create a detector set by using normal acceleration data as input. The second step is to use negative selection algorithm to detect and localize the damage of the structure. At last, CSA will quantify the damage severity of the structure. The experimental results of an 8-story shear frame structure indicated that this hybrid immune algorithm can efficiently and precisely detect, localize and quantify damage of civil engineering structures with different damage location, extent and measurement noise.

1. INTRODUCTION

This research is novel in terms of applying hybrid immune algorithm for structural damage detection, localization and quantification in civil engineering structures.

One of the first research applying artificial immune systems to fault or anomaly detection was led by Dasgupta and Forrest in 1995. In this research, tool breakage detection in milling operations was successfully conducted from dynamic variation of the cutting force signals. Dasgupta, KrishnaKumar, Wong and Berry proposed in 2004 an aircraft fault detection inserted in an intelligent flight control based on a real-valued negative selection algorithm for detection of control surface area loss. This algorithm tried to cover as efficiently as possible the nonself space. However, the localization problem was not tackled. Indeed, aircrafts were tested for engine failure, wing failure or full tail failure. In 2008, Strackeljan and Leiviska developed a fault detection method for rolling bearings by using an artificial immune network called AbNet.

2. PROPOSED APPROACH

A hybrid immune algorithm combined with Negative Selection and Clonal Selection Algorithm is proposed. NS and CSA play different roles in this process. The

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Ключевые слова:

Содержание.

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