

CO405H

Computing in Space with OpenSPL

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<http://www.doc.ic.ac.uk/~oskar/>
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CO405H course page:

WebIDE:

OpenSPL consortium page:

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<http://openspl.doc.ic.ac.uk>

<http://www.openspl.org>

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Aims and Objectives

- **Understand the basics of Computing in Space:**
 - the fundamental methods and techniques
 - the multiple dimensions of computing
 - main differences with temporal computing
- **Learn how to address design implications:**
 - at application and algorithmic levels
 - by solving system-level bottlenecks
 - by customizing data choreography
 - using arithmetic level optimizations
- **Become proficient in:**
 - splitting optimally applications into controlflow and dataflow
 - implementing and debugging high-performance parallel algorithms in space
 - reasoning about spatial complexity of algorithms, arithmetic and data moves
 - computational area and bandwidth trade-offs to improve performance
 - achieving maximal performance on a specific spatial computer implementation
- **Have fun!**

Reading List

- **Validity of the single processor approach to achieving large scale computing capabilities**, Gene M Amdahl, AFIPS spring joint computer conference, IBM Sunnyvale, California, 1967.
- **Some Computer Organizations and Their Effectiveness**, Michael J Flynn, IEEE Trans. Computers, C-21 (9): 948-960, Sept 1972.
- **Computer Architecture: Pipelined And Parallel Processor Design**, (Chapters 1-7) Michael J Flynn, May 1995.
- **iWarp: An integrated solution to high-speed parallel computing**, S. Borkar, R. Cohn, G. Cox, S. Gleason, T. Gross, H. T. Kung, M. Lam, B. Moore, C. Peterson, J. Pieper, L. Rankin, P. S. Tseng, J. Sutton, J. Urbanski, and J. Webb. In Proceedings of IEEE/ACM SC '88, pages 330-339, Orlando, Florida, November 1988.
- **Decoupled access/execute computer architectures**, J. E. Smith, Computer Systems, ACM Transactions on; Volume 2, Issue 4, pp 289-308, November 1984.
- **OpenSPL Specification, v1.0**, <http://www.openspl.org>
- **Sparse Coefficient polynomial approximations for hardware implementations**, N. Brisebarre, J. M. Muller and A. Tisserand, In Proc. of 38th Asilomar Conference on Signals, Systems and Computers, pp. 532-535, California, USA, 2004.
- **Moving from Petaflops to Petadata**, Communications of the ACM, Vol. 56 No. 5, May 2013.
- **Finding the Right Level of Abstraction for Minimizing Operational Expenditure**, Workshop on High Performance Computational Finance at SC11, November 2011.
- **Rapid Computation of Value and Risk for Derivatives Portfolios**, Concurrency and Computation: Practice and Experience, Special Issue Paper, July 2011.
- **Beyond Traditional Microprocessors for Geoscience High-Performance Computing Applications**, IEEE Micro, vol. 31, no. 2, March/April 2011.

Prerequisites: Java, Computer Architecture I, Logic Design, Algorithms and Data Structures

Assessment

- unassessed practice test (formative assessment only)
- 'driving test' (individual project) (20%)
- final 'main test' (80%)
- self-assessment using unassessed exercises (with model answers)
- the course “live” webpage will be made available this week