Results of the 2019 call of projects

IROE			
Leader	**Laboratory of the project leader**	**Title**	**Summary ot the project**
ALTMAN Eitan	INRIA Sophia-Antipolis	Strategic pricing using game theory for Distribution Network(for public and private service providers)	The distribution side of the power network is going through disruptive changes. Users can now inject power using distributed energy resources (e.g., solar panels, batteries, electric vehicles (EVs)). Those injections of power, however, can disrupt the power flow equations and lead into instabilities of the voltages if they exceed a certain limit. Self-consuming societies only need energies from the grid for short periods of time (for instance when it is cloudy). However, traditional generators cannot match the high demand for a shorter period of time. Thus, changes in the distribution side bring additional challenges to the grid which may disrupt the stability of the grid. We propose to develop a novel price mechanism which will ensure that the capacity constraints, and the power flow equations are satisfied across the users in the distribution side. The price mechanism will also try to maintain uniformity of consumption across the users over the time horizon.
ANJOS Miguel	School of Mathematics	Challenging mixed integer nonlinear programming problems for the maintenance planning for hydropower plants	This project will yield a framework for operators of hydropower systems such as EDF to improve their assessment of the impacts of maintenance on the power generation levels of their systems.

Results of the 2019 call of projects

AUSSEL Didier	Laboratory PROMES UPR CNRS 8521	New approaches of bidding and contract problems: use of non-self Nash games and Radner equilibrium concept	Within the upcoming future energy systems, such as smart grids, local agents largely distributed production, the question of contracting has moved back to the foreground. Aspects of concrete systems that need to be accounted for are uncertainty and the discrete nature of certain decisions. This projects aims at investigating how both features can be incorporated in a model.
BADOSA Jordi	Laboratoire de Météorologie Dynamique	High Photovoltaic penetration in Paris Region (HiPV)	We study the feasibility of a massive deployment of photovoltaic technology in the region of Ile de France. We use real consumption data from the Transmission System Operator RTE as well as profiles from different building categories, meteorological (solar and wind) regional observations, optimization and neural network tools to build models that emulate large numbers of deployed micro-grids (a grid is composed of the classical energy consumption elements, renewable and low carbon power generation systems and storage capacities of different kinds including electrical vehicles). The project goal is to find optimal combinations of power plants deployment (in particular photovoltaic and wind) and storage to achieve high penetration of the renewable sources in the electrical mix of Paris region. The related cost according to different price scenarios will be also investigated.

Results of the 2019 call of projects

BROTCORNE Luce	INRIA (Inria Lille); INOCS team	Modèles intégrés pour le dimensionnement et la localisation de bornes de recharge de véhicule électriques en présence de source d'énergie renouvelable : approche bi-niveaux	The purpose of this project is to locate and determine the number of charging stations to be installed in motorway service areas, taking into account the behaviour of road users and the expected quality of service. We consider that charging stations can include a local renewable energy production source as well as a battery to store energy. In order to represent the hierarchical decision making process between the company in charge of designing the charging stations and the road users, a stochastic bilevel model is studied. Efficient solution methods will be designed and tested .
DE PAOLA Antonio	Centre for Sustainable Power Distribution	Mean field game models for distributed coordination of thermostatically-controlled loads	Development of novel game-theoretical models for price-based, large-scale coordination of thermostatically-controlled loads
HENRION Rene	Weierstrass Institute for Applied Analysis and Stochastics (WIAS Berlin)	Advanced handling of uncertainty in energy problems with underlying network structure	Aspects of time-continuous static and discrete-time dynamic probabilistic constraints will be considered along with applications in hydro reservoir management.
LECLERE Vincent	CERMICS, Ecole des Ponts ParisTech	Two-scale optimization problem	We tackle stochastic réservéeoptimization problems with long term or design decisions impacting a short term stochastic optimization problem.
PETIT Marc	CentraleSupélec Dép. Energie - Laboratoire GEEPs	Optimal design and reliability of electrical network	This project is about the optimal design of electrical distribution network (MV medium voltage and LV Low voltage) and the reliability level of the electrical network and electrical component. The "Dielectrical Breakdown Model (DBM)" used at different levels, will be used to treat these two issues. This DBM algorithm is composed of deterministic Laplace equation and Monte Carlo simulation. Tools will developped in python.

Results of the 2019 call of projects

QUEVAL Loic	GeePs	Power systems' transmission network joint-optimization with large share of renewable energy	We propose to develop a methodology to determine the optimal generation plan of a power network with a large share of renewable energy while respecting both static and dynamic technical constraints, and with less simplifications than UC and OPF problems.

IROE & LABEX LMH			
Leader	**Laboratory of the project leader and of the Paris-Saclay partner**	**Title**	**Summary ot the project**
RUSSO Francesco	Unité de Mathématiques Appliquées (UMA)	A time reversal approach to stochastic control problems : application to energy storage management	The aim of the project is to provide new efficient numerical algorithms to solve stochastic control problems coming from energy management. One typical example arising in the new electrical system is related to microgrid management involving multi-storage management under various kind of uncertainties related either to demand or renewable generation. The original idea underlying the project consists in simulating backwardly in time the optimally controlled diffusion process, at the same time as the value function is progressively computed along those optimal paths. This approach would first allow to concentrate the computing time in regions of interest of the state space and second avoid the simulation of forward paths that should be stored in memory in order to be revisited during the backward recursion dedicated to the value function computation.

Results of the 2019 call of projects

PRMO			
Leader	**Laboratory of the project leader**	**Title**	**Summary ot the project**
ADLY Samir	Laboratoire XLIM	Second-order Variational Analysis with Applications in Optimization	The aim of this project is to study second-order variational analysis with applications in optimization.
BAMPIS Evripidis	LIP6	BeCOOL : Beyond COmpetitive analysis and On-line Learning	We consider over-time optimization problems where the decision maker faces a dynamically changing input and his goal is to maintain a good dynamic solution. We propose to study methods from the competitive analysis and the online learning frameworks.
BERTHOMIEU Jérémy	Laboratoire d'Informatique de Paris 6	Computer Algebra Methods for Semi-Algebraic programming	The goal of this project is to push forward the critical point methods by taking advantage of the most recent progress in algebraic computing in the area of polynomial system solving.

Results of the 2019 call of projects

BONNARD Bernard	Institut de mathématiques de Bourgogne	Optimized electrical pulses trains to human force-fatigue muscular model with medical applications	The project concerns the development of computational methods to design optimized electrical pulses trains to control the muscular force response. It is based on a series of models, in particular the Ding et al. model introduced in the 90's in biomechanics which are refinements of the muscular model due to Hill (Medicine Nobel prize 1922) and with additional complexity since fatigue variables were introduced. The control parameters are the interpulses and the amplitudes of the pulses. Using a linear filter of the model this led to a five dimensional nonlinear control model with discretized controls and the problem fits in the sampled data control frame. Different optimization strategies have to be compared and numerically implemented for this system. Direct and indirect methods for optimal sampled-data control problems with state constraints. Model Predictive Control for real time implementation using state and parameters observers. This study is complementary to an industrial project aiming to design and automatic muscular electrostimulator supported since 12/18 by a PEPS1 fund in the Labex AMIES.
DOSSAL Charles	Institut Mathématiques de toulouse	A dynamical system point of view of optimization	Use Ordinary Differential Equation to study Optimization Algorithm with application to image processing and Machine Learning.
FIGUEIREDO Rosa	Laboratoire Informatique d'Avignon - LIA	Clustering and path problems on signed social networks	Based on the solution of clustering and path problems defined on signed networks, we will develop tools that allow us to exploit original datasets describing public procurement and parliamentary voting behaviors.

Results of the 2019 call of projects

GRAPPE Roland	LIPN	Optimisation combinatoire pour la simulation numérique d'interfaces	This interdisciplinary project focuses on improving numerical simulation for multimaterial interfaces by using combinatorial optimization techniques.
KACEM Imed	LCOMS	Alternative approaches for evaluating approximation algorithms for scheduling and knapsack problems	The huge majority of the scheduling problems and nearly all knapsack problems are NP-hard. Thus, most theoretical investigations aim to attain approximate solutions with a guaranteed deviation from optimality (worst-case analysis). But in many problems the classical worst-case bound can be rather large even for algorithms which behave well in practical applications. The focus of this project is to consider other measures than worst-case analysis for judging the quality of an approximation algorithm for scheduling and knapsack problems. Since the data distribution is practically very hard to be predicted, we will consider a general framework where data are imprecise and only their lower and upper bounds are known. Two criteria will be studied: minimizing the maximum regret and differential approximation, but we intend to define new complementary criteria. The comparison and the statistical analysis of the behaviors of different criteria among each other will be also considered.

Results of the 2019 call of projects

LACROIX Mathieu	LIPN	Matrices totalement équimodulaires	A large part of optimization problems amounts to optimizing a linear function over a set of integer points satisfying a system of linear inequalities. The structure of the matrix defining this linear system has a huge impact on the complexity of the problem. When this matrix is totally unimodular, the set of points satisfying the system is a box-TDI polyhedra. This implies that the problem is easy since it can be solved without considering the integrality requirement. A recent result introduces the class of totally equimodular matrices which generalize the totally unimodular matrices. Polyhedra described by such matrices still have nice properties, such as being box-TDI. The aim of this project is to study this class of matrices.
LUST Thibaut	LIP6	Interactive Methods and Preference Elicitation for Solving Hard Multiobjective Combinatorial Optimization Problems	The aim of this project is to develop new algorithmic components to combine the elicitation of the preferences of the decision-maker and the computation of Pareto optimal solutions for real-world problems presenting several conflicting objectives.
LUTZELER Franck	Laboratoire Jean Kuntzmann (UMR 5224)	Distributed Optimization on Graphs with Flexible Communications	The goal of this project is to kick-start a collaboration between Grenoble and Singapore on the topic of distributed optimization for data sciences.
MAGRON Victor	LAAS CNRS	Exact Polynomial optimization with Innovative Certified Schemes	EPICS intends to design hybrid symbolic/numeric algorithms to output exact certificates for optimization problems with polynomial data, involving either commutative or noncommutative variables (e.g.~matrices).

Results of the 2019 call of projects

MAHJOUB Ridha	LAMSADE	Multi-objective Combinatorial Optimization: Mathematical Programming and Algorithmic Approaches	The project deals with the budgeted versions of some network design problems. Il also concerns some parametric issues for the global min cut and related problems.
MAIRET Francis	Physiologie et Biotechnologie des Algues, Ifremer Nantes	ORACLE: Optimal Resource Allocation in micro-organisms under Changing Environment	Given their key role in almost all ecosystems and in several industries, understanding and predicting microorganism growth is of utmost importance. Flux Balance Analysis is a methodology that allowed to predict the metabolic fluxes within a microorganism, assuming optimal growth rate (acquired through evolution). Already very successfully used, it is nonetheless restricted to static conditions, limiting its usage. The objective of this project is to develop and validate a methodology based on optimization that allows to predict the growth rate, the metabolic fluxes, and the composition of a microorganism under dynamic environmental conditions. The key idea is to represent microorganism growth as an optimal control problem. Fitting this model with experimental data results in a bi-level optimization problem, whose numerical resolution involves complex optimization issues. This interdisciplinary project -gathering experts in systems biology, optimal control and optimization- should lead to a cutting-edge method to represent microbial growth in dynamical conditions.

Results of the 2019 call of projects

NALDI Simone	XLIM	Hyperbolic optimization : algorithms and implementations	A real univariate polynomial is hyperbolic whenever all its roots are real or, in other words, if it equals the characteristic polynomial of a real symmetric matrix. This property can be extended to the multivariate case via the classical algebraic tool of symmetric determinantal representations. By the way, not every multivariate hyperbolic polynomial admits such a representation/certificate. Hyperbolic Programming (HP) is the natural convex optimization problem asking to minimize a linear function over the hyperbolicity cone of a multivariate hyperbolic polynomial. HP generalizes Linear (LP) and Semidefinite Programming (SDP), central problems in mathematics and its applications. The goal of this project is to contribute to the following two research directions: (1) the development of symbolic- numerical algorithms and implementations for the general HP problem, and (2) efficient computation of hyperbolicity certificates such as symmetric determinantal representations. The two questions above are highly related since when a polynomial has a symmetric determinantal representation or, more generally, when its hyperbolicity cone is a section of the cone of positive semidefinite matrices, then the associated HP problem reduces to a SDP problem.
POSS Michael	LIRMM	Combinatorial optimization in graphs with locational uncertainty	We will investigate combinatorial optimization problems defined in graphs embedded into Euclidean spaces, under uncertainty of the position of the nodes.

Results of the 2019 call of projects

SEMET Frederic	Centre de Recherche en Informatique Signal et Automatique de Lille - UMR 9189	A generic framework for routing and scheduling problems	The routing and scheduling problems aim to jointly determine the routes covered by vehicles and schedules of crews/drivers to minimize the total cost. Our main objective is to propose a generic model, an exact algorithm and a matheuristic, a heuristic based on exact mathematical programming algorithms, able to tackle different variants of the routing and scheduling problems.
SPYROS Angelopoulos	Laboratoire dÍnformatique de Paris 6	Searching with a hint	We study search problems in a setting in which some additional information about the hider is known in the form of a hint. Our objective is to design search strategies that are efficient if the hint is correct, but also hedge against the possibility that the hint is erroneous.

PRMO & LABEX LMH

Leader	Laboratory of the project leader and of the Paris-Saclay partner	Title	Summary ot the project
AKBALIK Ayse	Université de Lorraine, Université Paris-Sud, LRI	Efficacité énergétique en Planification de production : modèles et algorithmes d'Optimisation Combinatoire - EPOC	We tackle production planning problems under energy constraints to provide cost efficient and environment-friendly policies.
ELLOUMI Sourour	ENSTA ParisTech	The impact of quadratization in the solution of polynomial problems with binary variables	Our main objective in this project is to put together some recent results of the project members for solving polynomial optimization problems with binary variables, through quadratization

Results of the 2019 call of projects

KALISE Dante	University of Nottingham, ENSTA ParisTech	TIDAL: Taming the Curse of Dimensionality in Dynamic Programming	Computational methods for high-dimensional dynamic programming equations arising in nonlinear optimal control and applications in aerospace and fluid flow control
TSIGARIDAS Elias	LIP6, Sorbonne Université / CMAP, Ecole Polytechnique	ALgebraic Methods in gAmes and optimization	ALMA is an ambitious and interdisciplinary research project that builds a novel mathematical and algorithmic framework of algebraic algorithms to answer important open questions in optimization and games.
PERCHET Vianney	CMLA, ENS Paris-Saclay	Learning, Online and with USERs (LOUSER)	Study Online learning where the objectives and underlying assumptions are more aligned with practical problems (other agents, more general settings, etc.)

IRSDI

Leader	Laboratory of the project leader	Title	Summary ot the project
ANGULO Jesus	Mines, Fontainebleau	Radar Image Classification for Maritime Surveillance	Deep learning applied to track kinematics has already been investigated and showed very good results in classifying maritime targets. We propose here to go one step further into the classification by providing the maritime tracks with the target local radar video image extracted in the range-azimuth map. This two-dimensional intensity image provides richer information about the target nature than the single dimension range profile.

Results of the 2019 call of projects

DELAHAYE Daniel	ENAC, Toulouse	Rapid generation of aircraft trajectories from a realistic model of flight mechanics	This study focuses on the accurate simulation of an aircraft trajectory verifying physical constraints. We will use machine learning techniques to accelerate the generation of these trajectories.
DOERR Benjamin	LIX, Ecole Polytechnique	Passive Radar Coverage Optimization	Using state-of-the-art black-box optimization techniques to design optimal passive radar systems
JACQUES Julien	ERIC, Lyon 2	Deep Learning for Functional Data Co-Clustering (DeepFunCoClust)	This project focuses on the development of new co-clustering algorithm for functional data using effective low dimensional representation through deep neural networks, with applications to the analysis and the prediction of the electric power consumption of French households through the new “Linky” electricity meters (EDF), by detecting typical customers profiles in regard with their consumption but also with other indicators, as the temperature.
NOUVEL Damien	INALCO, Paris	Analyse d’arguments sur la transition écologique dans le contexte du grand débat	This project mainly aims at studying the opinions and arguments concerning ecological transition in the debates initiated in France in early 2019, with corpora collected from two websites: "Le Grand Débat National" and "Le Vrai Débat".

Results of the 2019 call of projects

PETETIN Yohan	SAMOVAR, Telecom SudParis	Théorie des processus ponctuels marqués pour le pistage multi-objets infrarouge	Multi-object tracking is a critical problem in signal processing. Roughly speaking, it consists in estimating the cinematic (position, velocity) of an unknown and varying number of targets over time. It has many applications, in particular in the case of maritime or aerial surveillance, which may rely on infrared sensors. In this context, the objective of the project is to study the contribution of the theory of point processes for target tracking, which consider targets and observations as a stochastic population of objects. Such methods have the advantage of being able to model the whole population as a unified stochastic process which enables decisions to be made based on the global surveillance scenario. Additionally, if suitable approximations of the process are made, low-cost algorithms can be developed which have linear complexity in the number of targets and number of measurements. This is crucial for scaleability: if the algorithm is linear, then tracking a very large number of targets is possible. This project will build on recent developments for low-cost multi-target tracking and develop this further by considering target identification, which is crucial for operators in practical tracking systems. This study benefits from collaboration with Thales OME which has a strong expertise with classical target tracking methods in this context.
WINTENBERGER Olivier	LPSM, Paris Sorbonne	Score aggregation for distributional prediction of time series	We propose to work on this project on how we can combine these different criteria to produce new probabilistic forecasts and study their theoretical properties. We propose to apply it on different real data sets: electricity demand and weather forecasts.