

Research Report (September, 2021- September, 2022)

Enrollment from
September 2021

Department of Pure and Applied Mathematics

Riku Suda

I. List of Papers

1. Riku Suda, *Two Types of Solutions for A Kirchhoff Elliptic Equation with Large Growth Non-Locality and Its Singular Perturbation Problem*, preprint.

II. List of Talks

1. "On two solutions of a Kirchhoff-type elliptic problem with high-growth non-locality", 第2回 非線形 PDE 若手ワークショップ (Online), 2022-03-15.

III. Research Results in AY2021

Reviewing and refining the argument of ongoing research about the variational analysis on a non-local elliptic partial differential equation called "Kirchhoff-type":

$$\begin{cases} -M\left(\|\nabla u\|_{L^2(\mathbb{R}^N)}^2\right) \Delta u = g(u); \\ u \in H^1(\mathbb{R}^N) \setminus \{0\} \end{cases}$$

Here, we assume that $N \geq 3$, $M(s)$ is a positive increasing function such as $M(s) = a + bs^\beta$ ($s > 0$) with $a, b, \beta > 0$ and g represents a certain type of general non-linearity known for papers by Berestycki and Lions. More specifically, the large β situation is the target, which implies stronger effects from the non-local term represented by the function M .

This year, the argument has been successfully strengthened, which has enabled us to deal with more general settings.

In addition, a result for the related singularly perturbed problem:

$$-\varepsilon^2 \left[a + b \left(\varepsilon^{2-N} \int_{\mathbb{R}^N} |\nabla u|^2 dx \right)^\beta \right] \Delta u = -V(x)u + f(u) \quad (\varepsilon > 0)$$

was also obtained, which has been reviewed as well.

These results are already summarized as a preprint and being prepared for publishing (see List of Papers).

IV. Research Plan for AY2022

Further research on the Kirchhoff-type singular perturbed problem, like seeking multi-peak solutions.