ABSTRACT

Recent advances in hardware and software have made **parallel processing** a viable and attractive approach for the solution of computationally intensive problems. The various issues related with parallel processing are hardware, software, algorithm and performance evaluation. The literature review indicates that there is increasing interest among researchers in use of available parallel computers and development of algorithms for various engineering applications. In the present research work, it has been planned to deal with various structural engineering problems, which are highly computational intensive.

Multiprocessors are classified as **tightly coupled system** or **loosely coupled system**. In tightly coupled system, numbers of processors are connected together cooperating closely on the solution to a problem and are accommodated in same system. They are sharing common pool of memory or having their own memory and accordingly they are known as shared memory or distributed memory multiprocessors. The supercomputers are the example of such systems. In loosely coupled systems number of processors or computers, not necessary identical, are connected through communication network. The supercomputers are very costly, difficult to maintain and their use require knowledge of hardware, software and operating system. This has restricted their use in the research institutes. On the other hand, the advances in networking and communication technology have increased the popularity of loosely coupled system or multi computer system, which is also known as, **distributed computing**. As network of computers are available in most of the organizations, computational intensive problems can be solved economically and efficiently using distributed computing.

From the literature review, it is found that majority of applications have been dealt either using supercomputers or using network of workstations and **message passing libraries**. As structural engineers are not exposed to these kinds of tools they find it difficult to use parallel and / or distributed computing for their application. The main objective of the present work, therefore, is to find not only the cost effective alternative but to evolve a methodology by which any user can develop distributed computing application very easily. **WebDedip** (Web enabled Development Environment for Distributed Image Processing), which has been developed using **JAVA** technology is explored in the present work for

distributed data processing applications. In use of WebDedip, the user has to simply visualize the parallel or distributed computing potential of application and accordingly divide it into number of small tasks. These tasks are performed on various computers connected through network and communication between them is done through intermediate files using File Transfer Protocol (**FTP**). The aim is to investigate issues related to and various paradigms available for distributed computing and in particular application of WebDedip environment to real life problems.

The use of network of computers either in form of Local Area Network (**LAN**) or **internet** is explored through various applications. Algorithms suitable for various applications are studied and are programmed in **VC++**. For structural analysis use of **substructure technique** for distributed implementation is explored. Variation of computational efficiency with respect to number of computers in various applications is considered in addition to examining parameters affecting the computational efficiency critically. Utilization of computational resources through internet, which is emerging research area, is also discussed with an application.

After giving historical account of developments in computer generations and issues related to parallel implementation of structural analysis problems in **Chapter 1**, literature review is covered in **Chapter 2**. Basic issues related to parallel processing are covered in **Chapter 3**, while detailed discussion about WebDedip environment and its use for development of distributed application is discussed in **Chapter 4**. Feasibility of WebDedip environment in structural analysis is explored in **Chapter 5**. Implementation of static finite element analysis over distributed computing environment and its performance is subject matter of **Chapter 6**. Distributed dynamic analysis of two dimensional rigid jointed structure is covered in **Chapter 7**. Application of distributed processing in training of Artificial Neural Network is included in **Chapter 8**. Use of internet in distributed computing is discussed in **Chapter 9**. Optimization of structure using biologically inspired Genetic Algorithm is implemented over distributed processing in **Chapter 10**. Distributed finite element analysis of composite laminated material is covered in **Chapter 11**. Implementation of nonlinear analysis over distributed environment is discussed in **Chapter 12**. Finally, **Chapter 13** highlights conclusions, contributions and future scope of present work.