Advanced Topics in Geometry A1 (MTH.B405)

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http://www.official.kotaroy.com/class/2025/geom-a1

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Important Pointers:

- http://www.official.kotaroy.com/class/2025/geom-a1
- https://lms.s.isct.ac.jp/ (Science Tokyo LMS)

Lecture:

- Schedule: Fridays 13:30–15:10
- Venue: Main Building, M-B43
- Lecturer: Kotaro Yamada (Dept. Math.);
  kotaro@math.sci.isct.ac.jp;
  Office: Room 231, the 2nd floor of the main building

Course Description

The fundamental theorem of surface theory and its applications will be introduced.

Theorem

Let

- $U \subset \mathbb{R}^2$ *be a simply connected domain,*
- I *be a positive definite symmetric quadratic form on* U
- II *be a symmetric quadratic form on* U*.*

Assume I *and* II *satisfy the Gauss and Codazzi equations. Then there exists a surface* $\boldsymbol{f} : U \to \mathbb{R}^3$ *whose first and second fundamental forms are* I *and* II*, respectively.*
Moreover, such an $\boldsymbol{f}$ *is unique up to orientation preserving isometry of* $\mathbb{R}^3$*.*

Textbook

No textbook is set.
Lecture note will be uploaded on Science Tokyo LMS within the previous day of each class.

- Handouts are also uploaded on LMS.
- Blackboards will be uploaded on LMS after the lecture.
- Recordings of the lecture can be viewd from website of zoom. URL is announced via LMS.

Grading Policy:

- Graded by weekly homeworks.
- Each homework consists of
  1. a problem on the topics in the lecture (up to 2 points), and
  2. to present a question on the contents of the lecture, or to point out error(s) in the lecture note/the lecture (up to 3 points).

- Upload: Science Tokyo LMS
- Deadline: Tuesday just after the lecture. 10:00AM JST
- Format: Use Homework Sheet, available from LMS
- Japanese is acceptable.

- Questions, requests and comments (and the answers, lecturer's comments) will be published on the following class.

Class Schedule

Date	Contents
April 11.	1. Overview
April 18.	0. cancelled
April 25.	2. Ordinary differential equations
May 02.	0. Schedule on Tuesdays
May 09.	3. Integrability conditions
May 16.	4. Surfaces in Euclidean 3-space
May 23.	5. Gauss and Codazzi equations
May 30.	6. Fundamental theorem for surface theory
June 06.	7. Applications

→ Adv Topics in Geometry B1 2Q (MTH.B406)
(including more applications of fundamental theorem, to "non-euclidean geometry".