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Research field: Applied Mathematics, Differential Equations
Key words: Numerical analysis, Finite element method, Navier–Stokes equations, Boundary conditions

Present research:

I am interested in mathematical justification of numerical simulations, in which it is usually impossible to directly compute exact solutions of mathematical models. The main aim is to rigorously prove that numerical solutions, obtained via some approximation or discretization, are indeed close to exact ones. Moreover, in case exact solutions themselves are not well understood, I would like to establish their existence and uniqueness by mathematical analysis. More concretely, I have been studying the finite element method to PDEs, especially non-standard boundary value problems (e.g., frictional BCs) of the Navier–Stokes equations.

In future studies, I will also try to consider other challenging topics such as:

- Justification of derivation of PDEs appearing in geophysics
- Modeling of various friction phenomena
- Justification of techniques utilized in shape optimization
- Generic error-estimation methods for FDM, FVM, etc.

Notice for the students:

It is not rare that people doing numerical simulations just focus on enhancing computational techniques and do not pay much attention to their justification. Students who are interested in resolving such discrepancy will be suited for numerical analysis. They are encouraged to make full use of the viewpoints from both of mathematics and numerics.

You are supposed to be acquainted with the calculus and linear algebra that you learned in undergraduate courses and with basic knowledge in functional analysis and ODEs/PDEs. In addition, it is recommended that you have deeply and seriously studied one of the fields of mathematics, physics, engineering science, etc.