



## *Ph.D. programme in Mathematics and Computer Science*

**Title:** SAT-Based Problem Solving

**Speaker:** Prof. Joao Marques-Silva

**Abstract:** The success of SAT solving is underscored by the widespread use of SAT solvers in practical applications. Whereas many practical applications can be cast as decision problems, for which a single query to a SAT oracle suffices, for many other applications, SAT oracles are called multiple times. Moreover, many computational problems are naturally formulated as function (or search) problems, and can be solved with a number of queries to a SAT oracle. This course overviews problem-solving based on multiple queries to a SAT oracle, focusing on approaches for solving function problems. Finally, the talk outlines a number of research topics in the area of problem solving with SAT oracles.

### **Organization:**

**Part I:** Introduction to SAT solving

CDCL SAT solvers, function problems related with SAT, e.g. MUSes, MCSes, minimal models, backbones, autarkies, etc.

**Part II:** SAT-based function problem solving

Algorithms for function problems, relationships among function problems, query complexity results, etc.

**Part III:** Solving optimization problems with SAT

Overview of recent MaxSAT algorithms and related optimization Problems.

**Short Biography:** Joao Marques-Silva received BSc and MSc degrees in computer engineering from IST/Technical University of Lisbon, Portugal, in 1988 and 1991, respectively, a PhD degree in electrical engineering and computer science from the University of Michigan, Ann Arbor, MI, USA, in 1995, and the Habilitation degree in computer science from the Technical University of Lisbon in 2004. He is currently Stokes. Professor of computer science and informatics, University College Dublin (UCD), Belfield, Dublin, Ireland, and a Full Professor with IST/INESC-ID, Lisbon, Portugal. Before joining UCD, he was with the University of Southampton, Southampton, U.K. Dr. Marques-Silva current research interests include decision and function procedures, using SAT, QBF and SMT, analysis of over-constrained systems, applied formal methods, applications in software engineering, including model checking, testing, debugging and security, and applications in artificial intelligence, operations research, design automation and bioinformatics. Dr. Marques-Silva serves as section editor of JSAT and as associate editor of Integration. He is a senior member of the IEEE and a member of the ACM. Dr. Marques-Silva was a recipient of the 2009 CAV Award for fundamental contributions to the development of high-performance Boolean satisfiability solvers.