Offer #2026-10510

Post-Doctoral Research Visit F/M
Bayesian calibration with model error in structural dynamics

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

Created in 2008, the Inria Saclay Center is located at the heart of the Paris-Saclay scientific and technological excellence cluster, which alone accounts for 15% of French research. Serving the development of the Université Paris-Saclay and the Institut Polytechnique de Paris, the Inria Saclay center employs 80 people in research support services and 500 scientists of 54 nationalities.

Benefiting from continuous growth, the center now has a total of 42 project-teams and two in the process of being created, including 21 jointly with the Institut Polytechnique de Paris, 16 with the Université Paris-Saclay, as well as 7 Inria EPs, including one in collaboration with Onera and one with the Pôle Universitaire Centre Val de Loire. These research teams are spread over more than ten sites.

Context

Supervised by:

- E. Denimal Goy at Inria Saclay, PLATON Inria project-team; Center for Applied Mathematics (Ecole Polytechnique); expert in structural dynamics and uncertainty quantification,
- Pietro M. Congedo at Inria Saclay, PLATON Inria project-team; Center for Applied Mathematics (Ecole Polytechnique); expert uncertainty quantification methods for engineering applications.

The work will be conducted in the Platon team, a joint research group between Ecole Polytechnique and CNRS, hosted by the Center for Applied Mathematics (CMAP) of École Polytechnique. The Platon project-team focuses on developing innovative methods and algorithms for uncertainty management in numerical

models, including advanced calibration strategies from data (observations, measurements, other model predictions) and uncertainty reduction.

General details:

- Duration: 12 months
- Starting date: no later than January 2027
- Location: Inria Saclay, 1 rue Honoré d'Estienne d'Orves, 91120 Palaiseau, FRANCE
- Salary: gross monthly salary of about 2700€
- Funding: ANR JCJC MeMoRa

Assignment

Project description and objectives

Predicting the dynamic behavior of mechanical and civil engineering structures is a central concern throughout their design and operational life, whether to ensure structural integrity under vibration and dynamic loading, or to anticipate fatigue and durability issues. Numerical models, and finite element (FE) models in particular, have become the primary tool for addressing these challenges, offering a flexible and cost-effective means of simulating structural response before physical testing.

Yet for these models to make accurate predictions, their parameters must reflect the real structure and the real environment, not just the nominal values assumed during design. Model calibration, also referred to as model updating, meets this need by adjusting uncertain or poorly known model parameters so that the numerical response matches measured data. In structural vibration, this is typically done using modal parameters (natural frequencies, mode shapes, damping ratios) or frequency response functions obtained from experimental campaigns.
This process is essential to improve the predictive capability of the model. Bayesian approaches are classical techniques to perform this calibration process. They rely on the assumption that the discrepancy between the numerical solver and the experimental data are explained by the experimental noise.

However, the models are built upon simplifying assumptions such as geometry, material properties, boundary conditions, joint behavior, etc. This leads inevitably to discrepancies between numerical predictions and experimental observations, which must be accounted for during the calibration process. In this context, Bayesian approaches can be used to explicitely account for uncertainties arising from measurement noise, model-form error, and parameter variability. The results obtained with such approaches provide more robust and physically meaningful estimates of the calibrated parameters along with quantified confidence in the model predictions. Recent works in the team have focused on the development of such frameworks for academic test cases [1,2].

Additionally, the quality of the calibration depends on the choice of the quantities used to perform it [3]. If these quantities are not sufficiently sensitive to the parameters being calibrated, the identification process becomes ill-posed, leading to poorly constrained or unreliable parameter estimates.

The objective of the postdoc is to develop a Bayesian calibration framework to account for model error in the context of structural dynamics. The following objectives have been identified:

- develop a Bayesian model calibration with model error framework for structural dynamics,
- identify relevant quantities for the calibration (resonance frequencies, vibration amplitude, etc),
- compare the results to state-of-the-art methods,
- accelerate this framework, using surrogate based strategies for example.

The person recruited will have to numerically implement, test and compare the different identified approaches developed during the postdoc.

Biblio

[1] Kahol, O., Congedo, P.M., Le Maitre, O. and Goy, E.D., 2025. {Efficient treatment of the model error in the calibration of computer codes: the Complete Maximum a Posteriori method.} International Journal for Uncertainty Quantification, 15(5).

[2] Kahol, O., Le Maître, O., Marco Congedo, P. and Denimal Goy, E., 2026. {Surrogate-based strategies for accelerated Bayesian calibration of computer codes with Complete Maximum a Posteriori estimation of model error.} Journal of Mechanical Design, 148(9), p.091706.

[3] Delette, N., Goy, E.D., Pfister, J.L., El Amri, R. and Mevel, L., 2025, May. {Model updating of rotating wind turbines using operational modal analysis and Floquet mode decomposition}. In IOMAC 2025-11th International Operational Modal Analysis Conference (pp. 1-7).

Main activities

- Literature review
- Development of calibration algorithms with model error
- Implementation and simulation of mechanical models
- Implementation of associated algorithms and validation on different test cases
- Writting documentation, reports and journal articles
- Prsentation (work progress meetings, team meetings, ANR consortiums meetings, conferences)

Skills

Candidates must hold a PhD in mechanical engineering, applied mathematics or a related discipline with background in at least one of these fields: structural

dynamics, model calibration, uncertainty quantification or related fields. In particular, candidates must be proficient scientific computing.

Applicants should submit a detailed academic CV with history of scientific production, evaluation documents of their PhD if available and a cover letter detailing the knowledge, skills and experience you think make you the right candidate for the job.

For further details, please contact E. Denimal Goy (enora.denimal-goy [at] inria.fr).

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

2788€ gross/month

General Information

- **Theme/Domain :** Stochastic approaches
  Scientific computing (BAP E)
- **Town/city :** Palaiseau
- **Inria Center :** Centre Inria de Saclay
- **Starting date :** 2027-01-01
- **Duration of contract :** 12 months
- **Deadline to apply :** 2026-11-30

Contacts

- **Inria Team :** PLATON
- **Recruiter :**
  Denimal Goy Enora / enora.denimal-goy@inria.fr

About Inria

Inria, the French national institute for research in digital science and technology, supports the French government in national research and innovation strategies in the digital field, acting as Digital Programs Agency. Inria leads over 300 research and innovation projects with its 3,500 scientists, engineers, and support staff, in partnership with universities and the digital ecosystem (businesses, entrepreneurs, and public stakeholders). Together, we explore strategic fields such as artificial intelligence, cybersecurity, quantum computing, cloud technologies, digital transformation in healthcare, digital twins, and digital technologies for defence. We develop practical solutions such as software, tech startups, partnerships with national companies, and cutting-edge training programmes. Our goal is to drive scientific, technological, and industrial excellence to ensure France’s digital sovereignty.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.