2 PhD student positions in Mathematics

Hyperfiniten methods for generalized smooth functions

DIANA (DIfferential Algebras and Nonlinear Analysis) research group
Department of Mathematics, University of Vienna, Oskar-Morgenstern-Platz 1, A-1090 Wien, Austria

Quest

The DIANA research group of the Department of Mathematics offers 2 PhD student positions for the FWF project Hyperfinite methods for generalized smooth functions (project leader: Paolo Giordano, see http://www.mat.univie.ac.at/~giordap7/).

The candidate should be interested in the following fields:

- Generalized functions
- Nonlinear theories of generalized functions (e.g. Colombeau algebras)
- Partial differential equations
- Functional analysis
- Non-Archimedean rings
Projects description

The main aim of the aforementioned project is to develop hyperfinite methods for the solution of PDE in the framework of generalized smooth functions. The nonlinear theory of generalized smooth functions has recently emerged as a minimal extension of Colombeau’s theory that allows for more general domains for generalized functions, resulting in the closure with respect to composition and a better behaviour on unbounded sets. By hyperfinite methods, we mean both the use of infinite integer Colombeau generalized numbers and the use of closed intervals with infinite boundary points. The former will be used to introduce a better notion of power series and hence a corresponding Cauchy-Kowalevski theorem which, in principle, will be applicable to any distributional PDE (not only to standard analytic ones). The latter will be used to define a Fourier transform applicable to any generalized smooth function (not only to those of tempered type). We plan to study the method of characteristics and to study operators defined by using hyperfinite methods. The proposal thus aims at both solving hard open problems like general existence theorems for nonlinear singular PDE, and at widely extending well known methods of mathematical analysis.

Job description

The research work during the PhD studies, will primarily focus on the development of topics extracted from this FWF project. The results obtained will, of course, be included in the PhD theses. A deep knowledge of generalized smooth functions is not required and can be fulfilled during the first part of the research work. In any case, acquiring this basic knowledge can be carried out so as to produce interesting and publishable research results. We aim to publish the main results (e.g. generalization of the Cauchy-Kowalevski theorem and of Fourier transform) in high-ranked journals. The candidate is also strongly encouraged to actively participate in the weekly talks and conferences of the DIANA research group.

Your background

The candidate should

• have a Master in Mathematics
• be able to work in a highly independent and creative way, and to integrate in the research activities of the group working on the same project

• have an independent thinking and should be sufficiently free from mainstream ideas

• be able to produce rigorous proofs and to develop a corresponding intuitive meaning

• have a very good aptitude to study mathematical topics searching for motivations and ideas underlying theories, definitions and statements

• privilege the understanding and development of theories instead of the solution of particular and specialized results.

Appointment

The financial support of FWF will cover 2 years of the PhD studies. The remaining year will be covered into other projects. The gross salary for the PhD student position is 37,680 euro per year corresponding to 30 working hours per week (see www.fwf.ac.at/de/projects/personalkostensaetze.html). There is funding for hardware (e.g. laptop), books and for conference participation. After the completion of the PhD studies, the interested candidates will be helped in getting a temporary post doc position in Vienna, or in submitting their own research project proposal (e.g. FWF Lise Meitner fellowship or Marie Curie fellowship).

References

To get an idea of the research area and the required skills, please have a look at the following web site and related bibliographical references:

• http://www.mat.univie.ac.at/~giordap7/

• http://www.mat.univie.ac.at/~diana/

Application

Applicants should submit:

1. Detailed curriculum vitae
2. Statement on how their research interests fit the above topics and requested backgrounds (1-2 pages)

3. Links to their Master’s theses or publications

Please send all documents until **10 June 2018** to paolo.giordano@univie.ac.at


Selected candidates will be contacted for an online interview.

Thanks for your interest,

Paolo Giordano

Senior researcher, Wolfgang Pauli Institute, Vienna