(Article: 30)

A SEARCH OF HIDDEN TREND IN FAILURE DATA OF INDIAN RAILWAY SIGNALLING SYSTEM

Debashis Sarkar[1*], Sankar Nayaran Patra[2], Subhash Chandra Panja[3], Simul Banerjee[3]

[1]Department of Mechanical Engineering, Asansol Engineering College, Asansol, India
[2]Department of Instrumentation Science, Jadavpur University, Jadavpur, India
[3]Department of Mechanical Engineering, Jadavpur University, Jadavpur, India
*aecpassport@gmail.com, aecdeba.me@gmail.com

ABSTRACT

Scaling analysis plays vital role to identify hidden dynamic patterns which could yield important insights into underlying failure data of South Eastern Zone (SEZ), Indian Railway (IR) signalling system. The statistical character of this failure may hold some distinct signatures of background influences. Here, power law scaling has been introduced to point out the dynamic behaviour of these signalling failure dataset collected from Santragachi Junction, SEZ, IR. The Hurst Exponent measurement has been used as a measure of the geometric (fractal) scaling for these signalling failure dataset. In this present study, break down failure data analysis is made of IR signalling system that cause irregular traffic movement with the objective of future failure prediction and maintenance scheduling so that safety and reliability can be achieved. The authors attribute the functional form of the scaling observed (Hurst Exponent, H= 0.17) in the failure pattern subjected to underlying nonlinear dynamics, which seem to be anti-persistent behaviour or short memory process. The approach, as introduced here, indicates a strong existence of multi periodic phenomena.

INTRODUCTION

The performance of signaling system can be measured in terms of its reliability [1, 2], availability, maintainability and safety [3, 4, 5]. The main objective is to improve signaling system performance, accommodate higher speeds of rolling stock, increased train density and to avoid deviation from the timetable. Any failure of signaling system and its subsystems cause delay, thus increasing the operating cost, maintenance cost and compromising safety. Being an electro-mechanical system, the railway signaling is interconnected with large number of components and lying under widely varying weather conditions. There are many factors, such as cable fault, loose packing, dry soldering, lamp fuse, high and low voltage in circuit, water logging and human error that influence the failure of signaling system.

Hence monitoring, inspection and detection of failure is required to reduce the operating costs by providing advanced warning of failure. Recent times, engineers and scientists are engaged to develop heuristic model to characterize failure pattern of the most important components like point machine, track circuits or even signaling system .They simultaneously have been trying to build up parsimonious stochastic prediction model to cop up right decision before havoc devastation or casualty. These kinds of researches seem to help not only mankind also minimize the financial expenditure of Indian Railway Board. In this paper, signaling system failure data has been collected in the period of 1st January, 2004 to 31st December, 2008, Santragachi Junction, IR. Santragachi Railway Station is a junction (Jn.) on South Eastern Railway having great importance as it is closely connected to two major terminal stations namely Howrah Jn. and Shalimar.

INTRODUCTION

It, itself plays multi-role as railway yard, terminal station where almost all non-stop and all stop trains from Howrah Jn. and Shalimar to South East India are departing and originating. Consequently, high degree of maintenances for failure free signaling system at this location is a continuous demand. The authors have gone through the entire data [Fig.1 (a)] of the failure events for Finite Variance Scaling Analysis [6, 7, 8].

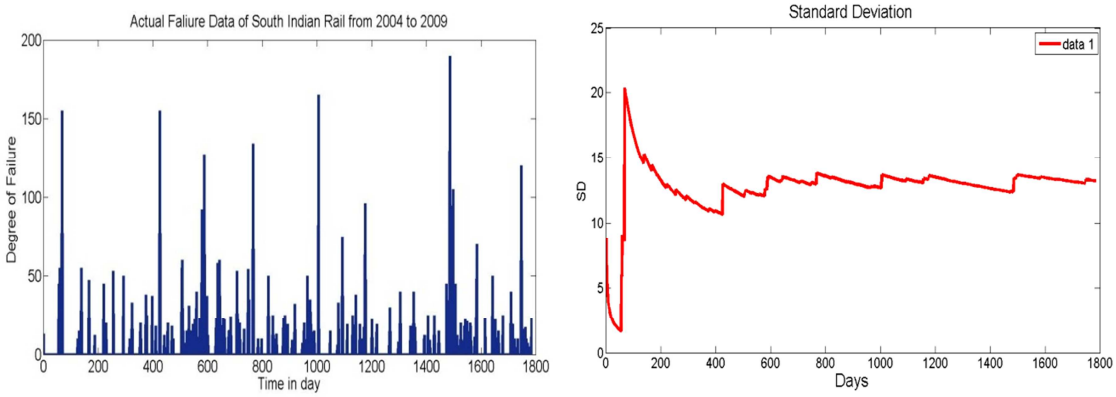

Fig 1:

a. *Signaling SystemFailure data from 1st January, 2004 to 31st December, 2008, IR*
b. *Standard Deviation Analysis*

For full paper ask the Author Or write to the Editor-in-Chief