4EU+ Educational Project: Introduction

Project Title

Joint master degree in Mathematics and Applications

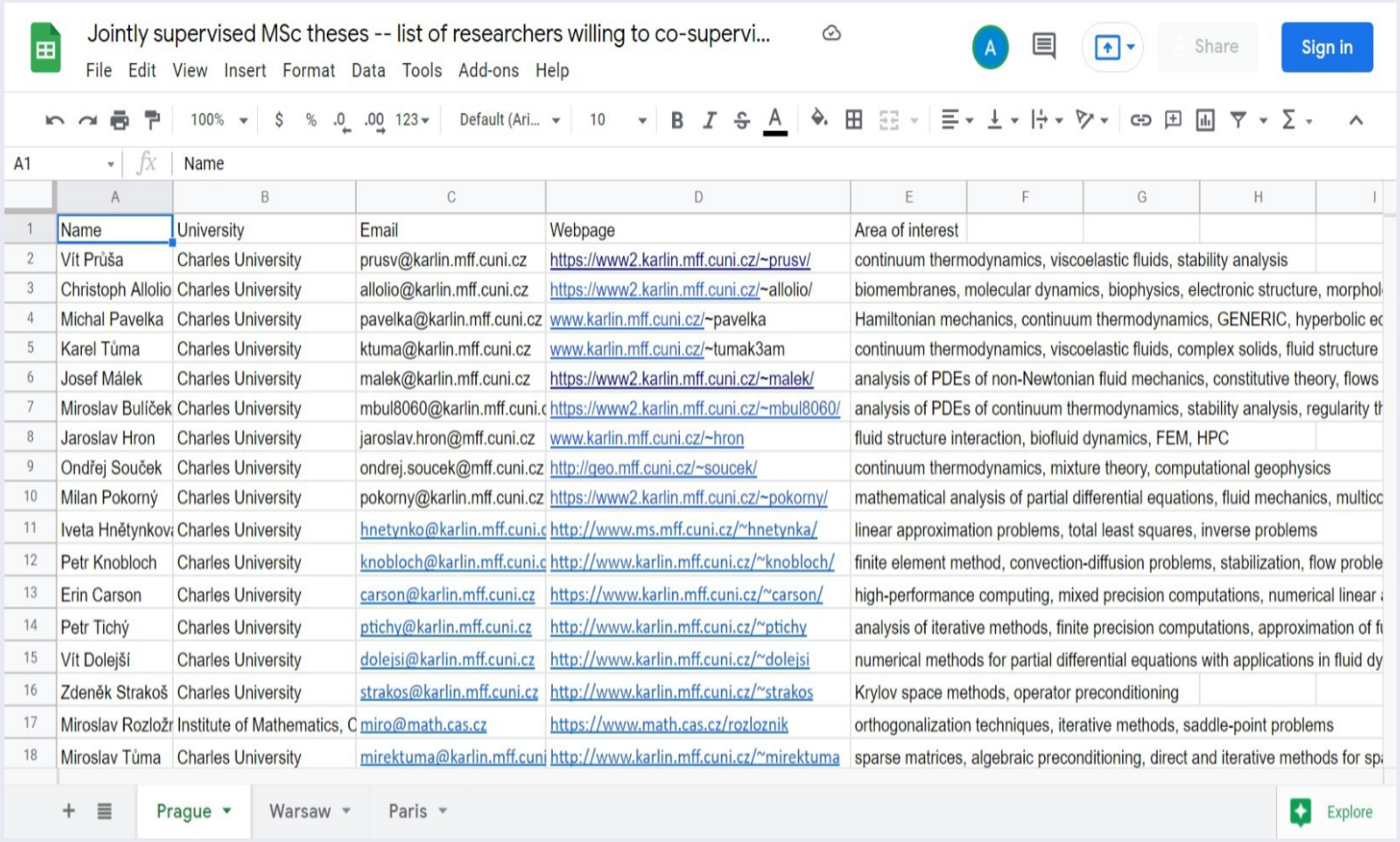
Background

One of the central objectives of the 4EU+ European University Alliance in the **collaboration in higher education**. The joint master degree is the activity that targets this objective.

Current status in joint supervision: Prague, 18.11.2021

Possible supervisors from CU: computational mathematics

- Summary: mathematical modelling + computational mathematics at CU



Jointly supervised MSc theses -- list of researchers willing to co-supervi...

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A1 Name

	A	B	C	D	E	F	G	H	I
1	Name	University	Email	Webpage	Area of interest				
2	Vít Průša	Charles University	prusv@karlin.mff.cuni.cz	https://www2.karlin.mff.cuni.cz/~prusv/	continuum thermodynamics, viscoelastic fluids, stability analysis				
3	Christoph Allolio	Charles University	allolio@karlin.mff.cuni.cz	https://www2.karlin.mff.cuni.cz/~allolio/	biomembranes, molecular dynamics, biophysics, electronic structure, morphol				
4	Michal Pavelka	Charles University	pavelka@karlin.mff.cuni.cz	www.karlin.mff.cuni.cz/~pavelka	Hamiltonian mechanics, continuum thermodynamics, GENERIC, hyperbolic ec				
5	Karel Tůma	Charles University	ktuma@karlin.mff.cuni.cz	www.karlin.mff.cuni.cz/~tumak3am	continuum thermodynamics, viscoelastic fluids, complex solids, fluid structure				
6	Josef Málek	Charles University	malek@karlin.mff.cuni.cz	https://www2.karlin.mff.cuni.cz/~malek/	analysis of PDEs of non-Newtonian fluid mechanics, constitutive theory, flows				
7	Miroslav Bulíček	Charles University	mbul8060@karlin.mff.cuni.c	https://www2.karlin.mff.cuni.cz/~mbul8060/	analysis of PDEs of continuum thermodynamics, stability analysis, regularity th				
8	Jaroslav Hron	Charles University	jaroslav.hron@mff.cuni.cz	www.karlin.mff.cuni.cz/~hron	fluid structure interaction, biofluid dynamics, FEM, HPC				
9	Ondřej Souček	Charles University	ondrej.soucek@mff.cuni.cz	http://geo.mff.cuni.cz/~soucek/	continuum thermodynamics, mixture theory, computational geophysics				
10	Milan Pokorný	Charles University	pokorny@karlin.mff.cuni.cz	https://www2.karlin.mff.cuni.cz/~pokorny/	mathematical analysis of partial differential equations, fluid mechanics, multicc				
11	Iveta Hnětynkov	Charles University	hnetynko@karlin.mff.cuni.c	http://www.ms.mff.cuni.cz/~hnetynka/	linear approximation problems, total least squares, inverse problems				
12	Petr Knobloch	Charles University	knobloch@karlin.mff.cuni.c	http://www.karlin.mff.cuni.cz/~knobloch/	finite element method, convection-diffusion problems, stabilization, flow proble				
13	Erin Carson	Charles University	carson@karlin.mff.cuni.cz	https://www.karlin.mff.cuni.cz/~carson/	high-performance computing, mixed precision computations, numerical linear a				
14	Petr Tichý	Charles University	ptichy@karlin.mff.cuni.cz	http://www.karlin.mff.cuni.cz/~ptichy	analysis of iterative methods, finite precision computations, approximation of f				
15	Vít Dolejší	Charles University	dolejsi@karlin.mff.cuni.cz	http://www.karlin.mff.cuni.cz/~dolejsi	numerical methods for partial differential equations with applications in fluid dy				
16	Zdeněk Strakoš	Charles University	strakos@karlin.mff.cuni.cz	http://www.karlin.mff.cuni.cz/~strakos	Krylov space methods, operator preconditioning				
17	Miroslav Rozložr	Institute of Mathematics, C	miro@math.cas.cz	https://www.math.cas.cz/rozloznik	orthogonalization techniques, iterative methods, saddle-point problems				
18	Miroslav Tůma	Charles University	mirektuma@karlin.mff.cuni	http://www.karlin.mff.cuni.cz/~mirektuma	sparse matrices, algebraic preconditioning, direct and iterative methods for spa				

Prague Warsaw Paris Explore

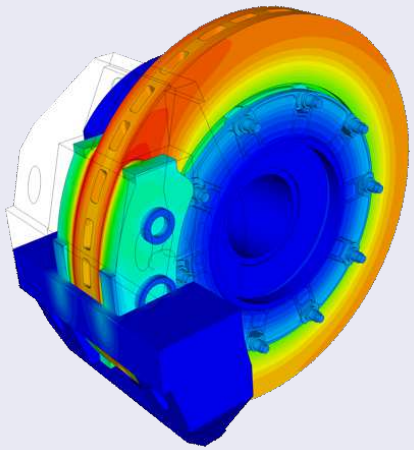
Computational mathematics

1. Linear approximation problems, least squares, iterative and direct methods

- example of deblurring
- mathematically: solving inverse problems, stopping iterative methods to get rid of noise, least squares, total least squares, image processing
- also: sparse matrices, solving large-scale linear systems, preconditioning

Computational mathematics

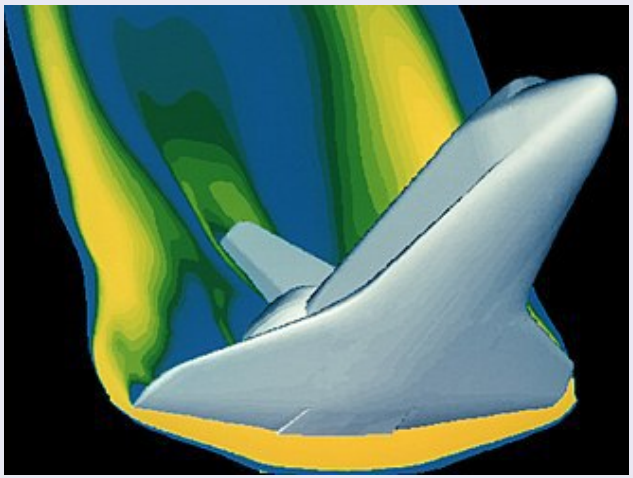
2. High performance computing



- Can we compute accurately at peta- and exa-scale computers of today?
- mathematically: numerical linear algebra, relaxing accuracy, getting theoretical guarantees.

Computational mathematics

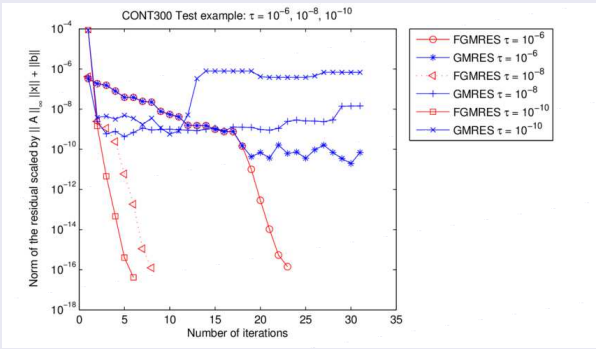
3. Numerical methods for PDEs, adaptivity, errors, flow problems, convection-diffusion problems

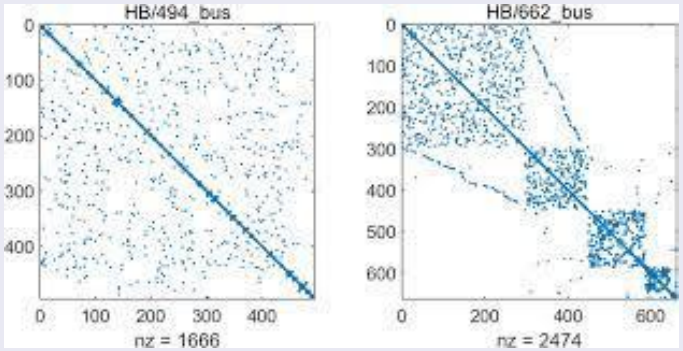


- Solving complex instances of these problems. Can we guarantee stability and/or efficiency?
- mathematically: numerical analysis, finite element method.

Computational mathematics

4. Krylov space methods, preconditioning, orthogonalization





- Can we solve still larger linear systems from discretized PDEs, or even more general systems?
- Discrete and continuous equations (operator preconditioning)? Practical tools? Coupling different physical quantities: saddle-point problems?
- mathematically: theoretical and computational research combining numerical analysis and numerical linear algebra.

- Possibilities not sorted by supervisors since we represent a relatively compact group and some scientific challenges can be shared.
- Persons/individual competencies are roughly described at our web pages.
- **Please, write/ask/contact us**

THANK YOU