# University of Minnesota

***Twin Cities Campus***

***School of Mathematics***
*College of Science & Engineering*

*127 Vincent Hall*
*206 Church Street S.E.*
*Minneapolis, MN 55455*

*+1 612 625-5591*
*Fax: +1 612 626-2017*


January 29, 2019

Dear Colleagues:

I am writing to support of my graduate student, Jonas Karlsson, to participate in the Applied Category Theory 2019 School. Jonas is pursuing an interesting Ph.D. project in the theory of "multispace", a concept of potential importance to a wide range of fields, including numerical analysis, differential geometry, differential equations, and applications. His project impinges on applied category theory, hence his interest in the school. He has also become especially interested in Sadrzadeh's work on applying category theory to linguistics, in which he has recently gained a level of understanding.

Jonas began his graduate career as a student of algebraic geometry, but a couple of years ago became interested in more applications-oriented directions and opted to pursue his Ph.D. thesis under my supervision. I decided the time was ripe to take advantage of his algebro-geometric training and revisit my earlier frustrations with realizing the multi-space construction for higher dimensional submanifolds. I am very encouraged that he has made some progress in this study, and is close to an understanding of the case of functions of two variables, which is the most important preliminary step towards resolving the general case. His work already explains intriguing, unusual formulas relating jets (derivatives) of functions of differing numbers of variables or, equivalently, submanifolds of varying dimensions, e.g. curves and surfaces, that I came upon in my study of multivariate interpolation theory.

Jonas is a smart, inquisitive student, with a wide range of mathematical interests. I thus fully support his application to attend the School.

Sincerely yours


Peter J. Olver
Professor and Head
e-mail: olver@umn.edu
http://www.math.umn.edu/∼olver

Dear sir or madam,

This is my application to the ACT 2019 school. I am a PhD student in mathematics at the University of Minnesota, supervised by Peter Olver. While my thesis deals with differential geometry I intend to switch over to more categorical topics after my graduation (later this year, knock wood). As part of this plan I attended SYCO 1 in Birmingham and was absolutely delighted to meet people working in categories. It is an unfortunate fact that category theory is not yet as mainstream and geographically well-represented as other mathematical areas (or else I would have written my thesis about it, which just wasn't an option). This makes initiatives like ACT all the more important to connect interested people. Specifically I would like to use categories to study language, since I also have a background in computational linguistics and programming. This motivates my ranking of the projects, Sadrzadeh's being by far the most interesting to me. Beyond the intrinsic interest of the project, the networking opportunities would be invaluable to me in my attempt to enter category theory more seriously than has hitherto been possible.

Project preference:

Sadrzadeh > Hofstra > Fritz > Milewski > (indifferent about the rest)

I will most likely be able to come to Oxford even without funding (say 80% sure).

I have asked my advisor Peter Olver to send a letter of recommendation.

# Jonas Karlsson


**Address** Rörviksgatan 11
96131 Boden
Sweden

**Mobile Phone** +46 (070) 554 1692
**Email** jonaskarls@gmail.com
**GitHub** https://github.com/jonka364


## Personal Profile

I am a mathematician with experience of programming and data engineering, eager to contribute to education, which I consider to be the most meaningful activity.

## Education

**2010-now** PhD studies in mathematics - University of Minnesota, Minneapolis, USA

Differential geometry with applications to numerical methods

**2006-2010** MSci in mathematics - Linköping University, Linköping, Sweden

Number theory (GPA 4.9/5)

## Employment History

**2017 - 2018** phData, Minneapolis, MN, USA
*Data Engineer*

Worked on-site with several customers, providing big data infrastructure and analytics.

**Technologies:** Hadoop ecosystem tools, Oracle databases, programming in Scala and Java.

**2010 - 2017** Department of mathematics, University of Minnesota
*Teaching assistant*

Led classroom discussion sessions, held office hours, prepared and graded quizzes and exams. Also led computer labs in Matlab and Mathematica.

**2007 - 2009** Department of mathematics, Linköping University
*Amanuensis*

Led classroom discussion sessions, graded quizzes and exams.

## Skills

- **Mathematics**

  *Machine learning/Artificial intelligence*
  *Differential geometry, Lie groups, machine vision*
  *Probability theory/Statistics*
  *Category theory*

- **Programming**

  *Scala, Python, Julia, Java, Haskell, R* - programming languages
  *git, SVN* - source version control
  *Linux, Windows, Mac* - experience working on all platforms
  *Matlab, Mathematica, Sage* - mathematical software packages

- **Languages**

  *Swedish* - Native speaker
  *English* - Fluent in speech and writing
  *German, Spanish* - Decent reading skills, rudimentary speaking skills

## Referees

| | | | |
|---|---|---|---|
| **Name** | Mac Nolan | **Name** | Peter Olver |
| **Company** | phData Inc. | **Institution** | University of Minnesota |
| **Position** | Chief Data Officer | **Position** | PhD advisor, department chair |
| **Contact** | mac@phdata.io | **Contact** | olver@umn.edu |

# Background

Jonas Karlsson

January 20, 2019

## Background in category theory

Throughout my years in graduate school I have nurtured an interest in category theory, and for this reason I have organized independent study groups with my fellow students; in this way I have acquired a solid knowledge of the foundations up to but not including Kan extensions. Some of the books I have studied are "Categories for the working mathematician" (Mac Lane), "Sets for mathematics" (Lawvere-Rosebrugh) and "Category theory in context" (Riehl). I had the pleasure to attend the first SYCO meeting (in Birmingham) and had no difficulty following the categorical parts of the talks.
I also have introductory coursework in computational linguistics, and I have worked as a programmer in industry. For this reason Sadrzadeh's project strikes me as the best fit for my background, although I would surely benefit from the other projects as well.

## Thesis

My thesis, to be defended later this year, uses ideas from algebraic geometry (Hilbert schemes) in differential geometry (jet bundles), aiming to provide a framework for symmetry-preserving discretizations of partial differential equations (like symplectic integrators but for more general Lie group actions).