



## **TEXT BOOKS:**

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4<sup>th</sup>. Edition, 2007.
2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, 2011.
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
4. David B. Kirk and Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kaufmann, 2010.

## **REFERENCES:**

1. Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", Second Edition, Pearson Education Limited, 2003.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
3. Ian Foster, "Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering", Addison Wesley Longman Publishing Co., USA, 1995.
4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/ Software approach" , Morgan Kaufmann / Elsevier Publishers, 1999.
5. OpenMP Programmer's Manual.
6. MPI Programmer's Manual

Lab Objective. The objective of this lab is to develop a parallel program for matrix multiplication. The lab assignments include:

- Exercise 1 • State the matrix multiplication problem.
- Exercise 2 • Code the serial matrix multiplication program.
- Exercise 3 • Develop the parallel matrix multiplication algorithm.
- Exercise 4 • Code the parallel matrix multiplication program.

Estimated time to complete this lab: 90 minutes.

According to the parallel computation scheme described in Exercise 3, it is necessary to arrange the available MPI program processes as a virtual topology in the form of a two-dimensional square grid in order to carry out the Fox algorithm efficiently. It is only possible that the number of the available processes is a perfect square.

### Parallel Programming Implementations.

There are two popular approaches for adding parallelism to programs. You can use either

- To implement parallelism, you can use any parallel framework you are familiar with. The high-level parallel frameworks available for each programming language include: Language. Available High-Level Parallel Frameworks. These parallel abstractions are made available to programmers as high-level programming constructs with a well-defined functional and extra-functional semantics. ...
- However, in the context of a single multi-core node where the performance metric is the primary optimization objective, the "pure" Actor Model is generally not used because Actors cannot exploit the physical shared-memory, thus reducing the optimization options. In this work, we propose to enrich the Actor Model with some well-known Parallel Patterns to face the performance issues of using the "pure" Actor Model on a single multi-core platform.