Keynote I

Middleware for Pervasive and Cyber-Physical Systems

Prof. Gurdip Singh
Kansas State University, USA

Abstract

Middleware typically provides abstractions for common tasks such as atomicity, synchronization and communication with the intention of isolating the developers of distributed applications from lower-level details of the underlying platforms. Although one would like to develop generic middleware services which can be used in a variety of different applications, efficiency considerations often force developers to design middleware and algorithms customized to specific operational contexts. In this talk, we will describe our efforts to develop a comprehensive framework for automated customization of distributed algorithms and middleware. That is, given a generic algorithm or a middleware service, how can it be automatically customized for a specific distributed application? We will focus on developing techniques to design middleware amenable to customization, techniques for specify and identify customization opportunities, and code transformations techniques to perform the customizations. We also discuss the challenges poised in designing middleware for pervasive sensor networks and cyber-physical systems.

Keynote II

Modeling, Simulation, and Integrated Design of Complex Dynamic Systems – Challenges, Benefits, and Trends

Prof. Atul G. Kelkar
Iowa State University, USA

Abstract

With increasing complexity of dynamical systems in all areas of science and engineering the need for faster and more efficient computational tools is more than ever. This talk is aimed at taking a closer look at the computational needs, challenges, and future trends in modeling, simulation, and design capabilities needed in the globally competitive environment. The dynamical systems are becoming increasingly multidisciplinary in nature and modeling of such systems requires integration of multiple discipline-specific computational tools. Markets are becoming highly competitive in the global economy and the demand for low cost engineering solutions is very high. There is a need for developing simulation capabilities that are robust, reliable, efficient, and economical. The talk will give an overview of various considerations that have to go into selection and/or design of a computational infrastructure for modeling and simulation of complex dynamic systems. The trends in industry for handling computationally intensive tasks will also be discussed. An example from an industry will be presented to highlight the practical aspects and potential solutions to address the computational needs in modeling, simulation, analysis and synthesis processes involved in designing a product. A virtual reality simulation of few example systems will also be presented.
Keynote III

Recent Research Trends in Quantum Algorithms and the Related Circuit Synthesis

Prof. Amlan Chakrabarti
Princeton University, USA

Abstract

Quantum Computing is an interesting area of research where the process of computation is performed using atomic scale matters. It has also been proved that in quantum computing domain computational problems can be solved in less amount of time compared to that of classical computing machines. A quantum algorithm is defined by a sequence of operations that runs on a realistic model of quantum computation. Since the first quantum algorithm proposed by David Deutsch (1985), a large number of impressive quantum algorithms have been developed. In this tutorial I will discuss the following issues related to the recent trends in Quantum Algorithms and Circuit Synthesis Techniques:

- Introduction to some new quantum algorithms.
- The quantum finite state machine model.
- Quantum Circuit design for the new algorithms.
- CAD for Quantum Circuit Synthesis.
- Related Implementation Issues.
- New trends in quantum multi-valued logic design.

Keynote IV

Big Data Technology and Future Scenario

Deepak Garg
Thapar University
Patiala, India

Abstract

World will have data in Yotta byte in 2020 which is $2^{80}$. Amount of data being generated is now exceeding the physical limits of storage devices available with many organizations. The percentage of the amount of data they are able to process is decreasing day by day. This kind of situation is leading to data conundrum where these organizations are not able to use their data for the purpose of analysing and understanding their future business requirements. Now IBM, Microsoft, Google and other leaders in Computing have come up with Big Data services which have the inherent parameter of volume, velocity and Variety. The data is coming at a very high speed with large volume. In critical systems it becomes necessary to analyse that data on the go. Now we are in the social instrumented and interconnected world which gives rise to many risks and opportunities. Social media websites also needs to be managed and explored using Big Data services due to their high throughput. Big Data is now spreading to almost all sectors of US and Europe business. Industry is looking for data engineers and people with skills on Hadoop and MapReduce. So, it is a promising area to work upon.
Keynote V
On the Notion of a Geometric Filter

E. G. Rajan
President, Pentagram Research Centre (P) Limited
Hyderabad, India

Abstract
The processing of images based on well-defined mathematical techniques has remained a subject of interest for many years. In particular, mathematical theories associated with the processing, enhancement, analysis and recognition of sensed imageries have received significant amount of attention and effort. So far with one or two notable exceptions, there is no construct or theory that defines how to accomplish complex image processing tasks such as pattern recognition. Nevertheless some attempts have been made to mathematically describe various collections of image processing methodologies with a rigorous mathematical frame work, for example, that of Serra’s mathematical morphology. In spite of these efforts, the wide variety of existing methodologies associated with image processing have yet to be consolidated under one rigorous unifying mathematical structure. The term ‘mathematical structure’ refers to 3-tuple < X, O, R >, where X is a set of mathematical objects, O is a set of operations and R is a set of relations. A mathematical structure with binary operations alone would fall under the algebraic structures of monoids, groups, rings, integral domains and fields. Alternatively, a mathematical structure with binary relations alone falls under the category of formal relational structures like that of lattices. The central idea on which the proposed Image Algebra is based, is that of treating an image as a construct made up of certain convex polygons or polyhedrons according as the image being 2-D or 3-D, and treating an image processing operation as a filtering by means of what we call as Geometric Filters (G-filters). In this presentation, we discuss the concept of geometric filters and of the algebra of G-filters.

Keynote VI
India’s Role in Advancement of Computing: Past, Present and Future

Shashi K. Gadia
Iowa State University, USA

Abstract
India has made great contributions to science and mathematics starting from ancient times. India’s contribution to computing is quite outstanding as well. The representation of numbers and algorithms is quite well known. Relatively lesser known is the contribution of India in Astronomy where until 17th century efficient computations were developed by Indian mathematicians that laid foundations to calculus. Even lesser known is the contribution of India in formal languages even though that area has been pioneered by India. The great scholar Panini gave a grammar for Sanskrit that was the quintessential path breaking event in study of formal languages. The grammar has rules that lead to what are known as context sensitive languages that in retrospect can be thought of the first serious model of computation. The well-known BNF (Bakus Naur Form), used to describe the syntax of programming languages, is a part of Paninian Grammar. In recent times the software industry in India has done rather well. It is an opportune time for India to make deeper inroads into the advancement of computing in academia and industry. The talk will also consider illustrations from various forms of data that are now taking the central stage in the entire spectrum of computing in academia, industry, business, and government.