Numerous tasks which require the computation power and alacrity are made possible by parallel processing. Parallel computing is the simultaneous processing of different tasks by two or more processors by dividing the job among multi processors with the objective of running a program in lesser time. To accomplish excellent parallel processing, the development of more proficient and cost-effective parallel systems is required. This can be achieved by a single computer with more than one central processing unit named as multiprocessors, or by multiple computers connected together to a network. Parallel systems need the processors, memories and switches to communicate with each other. The edifice of large scale parallel and distributed processing is feasible in the era of VLSI. Multistage Interconnection Network (MINs) plays a vital role in the multiprocessor systems and it is the mechanism to provide faster interaction among the processors and processor-memory modules. The performance of MINs is measured in terms of probability of acceptance, bandwidth, path length, fault tolerance, cost-effectiveness, routing, reliability and permutation passable.

In order to improve the performance, three new Irregular class of Multistage Interconnection Networks named New Four Tree (NFT), IFT (Improved Four Tree) and Improved Irregular Augmented Shuffle Network (IIASN) have been proposed in this work. The proposed NFT Network is based upon FT, QT, MFT, PHI and HZTN-2 networks to improve the performance of existing networks. The other proposed Network is an Improved Four Tree (IFT) Network that has been designed in such a way to further improve the performance of NFT and FT Networks. The third proposed IIASN is based on IASN network. The IIASN network can provide a “full access” capacity in the presence of multiple faults. A Simulator has been designed in .Net environment to measure the performance of various networks by implementing the various popular analytical models like approximation model, probabilistic approach and cost effective model. The various algorithms have been designed for the proposed networks for evaluation to assess the path length, routing tags, cost-effectiveness, permutation passable and bandwidth.
The simulation results indicate that the proposed networks achieve a significant improvement in terms of path length, cost, reliability, bandwidth, probability of acceptance and permutation passable over other popular existing irregular MINs like FT, QT, MFT, PHI, HZTN-2 and IASN. The structural characteristics of proposed NFT and IFT have been improved by reducing the conjugate loop switch by $\log_2 N - 2$ and $\log_2 N$ respectively of existing FT Network. Similarly, the performance of proposed IIASN network has been improved by reducing the conjugate loop switch by $\log_2 N$ in comparison to existing IASN network. The Mean Time to Failure (MTTF) of proposed NFT and IFT networks has been improved by reducing the number of switches of existing FT and MFT networks. The cost of proposed NFT network has been reduced by $N+2$ and $2*N+4$ units in comparison to FT and MFT. Further the cost of IFT has been reduced by $N/4$ in comparison to NFT. The cost of IIASN which is based on IASN has been reduced by $2*N-4$ units.

The bandwidth of proposed NFT and IFT networks has been improved by removing the bottleneck switches from the existing FT. The bandwidth analysis of IIASN has also been computed and compared with IASN in order to measure the performance of Network. Path length of the existing networks has been improved by removing the interior switches and numerous links. An IIASN network has been found to be better than IASN, FT, MFT, PHI, NFT and IFT networks in terms of path length, the simulated result shows that from a source to all its destinations it has at least two paths of different path lengths available; the same are not obtainable in any of these networks. The percentage of requests successfully granted in the presence or absence of a single fault or multiple faults in proposed networks is also computed and compared with existing Irregular Networks. In short, the proposed MINs have many better features than those in existing Irregular Dynamic Multistage Stage Interconnection Networks.