

# Multiscale Analysis, Modeling and Simulation

## -Top Global University Project, Waseda University-

### Report on Study Abroad

Name: Ryosuke Odoi

Date: May 31, 2022

1. Destination:

Indiana University-Purdue University Indianapolis (IUPUI), United States of America

2. Dates of Stay:

February 1, 2022 – March 29, 2022

3. Purpose:

To solve the Riemann-Hilbert problem for the singular solutions of the  $tt^*$ -Toda equations

4. Host Professor:

Alexander Its (IUPUI)

5. Education and Research Activity:

I am studying the  $tt^*$ -Toda equations, which is a special case of the radial (or cylindrical) reduction of the two-dimensional Toda equations (with opposite sign) which appeared in the work of Cecotti and Vafa on two-dimensional supersymmetric field theories. The main purpose of the trip is to solve the Riemann-Hilbert for the singular solutions of the  $tt^*$ -Toda equations to generalize a result I have shown last trip.

During the trip, Professor Its and I calculated the jump matrices of the Riemann-Hilbert problem which correspond to the singular solutions of the  $tt^*$ -Toda equations in the  $n=1$  and  $n=2$  cases. We looked for an appropriate deformation of the problem. Professor Its kindly helped me regarding this problem. And I attended his lecture course of the Riemann-Hilbert problems of the Painlevé II, III and the  $tt^*$ -Toda equations.

6. Other comments:

The trip was my second visit to IUPUI. As before, the people I met were very kind. Thanks to the kindness, my trip was comfortable. I would especially like to thank Professor Its. He tightly helped my research. And I also thank Kenta Miyahara, who is a Ph. D. student at IUPUI and was a student at Waseda. He and I had dinner several times and had discussions about the Riemann-Hilbert problem and other mathematics. I really enjoyed my visit to IUPUI again, and the trip was helpful to my research.

The trip is supported by Mathematics and Physics Unit “Multiscale Analysis, Modelling and Simulation”, Top Global University Project, Waseda University. I am grateful to Professor Yoshihiro Shibata, Professor Martin Guest, Ms. Ishizaki, Ms. Yoshida and all the staffs who supported my trip.

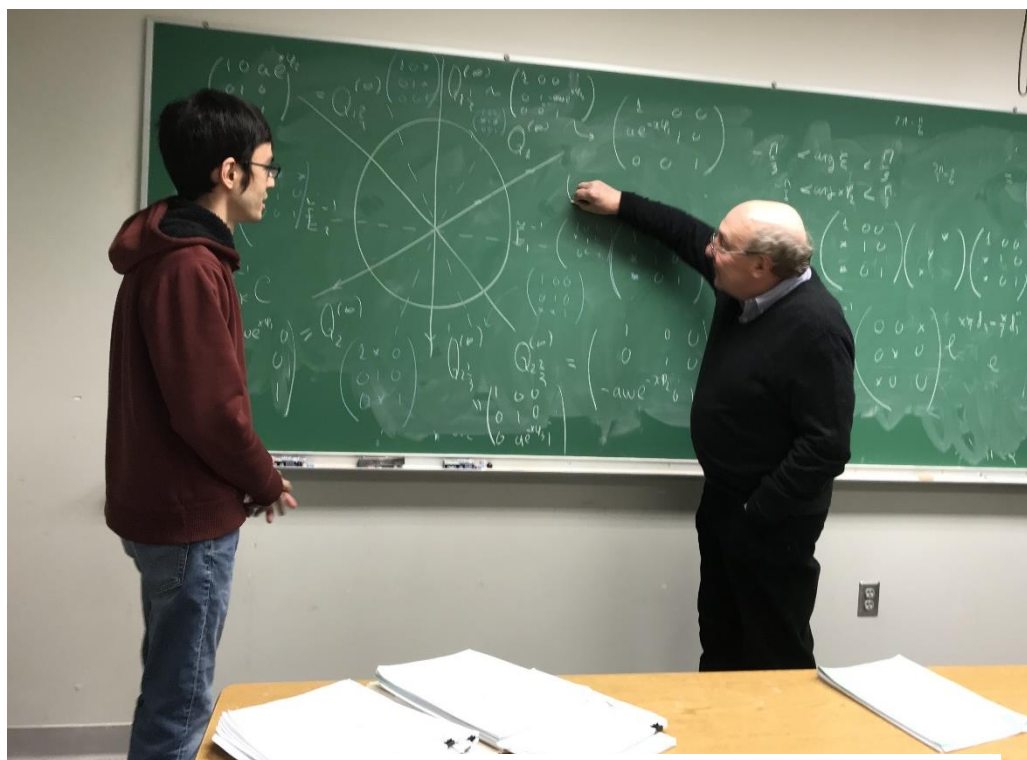


Figure 1. With Professor Its at IUPUI