# CO405H

## Computing in Space with OpenSPL

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http://www.doc.ic.ac.uk/~oskar/
http://www.doc.ic.ac.uk/~georgig/

**CO405H course page:** http://cc.doc.ic.ac.uk/openspl15/
**WebIDE:** http://openspl.doc.ic.ac.uk
**OpenSPL consortium page:** 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.
- **A Data Centric Perspective on Memory Placement,** MEMSYS 2015


**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 shortly