

## 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.	<b>课程名称 Course Title</b>	先进设计与制造系统 Advanced Design-Manufacture Integrated Technique
2.	<b>授课院系 Originating Department</b>	系统设计与智能制造学院 School of System Design and Intelligent Manufacturing
3.	<b>课程编号 Course Code</b>	SDM474
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业选修课 Major Elective Courses
6.	<b>授课学期 Semester</b>	秋季 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>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 &amp; Contact (For team teaching, please list all instructors)</b>	陈园, 助理教授 系统设计与智能制造学院 (设计智造学院) CHEN Yuan, Assistant Professor School of System Design and Intelligent Manufacturing (SDIM) Email:
9.	<b>实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact</b>	待公布 To be announced
10.	<b>选课人数限额(可不填) Maximum Enrolment (Optional)</b>	待公布 To be announced

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
	32		32		64
学时数* Credit Hours					
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	SDM262 材料工程基础 Materials Engineering Fundamentals, SDM282 设计力学 Design Mechanics				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NIL				
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 NIL				

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程的主要任务是使学生：

- 了解设计制造一体化的基本概念，发展历史、所涵盖的核心关键技术及发展趋势；
- 了解并掌握有限元、实验设计和代理模型等技术；
- 了解数字孪生、大数据技术和人工智能的基本含义；
- 熟悉设计制造一体化系统的组成与应用，掌握常见的工程应用流程；
- 认识到设计制造一体化的重要性，为学术未来的工程应用或科研规划打下基础。

The main task of current course is to enable the students:

- Understand the basic concepts, development history, core technologies and development trends of Design-Manufacture Integrated Technique;
- Understand and master finite element method, design of experiment and surrogate modelling, etc.;
- Master the basic concept of digital twin, big data and artificial intelligence;
- Familiar with the constituent and application of Design-Manufacture Integrated Technique, and master commonly-utilised flowchart for engineering applications;
- Recognize the importance of Design-Manufacture Integrated Technique, and help students to build solid foundations for their future engineering and research career.

#### 16. 预达学习成果 Learning Outcomes

完成本课程的学习后，学生将能够：

- 能够独立运用有限元分析、实验设计和代理模型等技术；
- 具备分析、设计和制造先进工程结构的能力，并运用常见的设计制造一体化方法解决实际工程问题；
- 初步具备结合设计制造一体化技术进行科研和应用的能力。

Upon completion of this course, students will be able to:

- Apply finite element method, design of experiment and surrogate modelling, etc.;
- Analyze, design and manufacture advanced engineering structures, and solve practical engineering problems with normal Design-Manufacture Integrated Techniques;
- Be capable of performing research and application using Design-Manufacture Integrated Technique.

#### 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.)**

	Lectures		Bite size lab/practical	
Week	Lecture Title	Hours	Demo/Lab/Practical title	Hours
1-2	<p><b>1 概论</b> 先进设计制造一体化目的和意义 先进设计制造一体化技术内涵 先进设计制造一体化国内外发展现状 先进设计制造系统概念和展望</p> <p><b>1 Introduction</b> Purpose and significance of Advanced Design-Manufacture Integrated Technique Technological definition of Advanced Design-Manufacture Integrated Technique State-of-the-art of Advanced Design-Manufacture Integrated Technique Definition and outlook of Advanced Design-Manufacture Integrated Technique</p>	4	<p><b>参观及座谈</b> 优秀企业参观学习和专家座谈</p> <p><b>作业</b> 参观报告</p> <p><b>Visits and Discussions</b> Excellent enterprises</p> <p><b>Homework</b> Visiting report</p>	4
3-4	<p><b>2 从数值模拟到数字孪生技术</b> (a) 有限元理论概论 分析和计算 实例展示 (b) 数字孪生技术 发展和应用</p> <p><b>2 From simulation to digital twin</b> (a) Finite element method Analysis and calculation Case study (b) Digital twin technique Development and application</p>	4	<p><b>项目</b> 汽车钣金件冲压成型（一）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Stamping forming of vehicle sheet metals (1)</p> <p><b>Homework</b> Project report</p>	4
5-6	<p><b>3 从实验设计到大数据技术</b> (a) 实验设计方法概论 实验设计分析和应用 实例展示 (b) 大数据概论 发展和应用</p> <p><b>3 From experimental design to big data</b> (a) Design of experiment (DoE) Analysis and application Case study (b) Big data Development and application</p>	4	<p><b>项目</b> 汽车钣金件冲压成型（二）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Stamping forming of vehicle sheet metals (2)</p> <p><b>Homework</b> Project report</p>	4



7-8	<p><b>4 从代理模型到人工智能技术</b> (a) 代理模型技术概论 代理模型技术和优化算法 实例展示 (a) 人工智能概论 发展和应用</p> <p><b>4 From surrogate modelling to artificial intelligence</b> (a) Surrogate modelling technique Optimisation algorithm Case study (b) Artificial intelligence Development and application</p>	4	<p><b>项目</b> 汽车钣金件冲压成型（三）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Stamping forming of vehicle sheet metals (3)</p> <p><b>Homework</b> Project report</p>	4
9-10	<p><b>5 先进设计制造系统理论和实践（一）</b> 机器人概论 控制理论与实践</p> <p><b>5 Advanced design-manufacture integrated system: theory and practice (1)</b> Robotics introduction Control theory and practice</p>	4	<p><b>项目</b> 高自由度机械臂焊接设计（一）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Welding design using high DOF robotic arms (1)</p> <p><b>Homework</b> Project report</p>	4
11-12	<p><b>6 先进设计制造系统理论和实践（二）</b> 焊接原理和理论 质量控制与评价</p> <p><b>6 Advanced design-manufacture integrated system: theory and practice (2)</b> Welding principle and theory Quality control and assessment</p>	4	<p><b>项目</b> 高自由度机械臂焊接设计（二）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Welding design using high DOF robotic arms (2)</p> <p><b>Homework</b> Project report</p>	4
13-14	<p><b>7 先进设计制造系统理论和实践（三）</b> 路径规划问题与算法 项目设计要求和说明</p> <p><b>7 Advanced design-manufacture integrated system: theory and practice (3)</b> Path planning problem and algorithm Project design requirement and description</p>	4	<p><b>项目</b> 高自由度机械臂焊接设计（三）</p> <p><b>作业</b> 项目报告</p> <p><b>Project</b> Welding design using high DOF robotic arms (3)</p> <p><b>Homework</b> Project report</p>	4
15-16	<p><b>8 先进设计制造系统的展望</b> 设计制造交互理念 传统的颠覆 创新的捷径 我国先进设计与制造系统的发展现</p>	4	<p><b>项目演讲 &amp; 报告</b></p> <p><b>Project presentation &amp; report</b></p>	4

状	<p><b>8 Outlook for Advanced Design-Manufacture Integrated System</b> Interactive design-manufacture concept An overturn technique An effective way Development of Advanced Design-Manufacture Integrated Technique in China</p>			
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18. 教材及其它参考资料 Textbook and Supplementary Readings

**Textbook and supplementary readings:**

1. Tatjana V. Šibaliija • Vidosav D. Majstorović, "Advanced Multiresponse Process Optimisation: An Intelligent and Integrated Approach", Springer International Publishing AG Switzerland, 2016.

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	1-16 周 Week 1-16	20		评估学生对课程学习内容的基本理解, 自学能力 To assess students' basic understanding of coursework, self-learning
课程项目 Projects	3-8 周 Week 3-8	30		评估学生对课程学习内容的基本理解, 项目(一)的完成情况, 自学和报告能力 To assess students' basic understanding of coursework and implementation of Project (1), self-learning and reporting skills
	9-14 周 Week 9-14	30		评估学生对课程学习内容的基本理解, 项目(二)的完成情况, 自学和报告能力 To assess students' basic understanding of coursework and implementation of Project (2), self-learning and reporting skills
平时作业 Assignments				
期中考试 Mid-Term Test				

期末考试 Final Exam				
期末报告 Final Presentation	第 16 周 Week 16	20		评估学生在团队合作、动手和应用所学知识方面的成果 To assess students' achievement in team working, hands-on and application of learned knowledge
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

