

Courses 2015-16

May 16-20, 2016

From 15:00 - 17:00 (10 hours)

BCAM Mazarredo 14, 48009 Bilbao, Basque Country, Spain www.bcamath.org

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INTRODUCTION TO PARALLEL PROGRAMMING

The aim of this course is to provide only a very quick overview of the extensive and broad topic of Parallel Computing. As such, it covers just the very basics of parallel computing, and is intended for someone who is just becoming acquainted with the subject and who is planning to expand his knowledge in this field. It is not intended to cover Parallel Programming in depth, as this would require significantly more time. The course begins with a discussion on parallel computing, what it is and how it is used, followed by a discussion on concepts and terminology associated with parallel computing. The topics of parallel memory architectures and programming models (MPI and OpenMP) are then explored. Finally, newer and upcoming parallel computing architectures (GPUs and Intel Xeon Phi) and its associated programming models are mentioned. All concepts and technologies explored are put into practice in a series of hands on sessions.

PROGRAMME

Session 1: Introduction	Session 2: MPI	Session 3: OpenMP	Session 4: Newer and upcoming technologies
<ul style="list-style-type: none">• HPC hierarchy	<ul style="list-style-type: none">• Point-to-point communication, collective communication	<ul style="list-style-type: none">• Parallel and work-sharing constructs	<ul style="list-style-type: none">• Architectures: GPUs, MICs, FPGAs
<ul style="list-style-type: none">• History of HPC	<ul style="list-style-type: none">• Blocking and non-blocking communication	<ul style="list-style-type: none">• Synchronizations mechanisms	<ul style="list-style-type: none">• Programming models: MPI-2, OpenCL, OpenAcc, DSLs
<ul style="list-style-type: none">• Why is it necessary?	<ul style="list-style-type: none">• Communicators, topologies	<ul style="list-style-type: none">• Tasking constructs	Hands-on
<ul style="list-style-type: none">• From grids to cores	<ul style="list-style-type: none">• Derived data types	<ul style="list-style-type: none">• Hybrid programs with MPI/ OpenMP	
<ul style="list-style-type: none">• Parallelism paradigms	<ul style="list-style-type: none">• Tips & Tricks	<ul style="list-style-type: none">• Tips & Tricks	
	Hands-on	Hands-on	

Session 5: Hands-on

REFERENCES

- Lawrence Livermore National Laboratory [MPI](#) and [OpenMP tutorials](#) / • OpenMP 4.0 [complete specifications](#) / • MPI 1.3 [complete reference](#) / • Kernighan, B. W. & Ritchie, D. M. (ed.) The C Programming Language. Prentice Hall Professional Technical Reference, 1988 / • Cormen, T. H.; Leiserson, C. E.; Rivest, R. L. & Stein, C. Introduction to Algorithms, Third Edition. The MIT Press, 2009 / • Rauber, T. & R nger, G. Parallel Programming - for Multicore and Cluster Systems. Springer, 2010

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