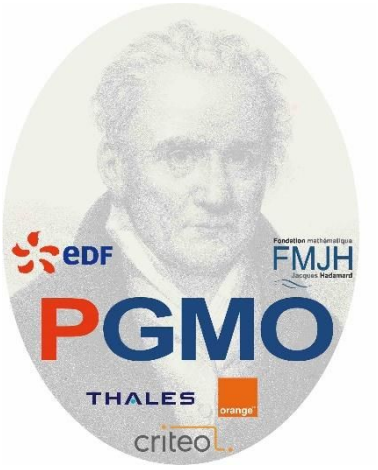
Gaspard Monge Program for Optimization, operations research and their interactions with data science



PGMO Icode Energy 2019 Call for Postdoctoral Projects

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1 Introduction

The Gaspard Monge Program for Optimization, operations research and their interactions with data science (PGMO), launched by EDF and the Jacques Hadamard Mathematical Foundation (FMJH), is a new type of corporate patronage whose aim is to foster, liven up a mathematical community of researchers coming from academia and industry, working in the field of optimization, operation research and data science, and working on academic themes and industrial issues.

iCODE is the Institute for Control and Decision of the Idex Paris Saclay. It was launched in March 2014 and aims are fostering research, spin-offs creation, training and diffusion of Control and Decision in Paris-Saclay. The scientific topics addressed by iCODE are organized in four challenges, among them the Energy Challenge which focuses on decision support for energetic transition.

The iCODE Energy Challenge launches a call for Post-Doc projects which is operated by PGMO. Icode will fund 2 years of Postdoc (either 2 postdocs of 1 year or 1 postdoc of 2 years will be funded). Teams submitting projects for 2 years are encouraged to also include a variant of their project based on Icode funding for only 1 year. Co-funding is also encouraged. The earliest hiring date for the post-doc is expected to be september 2019.

Projects funded by Icode must be be led by academic teams members of ICODE -- currently belonging to the Paris-Saclay Idex, but may also include other teams with no geographical restrictions. Funds will be managed by the Paris-Saclay team. For information, a general IROE call will be published before the spring 2019, not subject to the ICODE perimeter restrictions.

The objective is to support research projects through collaborative actions between academic researchers and industrial researchers, focused on solving industrial problems in the fields of control and decision applied to energy. Thus, involving industrial researchers is mandatory.

All results produced in the scope of projects supported by Icode will be free and publicly available. Reports, communications or papers will be freely published and free software production is encouraged.

Scientific scope

Icode Energy focuses on energy. Projects will thus be focused on solving problems from the energy industry, using the scientific background included in Icode: control and decision.

Realistic data sets may be provided, and the teams will benefit from the help of Industrial experts during the setting up of the project as well as during its whole life. Confidentiality agreement concerning data sets and some specific industrial knowledge may have to be signed. It will nevertheless be possible (after notifying the industrial contact) to publish results based on real data.

Teams willing to submit a project are encouraged to contact PGMO prior to submission.

Coordination and animation

As an objective of PGMO and Icode is to foster and liven up a research community around the main topics of both programs, regular events will be organized.

Workshops or working sessions gathering project teams on close subjects will be organizing, with the aim of discussing the methods proposed for solving the problems.

A conference is organized by PGMO every year in the Fall. Projects are expected to propose talks during the conference. All projects will be asked to send a very synthetic summary of the project before the conference.

2 Rules of the present call for projects

Projects will be submitted, in a 1-step process, by filling an online form and submitting a single PDF document (see the document template) through the EasyChair platform. (https://easychair.org/conferences/?conf=icodeiroepgmopostdoc). Submissions may be written in French or in English.

A summary of the project (around ½ page), which has to be understandable by non-specialists, is required. The quality of the submission documents will be taken into account for granting the financial support.

All submitted projects will be evaluated (scientifically + budget-wise) by the executive board and the scientific committee of the PGMO.

To submit a project, it is not necessary to have already a post-doctoral applicant, since the ICODE schedule will leave enough time for the leaders of selected projects to advertise the position and select their post-doc. However, in case a project leader already knows a post-doctoral applicant that he would hire in priority, the CV of this applicant can be included as an appendix to the submission documents.

2.1 Rules and Agenda

Publication of the call	December 12, 2018
Deadline for submission	January 10, 2019
Notification of acceptance or rejection	February 2019

This call for projects is focused on Post-doctoral funding. The financial amount for the salary will be 50k€/year (including taxes and social security). Environment support (travel...) can also be asked, in the limit of 10k€/year. Co-funding will also be appreciated. It is expected that the postdoc candidate has completed her/his PhD in a different laboratory. The perspective of professional insertion of the candidate after this postdoc must be explained in the application.

2.2 Important recommendations

Candidates are invited to get in touch with the PGMO board (pgmo@fondation-hadamard.fr) who may help them to build their project before submission. Candidates can also require the help of an EDF expert.

Project teams are invited to consider the possibility of grouping with other teams who may work on a close topic. Projects grouping many teams of different laboratories are encouraged in order to favor exchanges between laboratories on close topics.

The participation of young researchers is highly encouraged.

Pluridisciplinarity is encouraged.

Projects with several labs will have a unique leader, who will be in charge of the management of the allocated financial support. The leader has to belong to a Paris-Saclay Idex team.

All works published, all events organized, etc. must acknowledge the support of Icode, using specific instructions that will be sent on due time.

2.3 Agreement information

Projects funded will receive specific instructions concerning the redaction of acknowledgements

2.4 Contacts

PGMO coordinators: Stéphane Gaubert, Gilles Stoltz, Pierre Carpentier, Sandrine Charousset

FMJH administrator and Managing assistant: Magali le Chaponnier

Email: pgmo@fondation-hadamard.fr

3 Scientific scope

3.1 Energy Management

3.1.1 Long-term and investments

Fundamentals models are designed to calculate the long-term prices of energies on a set of interconnected areas. In the case of electricity, the main difficulties comes from the representation of strategies for the management of many stocks with various seasonalities, water in particular, the intermittence of production of renewable energies, the share of flexibility made possible by demand response and from the representation of the transmission network. Another difficulty is to anticipate the impact of the competition between primary energies on the long term electricity demand. The mathematical model dealing with these issues is a problem of economic stability across Europe, each area aiming at minimizing its costs while providing energy to its customers and contributing to the global European equilibrium. Balance prices calculated with this model can be interpreted as price indicators of electric energy.

The issue of Investment decision problems is to determine the technologies in which it will be best to invest in the future in order to meet energy demand. Due to the nature of those investments (building plants or storages, network expansion, ...), it is necessary to anticipate them far in advance. In other words it is necessary to take all relevant information necessary into account to determine the right sizing of production facilities on the horizon 15-20 years

3.1.2 Decentralized Optimization, local actors

The energy systems in Europe have originally been designed in order to reach the best possible economical objective in each country for satisfying a given demand. Economy of scale principles were applied and lead to build a mix mainly composed of large generation assets. Moreover, a centralised generation mix was seen to be the best solution to serve demand, as through centralisation it is possible to aggregate multiple very uncertain and variable demands and thus reach a relatively stable global demand.

The emergence of a high share of intermittent renewable energy sources in the energy system leads to many difficulties, due to their characteristics (intermittent, hardly predictable, usually non flexible, usually not contributing to frequency stability services, spread all over the territory, not always close to demand, connected to the distribution network thus constrained by its size).

Furthermore, recent and forthcoming regulatory and technical evolutions will deeply transform the system with the upcoming local demand management tools and a more proactive stance of actors in the field, including customers.

Therefore the energy management tools will need to change significantly and contributions to flexibility will gain "significant" value which will make their precise valuation primordial.

The generation management process at mid-term-term horizons of energy is conventionally done in France in a centralized way.

Decentralised Optimization covers many interesting problems :

- Integrated optimization. Integrated optimization means that all generation/flexibility means in a specific geographic frame are considered, either with a 'centralised' point of view or not. New constraints and mechanisms are to be dealt with
- Optimization of local players. Looking at a local level, new problems appear, which are related to the emergence of local players. They are facing local specific constraints (among them those coming from the distribution network). The modelling of these problems, especially in a context of intermittent energy is a topic in itself.
- Relationships between centralized power system management (supply-demand balance on a global scale and network balance management) and decentralized management (local management, due to the emergence of new players and means of production: photovoltaic, wind, smart grids, storage ...). Regarding the global supply-demand balance, one can address various questions : i) what are the role and impact of local actors on the centralized management ? ii) What will be the signals that are transmitted between the different actors and how will we model them? iii) how to consider local constraints with a global point of view?
- The emergence of local actors also suggests to consider problems related to (transmission) network and joint 'network-generation-demand flexibilities' optimization problems. (considering mainly the distribution network), and problems relative to modelling the behaviour of consumers in a competitive context.
- Moreover, contributions of multi-energy assets will need to be integrated.

This topic is fairly new and deals with issues at different levels of the supply-demand balance process.

Some mathematical approaches were identified including:

- Decomposition Methods
- Bilevel Optimisation,
- Game Theory

3.2 Electric Vehicle

The development of electric mobility leads to multiple research questions, which include:

- **[long-term "strategic" decisions]** Electric Vehicles (EV) charging infrastructure location and sizing - for standard individual / fleet mobility usages, or new mobility services (autonomous / shared mobility);
- **[short-term "operational" decisions]** "Smart charging" (i.e. EV consumption profile(s) scheduling) of one or multiple EVs (at home, in a parking, on public charging stations), which can be done at a local scale, in presence of Renewable Energy Sources;
- **[EV user services]** Design of user-centric information / incentive mechanisms (to share EV charging infrastructure in space and / or time).

In particular, the following research aspects could be very beneficial for this field:

- coordination/optimisation of charging decisions in a large set of EVs, and with constraints at hierarchical levels;
- the integration of EV battery aging modeling;
- the integration of load-flow based local electricity network constraints/metrics;
- the analysis of the specificity of EV as a "moving" electricity appliance (not always connected to the grid, not always at the same location).