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Agent-based computing, adaptive algorithms and bio computing

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Abstract

Agent-oriented system seems to be the attractive tool useful for numerous domains of applications. It gives the ability to integrate results of different domains of computer science and constitutes the powerful tool for solving various problems. The new approach to the simulation particularly in bio-computing and adaptive systems is possible to be developed mainly due to the results of the interactions among intelligent agents in complex adaptive systems. The modern agent-oriented paradigm allows understand the adaptive (e.g. finite element / finite difference) algorithms as a collection of interacting agents making local decision about refinements. This workshop focuses on the various applications of agent-oriented and adaptive systems and the roles of interactions of intelligent agents to build intelligent systems for miscellaneous, interesting applications.

Keywords: multi-agent systems; adaptive algorithms; nature inspired algorithms; bio computing; mathematical modeling and asymptotic analysis

1. Workshop overview

The Workshop "Agent-Based Simulation, Adaptive Algorithms and Bio Computing" follows meetings which held in Kraków, Poland 2004, Atlanta 2005, Reading 2006 and Beijing 2007, Kraków 2008, Baton Rouge 2009 in frame on ICCS series of conferences.

The first group of papers accepted to the Workshop fits into the categories of multi-agent systems in integration of different approaches as well as the multi-agent systems in high performance processing. The paper “A new agent-based paradigm for recognition of free-hand sketches” by Fernández-Pacheco et al. presents a new agent-based paradigm for recognition of free-hand sketches. The recognition process is supported by two level agents: Primitive Agents which are in charge of syntactic recognition, and Combined Agents which carry out semantic recognition

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using contextual information. A number of advantages of the proposed paradigm over existing approaches are discussed. A first implementation of the Primitive Agents has been performed and evaluated by means of several tests, achieving a success ratio of 96.41%. The paper "A Software environment for a human-aware ambient agent supporting attention-demanding tasks" by Memon et al. introduces a software environment for a human-aware ambient agent that provides support for a human performing an attention-demanding task. The agent obtains human attention-awareness by use of a dynamical model of human attention, gaze sensoring by an eye-tracker, and information about features of the objects in the environment. It has been implemented in a component-based, event-driven manner within the Adobe® Flex® environment, thereby also integrating the Tobii® eye-tracker. It has been applied in a setup for a task where the human has to identify enemies and allies, and eliminate the enemies. The last paper from the group, "Platform for distributed execution of agents for trusted data collection" by Emil Gatial et al., presents a design and implementation of a platform, which allows for obtaining trusted data collection from heterogeneous distributed sources including legacy systems and users. The Authors adopted the existing production grade service platform Jini to host agents. Presented architecture was demonstrated on the use-case scenario for drug distribution during pandemic process mitigation.

There is one paper that fits into the category of bio-computing and multi-agent systems. The paper "Individual-based simulation of sexual selection: a quantitative genetic approach" by van Dijk et al.considers sexual selection, in particular the evolution of male display and female preference. It presents an individual-based simulation model of sexual selection in a quantitative genetic context. It shows that under certain conditions, Fisherian self-reinforcing sexual selection takes effect, predicted by Lande's analytic model of female choice, and that the dynamics involved in the co-evolution of male display and female preference is much more complex than mathematics would predict. Based on this, it argues that the study of sexual selection through individual-based simulation could give new and more realistic insights.

The next group of papers fits into the categories of mathematical modeling, asymptotic analysis, and application of adaptive algorithms and simulation in context of adaptive Galerkin methods. One paper "A Multigoal-oriented adaptivity for hp-finite element methods" by David Pardo describing a goal-oriented grid-refinement strategy intended to simultaneously approximate several prescribed targets or goals. The multi-target refinement strategy is defined in context of a higher-order finite element method (FEM), and numerical results are illustrated with electromagnetic applications. An article "Design and development of an adaptive mesh manipulation module for detailed FEM simulation of flows" by Krzysztof Banaś et al. describing flexible data-structures for mesh-manipulation in adaptive finite element methods. The Authors use object oriented programming to obtain data-structures that exploit parallelism, and at the same time they efficiently use cache memory to increase the speed of the resulting software. A paper "Automatic terrain modeling using transfinite element analysis" by Victor Calo et al. introducing a new adaptive method that utilizes a special set of basis functions based on transfinite interpolation. This work is an extension of the so-called isogeometric analysis. The described method is applied in the area of terrain modeling to reconstruct the geometry of Palo Duro Canyon in northern Texas.

There is one paper that fits into the category of agent-oriented approach to adaptive simulations. The paper "Agent-based parallel system for numerical computations" by Marcin Sieniek et al., introduces an agent-based system for hp adaptive FEM simulations, including the management of mesh refinements, and multi-frontal direct solver. The Authors define formally a Computing Multi Agents System (C-MAS) for adaptive FEM based on Smart Solid Agent model and describe tasks executed by hp-FEM agents. The paper is concluded with numerical experiments concerning the nanolithography simulations performed with an application developed accordingly to the described model.

Two other papers fit into the categories of adaptive algorithms and simulations in context of parallel multi-frontal solvers. The first paper from the group, "Parallel multi-frontal solver for multi-physics p adaptive problems" by Maciej Paszyński et al. describes a new algorithm for an efficient parallel multi-frontal direct solver designed for non-uniform meshes resulting from multi-physics adaptive simulation. The paper uses the model of graph grammar in order to express the algorithm for managing computational nodes with different number of degrees of freedom. The second paper from the group, "Graph grammar-based multi-thread multi-frontal parallel solver with trace theory-based scheduler" by Paweł Obrok et al., introduces a graph-grammar based approach to express efficient parallel solver for 1D and 2D finite difference method (FDM) simulations. The Authors express the solver algorithm in terms of tasks related to graph grammar productions, which allows to employ the trace theory based scheduler, executing the tasks according to the Foata Normal Form (FNF).