Name： Kazuhiro Ishige

Research field： Differential Equations

Key words ： Diffusion equations, Geometric and asymptotic analysis of solutions

Present research ：Many phenomena that appear in natural sciences are described by differential equations, and the mathematical concepts and analytical methods developed to study such equations have significantly contributed to the advancement of mathematics. I am particularly interested in parabolic partial differential equations, such as the heat equation, and studied various topics —both linear and nonlinear—focusing on the geometric properties and asymptotic behavior of their solutions.

Example:
(1) The behavior of the maximum point of solutions to parabolic equations;
(2) Power concavity of solutions to diffusion equations;
(3) Higher-order asymptotic analysis of global-in-time solutions to nonlinear diffusion equations;
(4) Blow-up phenomena in solutions to nonlinear parabolic equations;
(5) Structure of solutions to elliptic equations with dynamic boundary conditions.

These topics are not isolated from one another, but rather deeply interconnected.

Notice for the students ： Research related to partial differential equations (PDEs) is extremely diverse, and gaining a comprehensive overview of the field is not easy. I recommend beginning by focusing on a single problem, striving to grasp its essence, and aiming to overcome the inherent difficulties it poses.

Research in PDE theory requires a solid foundation in various areas, such as ordinary differential equations, measure theory, functional analysis, and real analysis. It is important for students to deepen their understanding through their own efforts.