RESEARCH CENTER
Bordeaux - Sud-Ouest

FIELD

Activity Report 2013

Section Contracts and Grants with Industry

Edition: 2014-03-19

LFANT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. DGA

Contract with *DGA maîtrise de l'information* about number theory and cryptography

- Duration: two years, 2011–2013 (ended May 2013)
- Scientific coordinator: J.-M. Couveignes
- Topics covered: index calculus and discrete logarithms, fast arithmetic for polynomials, pairings and cryptography, algorithmics of the Langlands programme

ALEA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Contract with Astrium/EADS. The aim of this contract, in collaboration with the EPI AYIN, is to develop automatic object tracking algorithms on a sequence of images taken from a geostationary satellite. P. Del Moral cosupervises with J. Zerubia the PhD thesis of Paula Craciun on this subject.

Contract with CNES

The goal of this contract is to predict the trajectories of space debris around the earth. It is necessary to provide a new methodology since traditional methods such as Kalman filtering do not work satisfactory.

7.2. Bilateral Grants with Industry

- EDF (phd F. Proia)

BACCHUS Team (section vide)

CAGIRE Team (section vide)

CONCHA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.2. Bilateral Grants with Industry

CQFD Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Astrium

Participants: Romain Azaïs, Adrien Brandejsky, Benoîte de Saporta, François Dufour, Anne Gégout-Petit, Christophe Nivot, Huilong Zhang.

The goal of this project is to propose models for fatigue of structure and to study an approach to evaluate the probability of occurrence of events defined by the crossing of a threshold. In this context, Astrium funded the PhD Thesis of Adrien Brandejsky (2009-2012) and is a partner of ANR Fautocoes. A new contract started in 2013 about the optimization of the assembly line of the future European launcher.

7.2. DCNS

Participants: Benoîte de Saporta, François Dufour, Huilong Zhang.

In september 2010, an industrial collaboration started with DCNS on the application of Markov Decision Processes to optimal stochastic control of a submarine to maximize the acoustic signature of a target vessel. In 2012, we extended our previous results to multiple target vessels and 3D control. We also coupled our code with the output of a tracking software to take more realistically into account the uncertainty on the position and speed of the targets. In 2013, we coupled our optimization procedure with the output of the tracking algorithms to estimate the positions of the targets.

7.3. Thales Optronique

Participants: Camille Baysse, Benoîte de Saporta, François Dufour, Anne Gégout-Petit, Jérôme Saracco.

Integrated maintenance, failure intensity, optimisation.

As part of optimizing the reliability, Thales Optronics includes systems that examine the state of their equipment . This function is performed by HUMS (Health Unit Monitoring Systems). The collaboration is the subject of the PhD of Camille Baysse (CIFRE). The aim of this thesis is to implement in the HUMS a program based on observations that can determine the state of the system, optimize maintenance operations and evaluate the failure risk of a mission. This work was presented in the conferences [33], [40] and is to appear in [18].

GEOSTAT Project-Team (section vide)

MC2 Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Program PREDIT

Participants: Charles-Henri Bruneau, Iraj Mortazavi.

Program PREDIT ADEME with Renault and Peugeot. The aim of this program is the work on drag reduction in order to decrease the fuel consumption.

7.2. Renault

Participants: Charles-Henri Bruneau, Iraj Mortazavi.

CARAVAJE project with ADEME (PREDIT Véhicules propres et économes) notified october 24th 2008. Collaboration with Renault and Peugeot, two PME and 3 labs to reduce the drag coefficient of a ground vehicle. 95 k euros for 3 years.

7.3. Plastic Omnium

Participant: Iraj Mortazavi.

The MC2 team works actually with the Plastic Omnium company in order to study the flow behaviour around square back ground vehicles (like buses, camions,...) using LES and DNS techniques. The main target of this collaboration is to identify the structures of velocity fields that generate aerodynamical losses, in order to design drag reduction control strategies using pulsed or synthetic jets. In the framework of this project, we also want to compute accurately instantaneous velocity fields, with high velocities. The computations should be performed on long time for complex geometries. A part of this work is included in the PhD thesis of Yoann Eulalie.

7.4. Contracts with Industry

Thierry Colin is Scientific consulting for the CEA CESTA. The CEA is funding the thesis of M. Latige and a grand of 30 k euros has been obtained.

Angelo Iollo is consulting with OPTIMAD engineering.

7.5. Grants with Industry

CIFRE - Conventions Industrielles de Formation par la REcherche - with VALEOL (VALOREM Group)

REALOPT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contract with EDF on maintenance planning

We are currently working on a project aiming to plan the energy production and the maintenance breaks for a set of nuclear power plants generating electricity. We consider the large-scale power plant maintenance scheduling and production planning problem submitted by EDF to the 2010 Euro/Roadef Challenge. Two types of power plants are used to satisfy a customer demand over a specific time horizon. Type 1 plants can operate continuously while Type 2 plants have to be shut down regularly for refuelling and maintenance, and cannot produce during outage periods. The decision to be made consists of the dates of outages, the amount of refuel for Type 2 plants, and production level for both types of plants. The objective is to minimize the average cost of refuelling and production on various demand scenarios. In this work, we propose a novel column generation approach based on extended formulation which enables to solve within a few minutes a deterministic instance of the problem on a three years horizon, which is within the time frame of the operational tools currently used by EDF. Moreover, the approach can easily account for various demand scenarios. Our approach is tested on real life instances within a rolling horizon framework.
This project is carried in collaboration between EDF R&D (OSIRIS lab) Inria team Dolphin and Realopt.

7.2. Collaboration with ERTUS on sanitary treatment planning

In planning winary operations (most importantly sanitary treatments on the wine tree) under wheather forcast uncertainty, one searches for solutions that remain feasible and "cheap" in case of perturbation in the data. We consider the planning and scheduling of the operations that arise over a one-year horizon. More precisely, the operations to be sheduled include tasks related to soil care, or grape tree care: cutting, line building, thinning out leaves, ..., and chemical treatments. The latter are a main focus of our study since one of the principal goals of better planning is to reduce the amount of chemical treatments by selecting the appropriate products and schemes, but also by spacing out treatements while guarantying a desease free vineyard with some confidence. Each of the scheduled tasks requires its own resource, so the planning also triggers equipement and raw products selection decisions. The objective is to minimize both equipment and product costs augmented by an evaluation of the hazard of chemical product use. The planning should be "robust" to seasonal variations on the proper time frame for scheduling tasks.

7.3. Collaboration with Exeo-Solutions on dimensionning a vehicle fleet for waste collection

Through the internships of Damien Trut and Youcef Magnouche in Exeo, and the current work of Pierre Pesneau, we study the optimization of partitionning a urban area into zones that shall be assigned to vehicles for waste collection. The goal is to minimize the distance traversed by the vehicles in each zone. This can be modeled as a clustering problem with side constraints: zones assigned to a same cluster must be contiguous and satisfy capacity and time constraints.

7.4. Collaboration with B-Travel on a yield management problem

Through the PhD thesis of Martin Bué (in collaboration with inria team Dolphin), we are now working with society B-Travel on pricing and yield management. The goal is to find the best prices and incentives in the context of professional travel. The techniques used are based on network-flow formulations and mathematical programming.

7.5. Collaboration with Vekia on an employee-scheduling problem

Through the PhD thesis of Matthieu Gérard (in collaboration with inria team Dolphin), we are now investigating a very rich version of employee-scheduling problem. We have designed an efficient algorithm for computing the best shift for each employee, based on dynamic programming. This method is used in a greedy algorithm to find solutions in a faster manner, and in a branch-and-price method to prove the optimality of the solution.

CARMEN Team

7. Bilateral Contracts and Grants with Industry

7.1. Contract Medic Activ between Inria and Interaction Healthcare (Groupe Interaction)

The contract between Interaction Healthcare and Inria was signed on April, 13th, 2013.

Aiming to develop a numerical platform for simulation in medicine called « Medic Activ », the society Interaction Healthcare requested the help of the team Carmen, within a call for project entitled « serious games » from the Région Aquitaine.

The team Carmen will provide its expertise in numerical simulation of cardiac electrophysiology and the ECG (ElectroCardioGram), based on realistic human datasets. The society Interaction Healthcare is specialized in the design and creation of digital services and e-health. The complementarity between both partners is mandatory for the project to start on a coherent scientific basis.

The human resources engaged on the Inria side includes a engineer deveoted to the transfert side of the project, while a postdoc will be recruited to work on the research of the project (additional funding from *Agence AMIES*, see below).

MAGIQUE-3D Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with TOTAL

- Schémas en temps d'ordre élevé pour la simulation d'ondes élastiques en milieux fortement hétérogènes par des méthodes DG.

  Period: 2010 November - 2013 October, Management: Inria Bordeaux Sud-Ouest, Amount: 150000 euros.
- Propagateurs optimisés pour les ondes élastiques en milieux anisotropes

  Period: 2011 November - 2014 October, Management: Inria Bordeaux Sud-Ouest, Amount: 160000 euros.
- RTM en milieux hétérogènes par équations d'ondes élastiques

  Period: 2011 November - 2014 October, Management: Inria Bordeaux Sud-Ouest, Amount: 160000 euros.
- Construction de milieux équivalents en vue de la simulation d'ondes élastiques harmoniques en milieux fortement hétérogènes par des méthodes DG

  Period: 2012 October - 2015 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros
- Simulation de la propagation d'ondes élastiques et visco-élastiques en régime harmonique par des méthodes Galerkin discontinues d'ordre élevé en maillage non structuré adaptées au calcul haute-performance.

  Period: 2012 October - 2015 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros

MAGNOME Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

MAGNOME and the company BioLaffort are contracted to develop analyses and tools for rationalizing wine starter strain selection using genomics.

7.2. Bilateral Grants with Industry

The “SAGESS” project, below, section 8.1.1 , has been partially funded by a grant to BioLaffort from the Region.

MNEMOSYNE Team (section vide)

CEPAGE Project-Team (section vide)

HIEPACS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

ASTRIUM Space Transportation research and development contract:

- Design of a parallel version of the FLUSEPA software (Jean-Marie Couteyen (PhD); Jean Roman).

CEA Cadarache (ITER) research and development contract:

- Peta and exaflop algorithms for turbulence simulations of fusion plasmas (Fabien Rozar (PhD); Guillaume Latu, Jean Roman).

EDF R & D - SINETICS research and development contract:

- Design of a massively parallel version of the SN method for neutronic simulations (Moustapha Salli (PhD); Pierre Ramet, Jean Roman).

TOTAL research and development contracts:

- Parallel hybrid solver for massivelly heterogeneoux manycore platforms (Stojce Nakov (PhD); Emmanuel Agullo, Luc Giraud, Abdou Guermouche, Jean Roman).
- Parallel elastodynamic solver for 3D models with local mesh refinment (Yohann Dudouit (PhD); Luc Giraud and Sébastien Pernet at ONERA).
- Novel approaches to express fundamental algorithms using constructs that ensure their performance and scalability (G. Bosilca, visiting senior scientist).

PHOENIX Project-Team (section vide)

RUNTIME Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

SAMSUNG We have signed a contract with the Samsung company to work on the *Generation of Parallel Patterns based programs for hybrid CPU-GPU architectures* from october 2012 to september 2013.

7.2. Bilateral Grants with Industry

STMicroelectronics STMicroelectronics is granting the CIFRE PhD Thesis of Paul-Antoine Arras on *The development of a flexible heterogeneous system-on-chip platform using a mix of programmable processing elements and hardware accelerators* from October 2011 to October 2014.

TOTAL TOTAL is granting the CIFRE PhD thesis of Corentin Rossignon on *Sparse GMRES on heterogeneous platforms in oil extraction simulation* from april 2012 to march 2015.

CEA CEA is granting the CIFRE PhD thesis of Emmanuelle Saillard (2012-2015) on *Static/Dynamic Analysis for the validation and optimization of parallel applications* and Grégory Vaumourin (2013-2016) on *Hybrid Memory Hierarchy and Dynamic data optimization for embedded parallel architectures*

CEA - REGION AQUITAINE CEA together with the Aquitaine Region Council is funding the PhD thesis of Marc Sergent (2013-2016) on *Scalability for Task-based Runtimes*.

FLOWERS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Advanced platform for Urban Mobility (PAMU

Participant: David Filliat.

Development of a planning algorithm on a autonomous electric car for Renault SAS. We developped a planning module in order to produce global plans to reach a goal specified in a digital map and to perform local reactive planning to avoid dynamic obstacles. This module is integrated in the PAMU autonomous vallet parking developped by Renault with several academic partners.

7.2. Bilateral Grants with Industry

7.2.1. Development of an Contextual electronic copilot for driving assistance

Participant: David Filliat.

Financing of the CIFRE PhD grant of Alexandre Armand by Renault SAS with the goal of developping an Contextual electronic copilot for driving assistance based on the learning of the behavior of the driver.

MANAO Team

6. Bilateral Contracts and Grants with Industry

6.1. CIFRE PhD contract with Technicolor

Participants: C. Buron, G. Guennebaud and X. Granier

For this project, we aim to provide interactive generation and rendering for very large sceneries, based on grammars. We aim also to offer artist-friendly methods for controlling grammar behavior.

POTIOC Team (section vide)