Open position: Ph.D. student - NeCS team, Control Systems Department, INRIA/GIPSA-lab.

**Collaborative source seeking control**

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**Start:** Nov. or Dec. 2011, **Duration:** 3 Years.

INRIA contract. Monthly salary (gross): 1 957 euros (1st & 2nd year), 2 058 euros (3rd year)

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**Context:** NeCS ([http://necs.inrialpes.fr](http://necs.inrialpes.fr)) is a joint INRIA/CNRS research team focusing on Networked Control Systems. The team is bi-located at INRIA Grenoble Rhône-Alpes ([www.inria.fr/en/centre/grenoble](http://www.inria.fr/en/centre/grenoble)) and at GIPSA-lab at Grenoble’s campus ([www.gipsa-lab.inpg.fr](http://www.gipsa-lab.inpg.fr)).

**Application conditions:** this position concerns students with a background in control theory and optimization. Student should have a master (or equivalent) degree. Application should be sent to federica.garin@inrialpes.fr accompanied of:

1. a complete CV,
2. a scanned copy of a certificate with the grades obtained at university exams in recent years, and
3. two recommendation letters.

**Research Topic:**

Maximum seeking control is a well-known control strategy for real-time optimization [1]. Extremum seeking is also a method for adaptive control dealing with the problem of stabilizing a system to its known optimal (extremum) operation point. Examples of applications are ABS systems, bioreactors, combustion engines, electric distribution systems, compressors, optical amplifiers, exercise machines, etc. The basic idea of the extremum seeking control is to get an on-line approximation of the gradient of the function to be minimized, and then to move the search in the gradient direction. This is mainly done by injecting a proving signal to ensure some level of persistence of excitation as required in adaptive control. There are approaches based on deterministic/stochastic, continuous-time/discrete-time, but most of this work has been performed using a single sensor measuring the system output. The case of using several sensors (i.e., a sensor network) has been explored recently in our research team [4, 5]. In particular, we have investigated how to search an underwater source extremum, by collecting samples coming from a fleet of AUVs (see video demonstration at [http://www.lag.ensieg.inpg.fr/connect/](http://www.lag.ensieg.inpg.fr/connect/)). A circular formation has been used for this purpose [2, 3]. Reference [4] provides a centralized solution for gradient estimation whereas in [5] we provide a decentralized solution using average consensus.

The purpose of this thesis is to generalize the study to other cases of “collaborative source seeking control”, where a network of fixed or moving sensors is used to explore the source field, and a collaborative exchange of information allows to locate and/or to stabilize the system at the unknown extremum operation point. We would also investigate parallels/relations that exist between the well-known control structure as formulated in [1] which requires a proving signal, and the ones using multi-sensor technologies studied in our previous works. As study cases we will use a fleet of a quadrotor drones (Parrots), and the fleet of underwater AUVs.


