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**	计算机辅助设计建模 CAD:3D Modeling and Programming
2.	**授课院系 Originating Department**	系统设计与智能制造学院 School of System Design and Intelligent Manufacturing (SDIM)
3.	**课程编号 Course Code**	SDM216
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业核心课 Major Core Courses
6.	**授课学期 Semester**	秋季 Fall
7.	**授课语言 Teaching Language**	中文 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）**	周鼎，助理教授，系统设计与智能制造学院，zhoud3@sustech.edu.cn Asistent professor ZHOU Ding,SDIM,zhoud3@sustech.edu.cn 尉进，工程师，系统设计与智能制造学院，weij@sustech.edu.cn WEI Jin，Engineer，SDIM，weij@sustech.edu.cn 吴海龙，高级实验师，系统设计与智能制造学院，wuhl@sustech.edu.cn Dr.WU Hailong,Senior Experimenter,SDIM,wuhl@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
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	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	
学时数 Credit Hours	0		96		96	

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

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

该课程旨在为学生提供与 3D 建模软件和 MATLAB 相关的特定学习成果，以支持设计和工程研究与实践。

• 3D 建模（2 学分）：旨在为学生提供必要的技能，以有效地在三维环境中生成和可视化设计概念。在整个课程中，学生将学习使用 SolidWorks 和/或 Rhino 3D 等软件构建 3D 模型的技术和工具。他们将熟练掌握表面和参数化实体建模，从而能够创建对象和结构的详细和准确的表示。此外，学生还将能够组装不同的组件以创建复杂的模型并模拟其功能。这个过程涉及理解不同零件如何组合在一起以及它们在设计中的相互作用。通过本课程的学习，学生将掌握使用 Solidworks 和 Rhino 3D 等软件进行工程图纸绘制的必要技能。这些图纸是工程和设计领域中的重要沟通工具，因为它们展示了 3D 模型的精确尺寸、注释和规格。

• MATLAB（1 学分）：旨在为学生提供分析和分解工程程序算法的基本技能，使用 MATLAB 进行编程。在整个课程中，学生将全面了解各种编程结构及其在解决计算问题中的应用。学生将熟悉各种编程结构，如循环、条件语句、函数和数据结构。他们将了解每个结构在编程中的特定用途以及如何利用它们来解决计算问题。在课程结束时，学生将对 MATLAB 作为一种编程语言在工程上的应用有深入的理解。

This course is designed to provide students with the specific learning outcomes in skills related to 3D modeling software and MATLAB for design and engineering research and practice.

- 3D Modeling (2 credits): aims to equip students with the necessary skills to generate and visualize design concepts in a three-dimensional environment effectively. Throughout the course, students will learn the techniques and tools required to construct 3D models using software such as Solidworks and/or Rhino 3D. They will gain proficiency in both surface and parametric solid modeling, allowing them to create detailed and accurate representations of objects and structures. Additionally, students will be able to assemble different components to create complex models and simulate their functionality. This process involves understanding how different parts fit together and how they interact within the design. By the end of the course, students will have acquired the necessary skills to proficiently utilize software like Solidworks and Rhino 3D to produce engineering drawings. These drawings serve as essential communication tools within the engineering and design fields, as they illustrate the precise dimensions, annotations, and specifications of the 3D models.

- MATLAB (1 credit): aims to equip students with the essential skills to analyze and decompose engineering programs algorithmically using MATLAB. Throughout this course, students will comprehensively understand various programming constructs and their application in solving computational problems. Throughout the course, students will become familiar with diverse programming constructs, such as loops, conditional statements, functions, and data structures. They will discover how each construct serves a specific purpose in programming and how to leverage them to solve computational problems.By the end of the course, students will have a deep understanding of the application of MATLAB as a programming language in engineering.

预达学习成果 Learning Outcomes

在课程结束时，学生都将熟悉:

• SolidWorks

• 2D 草图绘制技能：学习使用几何约束和尺寸创建 2D 草图，作为构建 3D 模型的基础。

• 3D 建模技能：掌握使用拉伸、旋转、扫描、放样和圆角等功能构建 3D 零件的能力。

• 零件装配：学习将单个零件装配成具有适当配合关系和约束的功能性 3D 模型。

• 制图和详细说明：为制造制作详细的 2D 图纸，包括尺寸、注释、剖视图和公差。

• 模拟与分析：了解 Solidworks 的模拟工具，用于应力分析、流体力学或运动，以验证设计决策。

• Rhino 3D:

• 基于曲线的建模：发展绘制和编辑复杂曲线的能力，这些曲线是创建曲面的基础。

• 曲面的创建和编辑：掌握使用放样、扫描、平面和网络等工具创建和编辑曲面。

• 使用 Grasshopper 进行参数化建模：学习使用 Grasshopper，一种可视化编程环境，创建复杂的参数化模型，可以通过一组输入参数进行调整。

• 算法建模：通过算法和逻辑而不是手工建模创建几何图形的技能。

• MATLAB

• MATLAB 基本操作

• MATLAB 编程基础

• 数据可视化

• M 文件的创建和使用

•工程应用

Upon completing the course, students will gain the competency of:

- Solidworks:

- Sketching Proficiency: Learn to create 2D sketches with geometric constraints and dimensions that form the foundation for 3D models.

- 3D modeling Skills: Gain the ability to build 3D parts using features like extrude, revolve, sweep, loft, and fillets.

- Part Assembly: Learn to assemble individual parts into a functioning 3D model with proper mating relationships and constraints.

- Drafting and Detailing: Produce detailed 2D drawings for manufacturing, including dimensions, annotations, section views, and tolerances.

- Simulation and Analysis: Gain exposure to Solidworks' simulation tools for stress analysis, fluid dynamics, or motion to validate design decisions.

- Rhino 3D:

- Curve-Based Modeling: Develop the ability to draw and edit complex curves that serve as the basis for creating surfaces.
- Surface Creation and Editing: Master the creation and editing of surfaces using tools like loft, sweep, planar, and network.
- Parametric Modeling with Grasshopper: Learn to use Grasshopper, a visual programming environment, for creating complex parametric models that can be adjusted through a set of input parameters.
- Algorithmic Modeling: Skills for creating geometry through algorithms and logic rather than manual modeling.

• MATLAB

- Basic MATLAB operations
- Fundamentals of MATLAB programming
- Data visualization
- Creation and use of M files
- Engineering applications

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.)

Course Schedule

Week	Hour	Lecture		Practice	Hours
		Lecture Title	Language	Practice in Makerspace	
1		Course Title: Introduction to SolidWorks Environment	• Chinese	Introduction to SolidWorks software and its importance in engineering design. Overview of SolidWorks user interface: Command Manager, Feature Manager, and Property Manager. Practice: Hands-on practice navigating the SolidWorks interface. Basic sketching exercises to familiarize students with sketch tools and constraints.	6
2		Sketching and Basic Modeling	• Chinese	Sketching fundamentals: Lines, arcs, circles, and polygons. Extrusion and Revolve features: Creating 3D models from 2D sketches. Creating simple parts using extrusion and revolve features. Sketching exercises focusing on applying constraints and dimensions accurately.	6
3		Advanced Modeling Techniques	• Chinese	Advanced modeling features: Sweeps, lofts, and patterns. Using reference geometry and equations to create complex shapes. Applying advanced features to	6

				model complex geometries. Designing parts with varying cross-sections using sweep and loft features.	
4		Assembly Modeling and Motion Simulation	• Chinese	Assembling components: Mate, align, and insert components into assemblies. Introduction to motion simulation: Testing assembly motion and detecting interference. Creating assemblies from individual parts and applying appropriate mates. Conducting motion simulations to analyze assembly behavior.	6
5		Drawing and Documentation	• Chinese	Creating engineering drawings: Views, dimensions, and annotations. Best practices for organizing and detailing drawings. Generating 2D drawings from 3D models. Dimensioning drawings and adding annotations according to industry standards.	6
6		Advanced Modeling Features	• Chinese	Advanced modeling tools: Fillets, chamfers, and shells. Utilizing surfacing tools for complex geometry creation. Applying fillets, chamfers, and shells to enhance part designs. Exploring surfacing tools to create organic shapes and complex surfaces.	6
7		Simulation and Analysis	• Chinese	Introduction to SolidWorks Simulation: Stress analysis and static studies. Interpreting simulation results and optimizing designs for strength and performance. Setting up and running static studies to analyze part and assembly behavior. Interpreting simulation results and making design modifications based on analysis.	6
8		Design Projects and Presentation	• Chinese	Design project guidelines and expectations. Effective communication of design concepts through visual presentations. Working on design projects individually or in teams. Presenting design solutions using SolidWorks models, drawings, and simulations.	6
9		Curve Applications: Curve degree and continuity on surface modelling Surface Modelling: The subtle relationship between curves and surfaces	• Chinese	Mastering the basic methods of drawing curves; Mastering the methods of editing curves; Mastering the methods of generating curves from objects Mastering the methods of creating surfaces; Mastering the methods of editing and adjusting surfaces;	6

				Mastering the methods of checking surface continuity	
10		Solid Modelling: The recognition of surfaces, multiple surfaces, and solids Mesh Modelling: The relationship between mesh surfaces and NURBS surfaces	• Chinese	Mastering the methods of creating standard solids; Mastering the methods of extruding solids; Mastering the methods of boolean operations, filleting, and other solid editing methods Mastering the methods of creating mesh surfaces; Mastering the methods of converting between NURBS surfaces and mesh surfaces; Mastering the common editing methods of meshes; Mastering the methods of importing and exporting mesh surfaces;	6
11		Subdivision Modelling: Understanding subdivision modelling	• Chinese	Mastering the methods of creating subdivision models; Mastering the methods of converting between NURBS surfaces and subdivision models; Mastering the common editing methods of subdivision modelling; Mastering the methods of importing and exporting subdivision models	6
12		Introduction to MATLAB Environment	• Chinese	Hands-on exercises to practice basic arithmetic operations. Writing simple scripts and executing them in MATLAB. Using built-in MATLAB functions for mathematical computations.	6
13		MATLAB Programming Basics	• Chinese	Generating various types of plots (line plots, scatter plots, histograms). Customizing plot appearance and adding annotations. Visualizing engineering data sets using MATLAB plotting tools.	6
14		MATLAB Plotting and Visualization	• Chinese	Generating various types of plots (line plots, scatter plots, histograms). Customizing plot appearance and adding annotations. Visualizing engineering data sets using MATLAB plotting tools.	6
15		Numerical Methods and MATLAB	• Chinese	Implementing numerical methods (e.g., Newton-Raphson, bisection method) in MATLAB. Solving engineering problems involving numerical integration and differentiation. Comparison of analytical and numerical solutions using MATLAB.	6
16		MATLAB Applications in Engineering	• Chinese	Implementing matrix operations and solving systems of linear equations in MATLAB. Solving initial value problems of ordinary differential equations. Applying MATLAB for engineering simulations and modeling exercises.	6

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

Supplementary readings:

1.《SolidWorks 2021 快速入门与深入实战》，邵为龙，清华大学出版社

2.《SOLIDWORKS Motion 运动仿真教程(2020 版)》，DS SOLIDWORKS®公司，机械工业出版社

3.《SolidWorks 数字仿真项目教程》，鲍仲辅、曾德江，机械工业出版社

4.《中文版 Rhino 7 完全自学教程》，姚一鸣，人民邮电出版社

5.《灵犀 Rhino+Grasshopper 建模实战揭秘》，郜红合、王福兵，化学工业出版社

5.《MATLAB/Simulink 入门经典教程》，徐国保，清华大学出版社

课程评估 ASSESSMENT

19.

Type of Assessment	Assessment Time	% of final score	Penalty	Notes
SolidWorks Project	Week 8	50	NIL	To assess students' achievement in SolidWorks domain skills.
Rhino project	Week 11	20	NIL	To assess a student's achievement in Rhino application skills.
Matlab Project	Week 16	30	NIL	To assess a student's achievement in Matlab application.

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