南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	应用与计算拓扑 Applied and Computational Topology
2.	授课院系 Originating Department	理学院数学系 Department of Mathematics, School of Sciences
3.	课程编号 Course Code	MA523
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业选修课 Major Elective Courses （请保留相应选项 Please only keep the relevant information）
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	英文 English （请保留相应选项 Please only keep the relevant information）
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）	朱一飞，数学系，zhuyf@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced （请保留相应选项 Please only keep the relevant information）
10.	选课人数限额(可不填) Maximum Enrolment（Optional）	

11. 授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
学时数 Credit Hours	48	0	0	0	48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MA323 拓扑学 Topology
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
14. 其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

应用与计算拓扑作为本世纪以来新兴的研究领域已广泛地应用于跨学科共同关心的课题，例如数据科学中的模式识别、生命科学中的基因组演进，特别通过持续同调（persistent homology）的方法。同时，该领域运用计算机软件研究拓扑与几何学内蕴的理论课题。本课程的目标是对应用与计算拓扑做系统、全局性的介绍，使学生了解其基本理论和实例，特别强调持续同调及其应用。

Applied and computational topology has become a subject that applies to a wide range of topics. This includes pattern recognition in data science, and genomics and evolution in biology, notably through the method of persistent homology. It also employs computer softwares to study questions internal to topology and geometry. We aim to gain an overview of the subject, learn its basic theory and examples, with an emphasis on persistent homology and its applications.

16. 预达学习成果 Learning Outcomes

- 掌握应用与计算拓扑的基本理论和实例，特别是持续同调及其应用。
- 初步具备跨学科研究的意识和能力，拓展合作的可能性。

- Learn the basic theory and examples of applied and computational topology, particularly persistent homology and its applications.
- Acquire a scientific mentality and basic abilities for Interdisciplinary research, including possibilities for collaborations.

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

- Introduction (1 lecture)
- Graphs (2 lectures)
- Surfaces (2 lectures)
- Complexes (3 lectures)
- Supplementary examples and applications from computational geometric topology (1 lecture)
- Homology (2 lectures)
- Duality (2 lectures)
- Morse Functions (2 lectures)
- Supplementary examples and applications from computational algebraic topology (1 lecture)
- Persistence (3 lectures)
- Stability (3 lectures)
- Additional topics and applications (2 lectures)

18. 教材及其它参考资料 Textbook and Supplementary Readings

教材 Textbook

- Herbert Edelsbrunner and John L. Harer, Computational Topology: An Introduction, American Mathematical Society

参考书 References

- Gunnar Carlsson and Mikael Vejdemo-Johansson, Topological Data Analysis with Applications, Cambridge University Press
- Raúl Rabadán and Andrew J. Blumberg, Topological Data Analysis for Genomics and Evolution: Topology in Biology, Cambridge University Press

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		40		每周作业，设置助教批改 Weekly problem sets, with a grader

期中考试 **Mid-Term Test**		30		闭卷 Closed-book
期末考试 **Final Exam**		30		闭卷 Closed-book
期末报告 **Final Presentation**				
其它（可根据需要改写以上评估方式） **Others (The above may be modified as necessary)**				

20. 记分方式 **GRADING SYSTEM**

■ A. 十三级等级制 **Letter Grading**
☐ B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. **本课程设置已经过以下责任人/委员会审议通过**
This Course has been approved by the following person or committee of authority