

Introduction to analytic \mathcal{D} -modules and applications to complex algebraic geometry

Jun.4–Jun.22 2018

Instructor: Lei Wu at the University of Utah

Email: lwu@math.utah.edu

Schedule:

Lecture 1: June 4, Monday 2:00pm–4:00pm

Lecture 2: June 6, Wednesday 2:00pm–4:00pm

Lecture 3: June 8, Friday 2:00pm–4:00pm

Lecture 4: June 11, Monday 2:00pm–4:00pm

Lecture 5: June 13, Wednesday 2:00pm–4:00pm

Lecture 6: June 15, Friday 2:00pm–4:00pm

Lecture 7: June 18, Monday 2:00pm–4:00pm

Lecture 8: June 20, Wednesday 2:00pm–4:00pm

Lecture 9: June 22, Friday 2:00pm–4:00pm

Prerequisite information: Familiarity with complex algebraic geometry in the sense of Griffiths-Harris “Principles of Algebraic Geometry” Chapter 0, 1 and 3, and some basic homological algebra.

Brife course description: I will give an introduction to the theory of \mathcal{D} -modules from an analytic point of views. Topics that will likely to be covered:

1. The sheaf of differential operators and \mathcal{D} -modules: coherence and characteristic varieties
2. Operations on \mathcal{D} -modules: direct and inverse images, algebraic localizations and dualities
3. Holonomic \mathcal{D} -modules and Kashiwara-Malgrange filtrations
4. Various Deligne’s extensions of flat bundles and regular holonomic \mathcal{D} -modules
5. Perverse sheaves and Riemann-Hilbert correspondence
6. b -functions, nearby and vanishing cycles for perverse sheaves and \mathcal{D} -modules and comparisons
7. Variations of Hodge structures and Saito’s theory of Hodge modules
8. Applications in complex algebraic geometry: multiplier ideals and Hodge ideals

Useful references:

- Björk “Analytic \mathcal{D} -modules and applications”.
- Hotta-Takeuchi-Tanisaki “ \mathcal{D} -modules, perverse sheaves, and representation theory”.
- Saito’s huge paper: “Modules de Hodge polarizables” (1988)
- Budur-Mustata-Saito: “Bernstein-Sato polynomials of arbitrary varieties” (2004)
- Mustata-Popa: “Hodge ideals” (2017)