Publication list for Patrik Jansson [orcid:0000-0003-3078-1437]

Bibliometric information:

Prof. Jansson has

- 46 peer-reviewed publications,
- more than 2100 citations in total,
- and i10-index 33,
- according to Google Scholar.

1 Selection of research outputs

The following 10 of my publications are the scientifically most important for implementing the proposed research activities.

1. N. Botta, N. Brede, M. Crucifix, C. Ionescu, **P. Jansson**, Z. Li, M. Martínez, and T. Richter. Responsibility under uncertainty: Which climate decisions matter most? *Environmental Modeling & Assessment*, Feb. 2023. ISSN 1573-2967. DOI: 10.1007/s10666-022-09867-w.

   We apply our dependently typed, verified theory of policy advice [5,6] to measure the relative importance of different decision steps in a stylized greenhouse gas emissions process. In the current proposal we aim to extend this to multi-objective optimal control problems. I provided material for parts of the paper and was external collaborator in the TiPES (Tipping Points in the Earth System) project, which funded the work.

2. I. Pusztai, I. Ekmark, H. Bergström, P. Halldestam, **P. Jansson**, M. Hoppe, O. Vallhagen, and T. Fülöp. Bayesian optimization of massive material injection for disruption mitigation in tokamaks. *J. of Plasma Physics*, Feb. 2023. DOI: 10.48550/ARXIV.2302.01260.

   We apply Bayesian methods for multi-objective optimization under uncertainty in the fusion energy area. The tools and the methods developed will also be relevant in the currently proposed project. The paper was written in collaboration with the Physics group as part of the "Optimising Fusion with Functional Programming" project.

3. **P. Jansson**, C. Ionescu, and J.-P. Bernardy. *Domain-Specific Languages of Mathematics*, volume 24 of *Texts in Computing*. College Publications, Jan. 2022. ISBN 978-1-84890-388-3.

   The methodology detailed in the book is based on specifying and implementing Domain-Specific Languages as a way to understand a problem domain. We plan to use this methodology in the current proposal. I wrote almost all of the book, based on initial lecture notes by C Ionescu, and helped by J-P Bernardy.

4. N. Botta, **P. Jansson**, and C. Ionescu. The impact of uncertainty on optimal emission policies. *Earth System Dynamics*, 9(2):525–542, 2018. DOI: 10.5194/esd-9-525-2018.

   This is our first case study of the sequential decision problems theory [5,6], applied to the impact of uncertainty on optimal greenhouse gas (GHG) emission policies. The results are highly relevant for the proposed project, but need to be extended to the multi-objective setting. The paper was written in collaboration with Botta and Ionescu.

5. N. Botta, **P. Jansson**, and C. Ionescu. Contributions to a computational theory of policy advice and avoidability. *Journal of Functional Programming*, 27:e23, 2017a. DOI: 10.1017/S0956796817000156.

   The paper extends the earlier work on sequential decision problems [6] to a computational theory of policy advice and avoidability. It was done as part of the Global Systems Science research programme, funded by the EU, where I was site leader and also actively involved in both the theory and the implementation.

6. N. Botta, **P. Jansson**, C. Ionescu, D. R. Christiansen, and E. C. Brady. Sequential decision problems, dependent types and generic solutions. *Logical Methods in Computer Science*, 13(1), 2017b. DOI: 10.23638/LMCS-13(1:7)2017.

   This is our first specification and provably correct implementation of climate-relevant sequential decision problems using dependent types. The paper was the result of many discussions and iteratively refined prototypes in collaboration with Botta and Ionescu. Christiansen and Brady were brought in as experts on the underlying technology, the dependently typed programming language Idris.

7. C. Ionescu and **P. Jansson**. Dependently-typed programming in scientific computing - examples from economic modelling. In *Implementation and Application of Functional Languages - 24th International Symposium*, volume 8241 of *Lecture Notes in Computer Science*, pages 140–156. Springer, 2012. DOI: 10.1007/978-3-642-41582-1_9.

   We formalised concepts from economic modelling as examples of dependently-typed programming in scientific computing. We worked in three different EU projects on developing a computational theory of Global Systems Science based on Domain-Specific Languages. I worked closely with Ionescu who was then a guest researcher hosted (and funded) by me.

8. J. Bernardy, **P. Jansson**, and R. Paterson. Proofs for free - parametricity for dependent types. *Journal of Functional Programming*, 22(2):107–152, 2012. DOI: 10.1017/S0956796812000056.

   This paper is about theoretical research underpinning our work on "correct-by-construction" programming, inspired by our earlier work on "testing vs proving" [9] and "testing polymorphic properties" [10]. I was the PhD advisor of Bernardy and invited Paterson to collaborate on the paper.

9. C. Ionescu and **P. Jansson**. Testing versus proving in climate impact research. In *18th International Workshop on Types for Proofs and Programs*, volume 19 of *LIPIcs*, pages 41–54. 2011. DOI: 10.4230/LIPIcs.TYPES.2011.41.

   Together with Ionescu, then a PostDoc working with me, we explored and explained the pros and cons of testing versus proving in climate impact research, expanding on earlier work on testing of polymorphic properties. In the proposed project we expect to reconnect with this line of work in the context of multi-objective optimization.

10. J. Bernardy, **P. Jansson**, and K. Claessen. Testing polymorphic properties. In *Programming Languages and Systems, 19th European Symposium on Programming*, volume 6012 of *Lecture Notes in Computer Science*, pages 125–144. Springer, 2010a. DOI: 10.1007/978-3-642-11957-6_8.

    This paper uses parametricity to reduce intractable testing of polymorphic properties to tractable (but still as strong) testing of monomorphic instances of the property. It lead to applications in [8] and more fundamental theoretical results in [9]. I was the PhD advisor of Bernardy and Prof. Claessen is a collaborator at Chalmers.

2 Relevant peer-reviewed research outputs from 2016–2024

2.1 Original articles

1. J. Jansson and **P. Jansson**. Level-p-complexity of Boolean functions using thinning, memoization, and polynomials. *Journal of Functional Programming*, 33:e13, 2023. DOI: 10.1017/S0956796823000102.

2. I. Pusztai, I. Ekmark, H. Bergström, P. Halldestam, **P. Jansson**, M. Hoppe, O. Vallhagen, and T. Fülöp. Bayesian optimization of massive material injection for disruption mitigation in tokamaks. *J. of Plasma Physics*, Feb. 2023. DOI: 10.48550/ARXIV.2302.01260.

3. N. Botta, N. Brede, M. Crucifix, C. Ionescu, **P. Jansson**, Z. Li, M. Martínez, and T. Richter. Responsibility under uncertainty: Which climate decisions matter most? *Environmental Modeling & Assessment*, Feb. 2023. ISSN 1573-2967. DOI: 10.1007/s10666-022-09867-w.

4. N. Botta, N. Brede, **P. Jansson**, and T. Richter. Extensional equality preservation and verified generic programming. *Journal of Functional Programming*, 31, 2021. DOI: 10.1017/S0956796821000204.

5. N. Botta, **P. Jansson**, and C. Ionescu. The impact of uncertainty on optimal emission policies. *Earth System Dynamics*, 9(2):525–542, 2018. DOI: 10.5194/esd-9-525-2018.

6. N. Botta, **P. Jansson**, and C. Ionescu. Contributions to a computational theory of policy advice and avoidability. *Journal of Functional Programming*, 27:e23, 2017a. DOI: 10.1017/S0956796817000156.

7. N. Botta, **P. Jansson**, C. Ionescu, D. R. Christiansen, and E. C. Brady. Sequential decision problems, dependent types and generic solutions. *Logical Methods in Computer Science*, 13(1), 2017b. DOI: 10.23638/LMCS-13(1:7)2017.

8. J. Bernardy and **P. Jansson**. Certified context-free parsing: A formalisation of Valiant's algorithm in Agda. *Logical Methods in Computer Science*, 12(2), 2016. DOI: 10.2168/LMCS-12(2:6)2016.

2.2 Conference contributions **(which are not included in other publications)**

Note to non computer scientists Conference articles in computer science are peer reviewed full articles — not 1–2 page abstracts, and are the normal form of refereed publication.

1. R. Krook and **P. Jansson**. An algebra of sequential decision problems: Extended abstract. In *Proceedings of ACM SIGPLAN Workshop on Type-Driven Development*. ACM, 2019. See also the Technical Report.

2. **P. Jansson**, S. H. Einarsdóttir, and C. Ionescu. Examples and results from a BSc-level course on domain specific languages of mathematics. In *Proceedings Seventh International Workshop on Trends in Functional Programming in Education*, volume 295 of *EPTCS*, pages 79–90, 2018. DOI: 10.4204/EPTCS.295.6.

3. C. Ionescu, **P. Jansson**, and N. Botta. Type theory as a framework for modelling and programming. In *Leveraging Applications of Formal Methods, Verification and Validation.*, volume 11244 of *Lecture Notes in Computer Science*, pages 119–133. Springer, 2018. DOI: 10.1007/978-3-030-03418-4_8.

4. M. Algehed, **P. Jansson**, S. H. Einarsdóttir, and A. Gerdes. Saint: An API-generic type-safe interpreter. In *Trends in Functional Programming - 19th International Symposium*, volume 11457 of *Lecture Notes in Computer Science*, pages 94–113. Springer, 2018. DOI: 10.1007/978-3-030-18506-0_5.

5. M. Algehed and **P. Jansson**. VisPar: visualising dataflow graphs from the par monad. In *Proceedings of the 6th ACM SIGPLAN International Workshop on Functional High-Performance Computing*, pages 24–29. ACM, 2017. DOI: 10.1145/3122948.3122953.

6. C. Ionescu and **P. Jansson**. Domain-specific languages of mathematics: Presenting mathematical analysis using functional programming. In *Proceedings of the 4th and 5th International Workshop on Trends in Functional Programming in Education*, volume 230 of *EPTCS*, pages 1–15, 2016. DOI: 10.4204/EPTCS.230.1.

2.3 Books and book chapters

1. **P. Jansson**, C. Ionescu, and J.-P. Bernardy. *Domain-Specific Languages of Mathematics*, volume 24 of *Texts in Computing*. College Publications, Jan. 2022. ISBN 978-1-84890-388-3.

   This book is used as course litterature for a BSc course in computer science at Chalmers and University of Gothenburg. The methodology detailed in the book is based on specifying and implementing Domain-Specific Languages as a way to understand a problem domain. We plan to use this methodology in the current proposal. I wrote almost all of the book, based on initial lecture notes by C Ionescu, and helped by J-P Bernardy.

3 Relevant non peer-reviewed research outputs from 2016–2024

The presentations below are linked to from my homepage: https://patrikja.owlstown.net/.

3.1 Invited presentations

2024-04-04: "Tensors DSLs and Curved Space-Time" at the IFIP Working Group 2.1 on Algorithmic Languages and Calculi, meeting #81, in Neustadt, Germany.

2023-08-30: "Domain-Specific Languages of Mathematics", mini-course as part of the Wisla'23 Summer School (online / Gothenburg, Sweden).

2023-07-18: "Tensors: where linear transformations meet linear types" at the IFIP Working Group 2.1 on Algorithmic Languages and Calculi, meeting #80, in Oxford, UK.

2023-04-19: Outreach (in Swedish): "Beräkna Bästa Beslutet" as part of Vetenskapsfestivalen 2023, Gothenburg, Sweden. Directly related to the topic of the current application.

2023-02-28 "Dimension analysis and graded algebras" at the IFIP Working Group 2.1 on Algorithmic Languages and Calculi, online meeting 2023-02.

2022-12-14 "Level-p-complexity of Boolean Functions: Using thinning, memoization, and polynomials" at the IFIP Working Group 2.1 on Algorithmic Languages and Calculi, online meeting 2022-12.

2022-11-11 "Dimension analysis and graded algebras" at the 31st Agda Implementors' Meeting in Edinburgh, UK.

2022-09-20 "Domain-Specific Languages for Societal Challenges" at the Final conference: Mathematics of complex social systems, Thematic Einstein Semester 2022, online and in Berlin, Germany.

2020-01-07: "AlgSDP: Algebra of Sequential Decision Problems" at the IFIP Working Group 2.1 on Algorithmic Languages and Calculi, meeting #79, in Otterlo, the Netherlands.

2018-07-05: "Examples and Results from a BSc-level Course on DSLs of Mathematics" at the IFIP WG2.1, meeting #77 in Brandenburg, Germany.

2017-12-11: "Keynote: GSS applications and challenges" at the GSS in H2020 and Beyond, workshop in Brussels, Belgium.

2016-06-14: "FLABloM: Functional Linear Algebra with Block Matrices" at the IFIP WG2.1, meeting #74 in Glasgow, UK.

2016-04-06: "Reproducibility, Proofs and Domain Specific Languages" at the Alan Turing Institute Symposium on Reproducibility in Data-intensive Research, Oxford, UK.

3.2 Preprints

In addition to the published papers listed earlier, the following preprints were posted on arXiv in connection with the paper submissions, but are not yet accepted for publication:

2024-02: "Fluid and kinetic studies of tokamak disruptions using Bayesian optimization" submitted to J. Plasma Physics (arXiv:2402.05843)

2023-12: "Domain-Specific Tensor Languages" (arXiv:2312.02664) submitted to J. Functional Programming.

2023-08: "Types, equations, dimensions and the Pi theorem" (arXiv:2308.09481) submitted to J. Functional Programming.

3.3 Other outputs

1. I. Ekmark, I. Pusztai, M. Hoppe, **P. Jansson**, T. Fülöp. Bayesian optimization of disruption scenarios with fluid-kinetic models, *49th EPS Conference on Contr. Fusion and Plasma Phys* P5.008 (2023).

   This is a physics conference extended abstract published the year before the corresponding preprint (arXiv:2402.05843) listed above (2024-02).