

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	复合制造技术前沿 Frontiers in Hybrid Manufacturing Processes				
2.	授课院系 Originating Department	机械与能源工程系 Department of Mechanical and Energy Engineering				
3.	课程编号 Course Code	ME355				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业选修课 Major Elective Courses				
6.	授课学期 Semester	秋季 Fall				
7.	授课语言 Teaching Language	中英双语 English & Chinese				
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)	吴勇波 南方科技大学 机械与能源工程系 wuyb@sustec.edu.cn Prof. Yongbo Wu Department of Mechanical and Energy Engineering				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced				
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				48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	ME302 机械制造基础 Fundamentals of Manufacturing
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.	不限

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

机械制造在制造业中占有非常重要的地位，且近年随着高端制造业的快速发展，传统的单一制造工艺已越来越难满足更精密更高效的要求。在此背景下，以某一工艺为主辅以另一种或多种工艺的复合制造技术成为当前高端制造业的一个重要发展方向。本课程的教学目标是使学生掌握常见复合制造技术的工艺原理和应用，并了解相关技术领域的最新进展。通过将教授的课堂讲授、学生的演讲讨论和现场参观进行有机的结合，在进行理论知识传授和现场认知的同时，培养学生就相关专业进行归纳、演讲的能力以及发现和解决问题的创新思维能力，为以后从事机械制造领域的工程技术工作、科学研究工作以及开拓新技术领域奠定坚实的专业基础。

Mechanical manufacturing is important in manufacturing industry. Especially in recent years, with the rapid growth of advanced manufacturing industry, it become harder and harder for the traditional single manufacturing process to meet the requirement on the manufacturing accuracy and efficiency. Under this situation, hybrid manufacturing processes which combine two or more different manufacturing processes have been rapidly developed towards the level elevation of manufacturing technologies. The aim of this course is to enable students to master the principles and applications of typical hybrid manufacturing processes, and to understand the latest developments in related technical fields.

This course combines the class-teaching with the discussion and technical tours. Students will learn the related theories, the ability to summarize and present relevant knowledge, and the skills to find out and solve problems. Through this course, students will have the potentiality which is important for them to perform well as an excellent scientist or engineer in advanced manufacturing industry.

16. **预达学习成果 Learning Outcomes**

本课程通过教授的课堂理论讲授，使学生掌握各种常见辅助/复合加工技术的基本原理和加工特性，掌握超声、激光、电火花、磁流变、电化学等物理化学现象的基本概念以及将它们应用于切削、磨削、抛光、焊接、压力成型等传统制造工艺时的基本原理和实现这些原理的装置设计方法；通过自主演讲讨论，培养归纳总结、内容表达、发现问题和解决问题的能力。

By class-teaching, this course enables students to master the basical principles and characteristics of typical hybrid manufacturing processes. Students will learn the fundamentals of ultrasonic vibration, laser, electric discharge, magnetorheology, electrochemistry and other physic or chemical phenomena, and learn the technologies in which the above-mentioned phenomena are employed in cutting, grinding, polishing, welding, forging, and other traditional manufacturing processes. Through discussion and presentation, students will learn the ability to summarize and present relevant knowledge, and the skills to find out and solve problems.

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.)

章节/Section	课程内容/Course contents	教学要求	课时 /Credit hours
1. Introduction 绪论	Definition and classification of hybrid processes 复合制造的定义和分类	Understand the definition and classification of hybrid processes 了解复合制造的定义及其分类	3
2. Assisted Hybrid Processes 辅助制造技术	2.1 Vibration- and Laser-assisted cutting 振动/激光辅助切削	Understand the processing principle of vibration/laser assisted machining and their fundamental machining characteristics 掌握振动/激光辅助切削的原理与基本加工特性	3
	2.2 Media-assisted machining 介质辅助加工	Learn what is the media-assisted machining, what kind of equipment is used, and how it performs. 了解什么是介质辅助加工及其设备和基本加工特性	3
	2.3 Vibration assisted grinding, polishing and EDM 振动辅助磨削/抛光/电火花加工	Understand the concept and principle of the vibration assisted grinding, polishing and EDM, and learn about the fundamental machining characteristics of this process. 掌握振动辅助磨削/抛光/电火花加工的基本概念和原理, 了解其基本加工特性	3
	2.4 Pulsed electrochemical machining - PECM 脉冲电流加工	Learn how the pulsed electrochemical machining -PECM is performed and what is its basic machining characteristics. 学习并掌握脉冲电流的加工方法, 了解其基本加工特性。	3
	2.5 Air assisted jet electrochemical machining; Laser assisted chemical and electrochemical machining 空气注射/激光辅助电化学加工	Be familiar with the air assisted jet electrochemical machining and the laser assisted chemical/electrochemical machining, understand their basic machining characteristics 熟悉空气注射/激光辅助电化学加工方法, 了解它们的基本加工特性	3
	2.6 Vibration and Laser assisted forming 振动/激光辅助成型加工	Can explain the machining principle of vibration and Laser assisted forming and understand its basic machining characteristics 能说明振动/激光辅助成型加工的原理, 掌握其基本加工特性	3
3. Mixed or Combined Processes 复合制造技术	3.1 Combinations of EDM/Grinding and ECM/Grinding 电火花/电化学磨削加工的复合	Understand the concept of the combinations of EDM/Grinding and ECM/Grinding 掌握电火花/电化学磨削加工的复合方法	3
	3.2 Combination of ECM and EDM 电火花/电化学加工的复合	Learn how to combine ECM and EDM and understand its fundamental	3

		performance 学习怎样对电火花加工和电化学加工进行复合, 掌握其基本特性	
	3.3 Hybrid processes for polishing applications and others 复合加工在抛光中的理论和应用	Understand the hybrid processes for polishing applications and others 了解复合加工在抛光中的理论和应用	3
	3.4 Combined deep drawing and cold forging Combination of hot extrusion and equal channel angular pressing (iECAP) 深冲压和冷锻造的复合, 热挤压和等通道转角挤压的复合	Learn how to combine deep drawing and cold forging, and understand the combination of hot extrusion and equal channel angular pressing (iECAP) 掌握深冲压和冷锻造的复合方法, 理解热挤压和等通道转角挤压的复合加工原理	3
	3.5 Combination of spinning and bending for tube forming 管材成型中弯曲和旋压的复合	Learn how to combine spinning and bending for tube forming and understand the basic performance of this combination 掌握管材成型中弯曲和旋压的复合方法, 了解这种复合加工方法的基本特性	1.5
	3.6 Combination of extrusion and bending (curved profile extrusion) 挤压和弯曲的复合 (曲面型材挤压)	Learn the method to combine extrusion and bending, and Understand the fundamental characteristics of this combined process 学习挤压和弯曲的复合方法, 掌握这种复合法的基本加工特性	1.5
	3.7 Combination of stretch forming and incremental sheet forming 拉伸成型和板材渐进成型的复合	Understand the combination of stretch forming and incremental sheet forming 掌握拉伸成型和板材渐进成型的复合方法	1.5
4. Combination of controlled process mechanisms 可控技术复合	4.1 Grinding hardening 磨削硬化的利用	Can explain the concept of grinding hardening and understand its basic performance 能解释磨削硬化现象并掌握其基本特性	1.5
	4.2 Combination of forming and hardening (hot stamping) 成型和硬化的复合 (热冲压)	Learn how to combine forming and hardening and understand its fundamental characteristics 学习成型和硬化的复合方法并掌握其基本加工特性	3
	4.3 Combination of rolling and hardening 轧制和硬化的复合	Learn how to combine rolling and hardening and understand its fundamental characteristics 学习轧制和硬化的复合方法并掌握其基本加工特性	3
5	Final Presentation 期末报告		3

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

以英文综述论文“B. Lauwers et al, Hybrid processes in manufacturing, CIRP Annals-Manufacturing Technology 63 (2014) 561-583”及文中所列部分参考文献为基础自编

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		10		
课堂表现 Class Performance		20		
小测验 Quiz				
课程项目 Projects		60		
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		10		
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

机械与能源工程系教学委员会