

FICHE NAVETTE: DOCTORANTS IDEX

SECTOR : Higher Education Institution

LOCATION: France, Grenoble

RESEARCH FIELD: **RISK MODELLING, ASSESSMENT AND MANAGEMENT, CONTROL, SYSTEMS, SIGNAL**

RESEARCHER PROFILE:

□ *First stage researcher (Master Degree level required)*

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes¹ enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL²). The vibrant ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alpes is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled "Initiative of Excellence". This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations", "Digital technology").

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

¹ Univ. Grenoble Alpes

² ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

PHD TOPIC

Within CDP RISK @ Univ. Grenoble Alpes

TITLE: Modeling and information reconstruction from heterogeneous data in the context of gravitational hazards – Application to Harmalière landslide.

[Modélisation et reconstruction d'information sur le risque gravitaire à partir de données hétérogènes - Application au glissement de terrain de l'Harmalière]

Primary scientific department: GIPSA-lab

Secondary scientific departments: IRSTEA, ISTerre

Primary Doctoral School (for registration): EEATS

Secondary Doctoral School: TUE

Supervisors: G. Besançon (GIPSA-lab), G. Chambon (IRSTEA)
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Co-supervisor: L. Baillet (ISTerre)
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Short topic description :

In the challenging context of environmental monitoring, the PHD will focus on the case-study of *Harmalière landslide* (Isère, France), for a purpose of *anticipation/estimation of the associated hazards* (e.g. predictions of mass propagation and headscarp regression), and with a special attention to the problem of *heterogeneity* in data (ground/remote sensors, signals/images, instrumental/testimonial data, synchronous/asynchronous measurements, etc.). It will be based on available measurements, underlying mechanics, and system approach, to develop an appropriate dynamical model of the landslide behavior. This in short includes suitable data processing, model structure definition and calibration, observer-based evolution/fault prediction.

REQUIRED SKILLS

- Theoretical skills : systems, control, signal processing / mechanics, modeling
- Methodological skills: information technologies, numerical implementation
- Language: A good level in French and English is an asset

ELIGIBILITY CRITERIA

Applicants must hold a Master degree (or be about to obtain one) or have a university degree equivalent to a European Master (5-year duration).

SUBJECT DESCRIPTION

'Harmalière' landslide is a complex and active landslide located in Isère (Trièves plateau) [4]. The headscarp is subjected to continuous northward regression towards the nearby village of Sinard. Below the headscarp, the deconsolidated clay material undergoes a rapid solid-fluid transition and shows viscous-like flow. The objective of the PHD is to produce efficient methods and tools for the anticipation/estimation of the associated hazards (e.g., predictions of mass propagation and headscarp regression). The work will be based on an appropriate processing of the data and information directly collected on the phenomena, in the framework of *dynamical system modeling and analysis*. Special attention will be paid to the problem of *heterogeneity* in available data (ground/remote sensors, signals/images, instrumental/testimonial data, synchronous/asynchronous measurements, etc.).

In detail, the issues to be addressed are threefold:

- Analysis and pre-processing of the measurements. While the parameters of interest are, typically, changes in mechanical property of the materials (e.g., cohesion, friction, effective viscosity) prior to rupture and flowing events [5], data can also be affected by various environmental effects (temperature, precipitations, ice) that have to be removed using appropriate *signal processing techniques*.
- Development of a relevant mechanical model at the scale of the landslide. Remaining in a dynamical system framework, this model shall couple block ruptures and sliding at the headscarp (soil stability approaches [3]) and flow-like movements at the toe (lubrication-type approaches). *Sensitivity analyses* and *inverse modeling* will then be used for parameter identification from available data.
- Development of *observer-based approaches* [2] for dynamical monitoring and hazard evaluation based on the available measurements and models (event-based or asynchronous techniques for instance). These aspects are part of recent research developments in so-called 'event-based' control [1], whose extension to information processing/reconstruction is a significant challenge of this PHD.

The PHD will be mainly located in GIPSA-lab. However, this multidisciplinary project will be conducted in the frame of a close collaboration between three laboratories of Grenoble-Alpes University (GIPSA-lab, IRSTEA, ISTERre). Applicants shall have a strong background and solid skills in control and information technology. Additional knowledge in mechanical modeling and/or geosciences would be an advantage.

Some references

- [1] Aström, K.J. , **Event Based Control**, in Analysis and Design of Nonlinear Control Systems, A. Astolfi / L. Marconi (Eds), Springer, pp.127- 147, 2008.
- [2] Besançon, G. (Ed), **Nonlinear observers and applications**, Springer LNCIS 363, 2007.
- [3] Iverson, R. M., **Regulation of landslide motion by dilatancy and pore pressure feedback**, *J. Geophys. Res.*, 110, F02015, 2005.
- [4] Moulin, C. & Robert, Y., **Harmalière landslide near Sinard village (in French)**, Proceedings of the workshop Ryskhydrogeo, Program Interreg III, La Mure (France), 2004.
- [5] Naaim, M.; Durand, Y.; Eckert, N., Chambon, G. **Dense avalanche friction coefficients: influence of physical properties of snow**, *J. Glaciol.*, 59, 771-782, 2013.

APPLICATION PROCEDURE

Applicants will attach a file including:

- Their CV
- A cover letter / letter of motivation
- A summary of previous work done/publications in Master 1 and Master 2
- A record of the grades of Master 1 and Master 2
- A copy of their last diploma

Address to send the application: **gildas.besancon@grenoble-inp.fr, guillaume.chambon@irstea.fr,
laurent.baillet@univ-grenoble-alpes.fr**

APPLICATION DEADLINE: **May 31, 2018** at 17:00 (CET)

SELECTION PROCESS

Applications will be evaluated through a three-step process:

1. Eligibility check of applications on **June 7, 2018**
2. Selection: the applications will be evaluated by a Review Board in June 2018
3. Results will be given by **July 12, 2018**.

NB: for early applications, the selection process may be brought forward.

IN CASE OF SUCCESS

TYPE of CONTRACT: temporary 3 year-doctoral contract

JOB STATUS: Full time

HOURS PER WEEK: 35

CONTRACT STARTING DATE: **October 1, 2018**

SALARY: 1768.55 € gross per month