Research Report（April, 2018 - March, 2019）

Enrollment from April 2018 | Department of Pure and Applied Mathematics | Ryo Kanamaru

Ⅰ. List of Papers

1. Kanamaru, R.,: Brezis-Gallouet-Wainger type inequalities and a prior estimates of strong solutions to Navier-Stokes equations. J. Funct. Anal. (submitted)
2. Kanamaru, R.,: Improvement of the extension criterion on strong solutions to the Navier-Stokes equations in Vishik type spaces. Commun. Math. Phys. (submitted)

Ⅱ. List of Talks

1. Brezis-Gallouet-Wainger type inequalities and a prior estimates of time local strong solutions to Navier-Stokes equations, 日本数学会 2018 年度秋季総合分科会, 岡山大学, 2018 年 9 月 24 日～27 日.
2. Improvement of the extension theorem of strong solutions to Navier-Stokes equations by Vishik type spaces, 研究集会「若手のための偏微分方程式と数学解析」, 福岡大学, 2019 年 2 月 13 日～14 日.
3. Improvement of the extension theorem of strong solutions to Navier-Stokes equations by Vishik type spaces, 日本数学会 2019 年度年会, 東京工業大学, 2019 年 3 月 17 日～20 日.

Ⅲ. Research Results in AY2018

We showed the Brezis-Gallouet-Wainger inequalities by means of the Vishik type spaces which are in some cases larger than $\dot{B}^0_{\infty,\infty}$. As an application of those inequalities, we proved that the strong solutions to the Navier-Stokes equations can be extended if the scaling invariant quantity of vorticity is finite. Namely, the Beale-Kato-Majda type regularity criteria are improved in the terms of the Vishik type space. Furthermore, we established a new a priori estimate of strong solutions to the Navier-Stokes equations which has an almost single exponential growth form with respect to the scaling invariant quantity of the vorticity. Our method is based on the double logarithmic type Sobolev inequality of the Vishik space.

Ⅳ. Research Plan for AY2019

We will consider the Beale-Kato-Majda type regularity criteria on strong solutions by applying the Brezis-Gallouet-Wainger inequalities to other equations, such as the Euler, MHD, Boussinesq, quasi-geostrophic, Cahn-Hilliard and harmonic-heat-flow equations.