**Previous works**

In our previous works, we studied 2 types of reaction diffusion equations. The first one is a reaction diffusion system which describes the time evolution of reversible chemical reaction and it is derived from mass-action law. The second one is a semilinear heat equation with the nonlinearity of type $|u|^{p-1}u$. Both of them are well-known mathematical models but, from the point of view of mathematical analysis, there are many open problems, including well-posedness of the solutions. Through our previous works, we focused on the structures of the equations which characterize the phenomena and tried to introduce new ideas and methods to solve the open problems.

## Mathematical analysis of reaction-diffusion systems describing reversible chemical reactions.

[1] 「Global-in-time behavior of weak solutions to reaction-diffusion systems with inhomogeneous Dirichlet boundary condition」

We study reaction diffusion systems describing, in particular, the evolution of concentrations in general reversible chemical reaction. We concentrate on inhomogeneous Dirichelt boundary conditions. We first prove the L1 compactness of approximate solutions. Then, we obtain global existence of (very) weak solutions. We also proved that these solutions converge exponentially in L1 norm toward the equilibrium.

[2] 「Asymptotic behavior in chemical reaction-diffusion systems with boundary equilibria」

We consider the asymptotic behavior for large time of solutions to reaction-diffusion systems modeling reversible chemical reactions. We focus on the case where multiple equilibria exist. In this case, due to the existence of so-called "boundary equilibria", the analysis of the asymptotic behavior is not obvious. The solution is understood in a weak sense as a limit of adequate approximate solutions. We prove that this solution converges in $L$1 toward an equilibrium as time goes to infinity and that the convergence is exponential if the limit is strictly positive.

## Local in time well-posedness of a semilinear heat equation with singular initial data

[4] 「A semilinear heat equation with initial data in negative Sobolev spaces」

We give a sufficient condition for the existence, locally in time, of the solutions to a semilinear heat equation with the nonlinearity of type $|u|^{p-1}u$, when the initial data is in negative Sobolev spaces. This is a generalization of the case the initial data is in $L^q$ spaces.