NTU-KU Joint Funding

Final Report

Section 1

NTU principle investigator	
Name (last name, first name)	**Chen, I-Kun**
Position	**Associate Professor**
Faculty/Department	**Department of Mathematics**

KU principle investigator	
Name (last name, first name)	**Kawagoe, Daisuke**
Position	**Assistant Professor**
Faculty/Department	**Graduate School of Informatics**
Visiting ECR*	
Name (last name, first name)	**Su, Jhe-Kuan**
Position	**PhD student**
Faculty/Department	**Department of Mathematics**

*Please complete this section if the KU principal investigators hosted ECRs from NTU.

Host researcher*	
Name (last name, first name)	
Position	
Faculty/Department	

*Please complete this section if the host researcher is different from the KU principal investigator.

Section 2

Project title
Regularity of the solution to the stationary Boltzmann equation in a bounded domain

Section 3

Period of project	
From dd/mm/yy to dd/mm/yy	From 19/10/2022 to 01/11/2022

Section 4

Summary of the project (approx. 100 words)
*KU PIs are required to submit a summary of the project in Japanese in addition to the English summary (approx. 200–300 characters).

(Please enter the summary of the project)

During the ECR's stay, we discussed singularity of the first derivatives of solutions to the inflow boundary value problem of the stationary linearized Boltzmann equation. So far, he showed that the solution belongs to the Sobolev space H^1, which means that its first derivatives are square-integrable, if the domain is bounded convex of positive Gaussian curvature and if it is small enough. In this project, we consider a thin slab domain and constructed an example of a solution whose first derivative is not square-integrable. This example supports that the positive Gaussian curvature condition is crucial in the previous result.

入射境界条件を伴う定常線型 Boltzmann 方程式の解の偏導関数の特異性を議論した. ECR の Su 氏はこれまでに, 方程式を考える領域が有界凸でその境界の Gauss 曲率が一様に正である場合に, 領域の直径が十分小さければ, 滑らかな入射に対して解は Sobolev 空間 H^1 に属することを示していた. これは, 解の偏導関数が2乗可積分であることを意味する. 本プロジェクトでは, この Gauss 曲率に関する条件に焦点を当て, 曲率が0である平行平板の問題を考え, 解の偏導関数が2乗可積分でないような例を構成した. この例は, 境界の Gauss 曲率が解の偏導関数に影響を与えることを示唆している.

Section 5 (Please complete this section if ECRs from NTU participated in collaborative research at KU)

Achievements and Outcomes of ECRs' Stay (approx. 100–250 words)
*This section should be filled by each of the ECR(s) (one paragraph per ECR) based on his/her experience of staying in Japan.

(Please enter the achievements and outcomes for each of the ECR(s).)

In the stay in Kyoto, I discussed with Professor Kawagoe about the H^1 regularity problem for stationary linearized Boltzmann equation with incoming boundary condition in slab domain. Initially we construct an L^2 solution and decomposed it into some parts and examine the regularity of each term. In the process, I learned some new ways to estimate the integral operator, which can be used for simpler mathematical argument. As a result, we finished some crucial step for constructing some counterexample for H^1 regularity of solution, which implies that the assumption that the boundary of domain is of positive Gaussian curvature is crucial for the H^1 regularity of the stationary solution.

Section 6

Photographs with captions
*Please submit digital files (such as JPEG or GIF files) of the photographs used in your report as attachments. The size of each image should be at least 4MB, so that it can be used for printed materials. Please ensure that none of the photographs submitted will cause any issues relating to portrait rights.
URL at which project outcomes can be viewed (Optional)
*E.g. workshop notifications/programs/reports, evidence of academic papers published or otherwise made available, etc.
URL: