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Research field: Applied Mathematics, Differential Equations
Key words: finite element method, finite volume method, nonlinear partial differential equation, fluid-flow computation

Present research: Numerical analysis of partial differential equations (PDEs), my current research theme, is aimed at development of numerical schemes to solve PDEs using computers, in addition to verification of them and their feasibility. The targeted specific equations are the Navier–Stokes equations for the motion of a viscous incompressible fluid, the Keller–Segel equation for cellular slime mold aggregation, and associated nonlinear elliptic systems for steady states of these problems. Discretization of these equations using finite element, finite difference, and finite volume methods is the central concern of my research. In the design of discretization procedures, the analytic property of the solutions for these equations must not be spoiled. Some associated themes of development and research are the stability of numerical and approximate solutions, analysis of the asymptotic dependence of errors on discretization parameters (*a priori* analysis) and a procedure to provide solutions with prescribed precision (*a posteriori* analysis). Application of computer simulation of wide range phenomena is expanding to life sciences, clinical medicine, economics, and other areas beyond the limited fields of science and technology. That expansion is bringing about wide and useful information for use in our society. The greater the degree to which computer simulations are used to address complicated and large scale problems, the greater becomes the demand to find solutions to their related mathematical problems. Summing up, numerical analysis demands the pursuit of mathematical truth and contributes to society through mathematics simultaneously – a quite rewarding activity.

Notice for the students: Students probably express various interests and levels of interest in numerical analysis. Irrespective of their interest, they are presumed to be willing to deepen their understanding of mathematical theory and computing skills simultaneously. Otherwise, they cannot be successful in this field. Although the minimal background is functional analysis, they should rely on complex and real analyses whenever they are found useful. It goes without saying that skills of programming and data visualization are desired. Along with these prerequisites, students must be familiar with the theory of PDEs. However, they can probably make a good start given some level of confidence in any of the subjects presented above. The subject of applied mathematics is not an enumeration of successful applications of established mathematics but is instead a study of mathematical action on the real world. Therefore, strong will and energy to learn and absorb new ideas are of paramount importance in the study of applied mathematics (Not to mention that numerical analysis is a part of applied mathematics.). I wish to study this subject hand in hand with enthusiastic graduate students filled with such passion.
For additional and specific information, consult with *http://www.infsup.jp/saito/*