Post-Doctoral Research Visit F/M World3 dynamics [Campagne Post-Doc BMI-NF-GRA-2024]

Le descriptif de l’offre ci-dessous est en Anglais

Type de contrat : CDD

Niveau de diplôme exigé : Thèse ou équivalent

Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

The Centre Inria of the Université de Grenoble groups together almost 600 people in 22 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (Université Grenoble Alpes, CNRS, CEA, INRAE, …), but also with key economic players in the area.

The Centre Inria de l'Université Grenoble Alpe is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Contexte et atouts du poste

The World3 model [1] has been proposed almost fifty years ago in the Club of Rome's report on the predicament of mankind. It is a global dynamic model that describes the interactions between five sectors – population, non-renewable resources, industrial output, food production and pollution – with the aim of assessing the global systemic risk faced by modern societies. After negative criticism following publication, the model has been almost ignored for a while and is currently the object of a renewal of interest due to a growing concern over planetary limits. Recently, various recalibrations and empirical-data comparisons have been carried out, which shed new light on the validity and predictive power of the model. Early criticism comes from some misunderstandings or misconceptions on the new systemic approach proposed by the authors. The World3 system has now become the cornerstone of global systemic risk modelling and its main message is even more relevant: global collapse appears to be the most realistic scenario if society keeps pursuing material growth.

The World3 model consists of several interacting subsystems, based on the description of stocks, rates and flows between its constitutive components and the complexity of the dynamics arises from the interactions between global variables. The important number of parameters and nonlinear fitted functions makes an analysis and understanding of its behavior difficult, beyond numerical simulations. Parameter sensitivity analysis helps to determine critical parameters but requires large computation times and does not give a complete understanding of the dynamics. There is a crucial need for mathematical analysis and rigorous results to obtain new insight into the World3 model.

Some progress on these issues has already been made in the STEEP team [2], in particular in the course of a recent PhD thesis. The main objective of the present post-doctoral proposal is to complete this initial effort and possibly extend it in other directions as part of a new collaboration between STEEP and TRIPOP teams.


Mission confiée

Research.

Principales activités

The proposed work is semi-qualitative and quantitative in nature. On the semi-qualitative side, the candidate will complete an analysis of the different time scales of the system, a question that has been
poorly addressed in previous work. On the quantitative side, the first task of the candidate will be to complete the feedback loop dominance analysis that has already been largely undertaken on the basis of the so-called LEEA method (loop eigenvalue elasticity analysis). The main objective is to characterize the transitory regime, which is of most direct importance in the discussions of the implications of the models for the future of the Earth system.

Depending on time, other analyses will be conducted. An important issue is to characterize the degree of endogeneity of the most important variables of the model. An original method has been developed in the STEEP team to this effect but never tested. The post-doc will evaluate the effectiveness of this method on standard dynamical toy models, and, if appropriate, implement it on World3. Other secondary objectives, e.g., by pursuing the line of work of Thissen [3] in combination with classical tools (time-scale separation, quasi static approximations, piecewise linearizations, asymptotic expansions) may also be pursued in order to further characterize the transitory regime and the robustness of the model.


Avantages

- 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 (90 days / year) and flexible organization of working hours (except for internship)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage under conditions

Rémunération

2 788 euros gross salary / month

Informations générales

- Thème/Domaine : Optimisation et contrôle de systèmes dynamiques
- Biologie et santé, Sciences de la vie et de la terre (BAP A)
- Ville : Montbonnot
- Centre Inria : Centre Inria de l'Université Grenoble Alpes
- Date de prise de fonction souhaitée : 2024-09-01
- Durée de contrat : 12 mois
- Date limite pour postuler : 2024-04-30

Contacts

- Équipe Inria : TRIPOP
- Recruteur : Tonnelier Arnaud / arnaud.tonnelier@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

The successful candidate should have basic knowledge of dynamical systems and numerical simulations with a clear interest in applied dynamical systems. A PhD in applied mathematics, or in related field (physics, computer science), is desirable.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n’est pas garanti.

Consignes pour postuler

Applications must be submitted online via the Inria website.
Applications must include a CV, motivation letter, recommendation letter(s), if available evaluation reports about the PhD manuscript and the defense (in case the PhD thesis has not yet been defended: expected date of defense and elements to confirm it, e.g. letter from the advisor), list of publications including the best publication.

Sécurité défense :
Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.