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On Performance Analysis of IASEN–3 in Faulty and Non–Faulty Network Conditions

Ved Prakash Bhardwaj and Nitin, *Senior Member, IEEE**

Department of Computer Science & Engineering and Information & Communication Technology, Jaypee University of Information Technology, Waknaghat, Solan–173234, Himachal Pradesh, INDIA
ved.juit@gmail.com and delnitin@ieee.org

Abstract

This paper presents a new fault sustainable interconnection network (IN) called as Irregular Augmented Shuffle Exchange Network–3 (IASEN–3) and its routing algorithm. The Performance of IASEN–3 has been evaluated and compared with existing IASEN–2. The experimental results shows that IASEN–3 is more efficient than IASEN–2 in terms of throughput and processor utilization. These results are analyzed in faulty and non–faulty network environments.

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Keywords: Interconnection Network; Multistage Interconnection Network; IASEN–2; IASEN–3; Fault.

1. Introduction and Motivation

Presence of Multi–stage Interconnection Networks (MINs) in all parallel and distributed computing applications makes them fast and reliable. The efficiency, cost and various other factors makes it better and more robust than the other INs [1, 2]. Sometimes, MINs faces the faulty situations during data transmission process [2–5]. This situation may arise due to any link failure or any switch failure. Both conditions create disturbance in the network and degrade the performance of network [3–8]. This paper deals with the switch failure problem and presents a new IN named Irregular Augmented Shuffle Exchange Network–3 (IASEN–3). The IASEN–3 performs well in case of multiple faulty switching elements (SEs). The designed pattern of IASEN–3 is inspired by IASEN–2 [8] and therefore, performance of IASEN–2 is compared with IASEN–3 on

* Nitin Tel.: +91-1792-239-369; fax: +91-1792-245362.
E-mail address: delnitin@juit.ac.in

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the basis of various performance parameters. Data packets are transmitted through IASEN–2 [8] and IASEN–3 to a preset number of destinations. Results show that IASEN–3 has better throughput and processor utilization than the IASEN–2 [8] in faulty and non–faulty network scenario.

The rest of the paper is structured as follows: In section 2, structure of IASEN–3 is discussed. Section 3 shows the routing algorithm. In section 4, the performances factors are explained. Results are shown in section 5. At last, section 6 is followed by conclusion and references.

2. Proposed Interconnection Network

The structure of Irregular Augmented Shuffle Exchange Network–3 is based on IASEN–2 [8]. In Fig. 1, we can see that it has 16 sources and 16 destinations, hence the size of IASEN–3 is N =16. All the sources and destinations are tightly coupled with the complete network through multiplexers (Mux) and demultiplexers (Demux). This is a 3–stage MIN. In first and last stage, each source or each destination is connected with three switching elements (SEs) of that particular stage e.g. source 11 is connected with SE *f*, *a* and *d* and therefore *f*, *a* and *d* are the primary, first alternate and second alternate SEs for source 11. Similarly, we can find out the primary, first alternate and second alternate SEs for other sources and destinations. The size of each SE in first and third stage is 2×3 and 3×2 respectively. In stage 2, the size of each SE is 8×8.

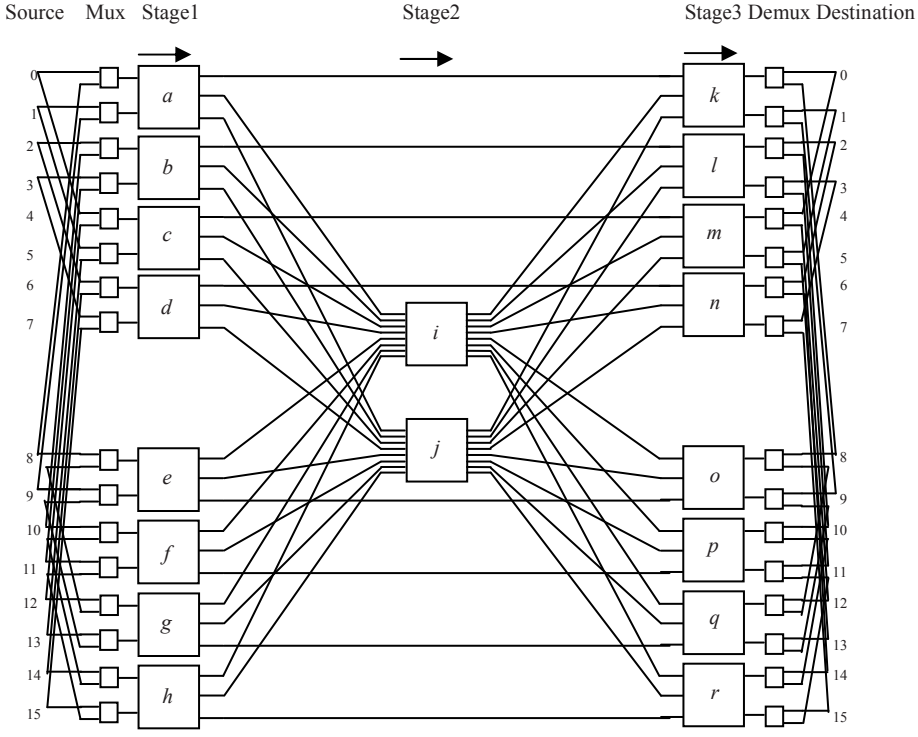

Fig. 1. irregular augmented shuffle exchange network–3

3. Routing Algorithm of IASEN–3

In the routing algorithm of IASEN–3, if request arrives at the primary SE of first stage (PSE_1) or primary SE of third stage (PSE_3), then we have to check that SE. If it is busy or faulty (FBY) then first alternate SE