**AV424-《粘性流体力学》课程教学大纲**

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| 课程基本信息（Course Information） |
| 课程代码（Course Code） | AV424 | \*学时（Credit Hours） | 48 | \*学分（Credits） | 3 |
| \*课程名称（Course Name） | （中文）粘性流体力学 |
| （英文）Viscous Fluid Mechanics |
| 课程性质(Course Type) | 专业选修课（elective course） |
| 授课对象（Target Audience） | 本科四年级学生（undergraduate senior） |
| 授课语言(Language of Instruction) | 英语（English） |
| \*开课院系（School） | 航空航天学院（School of Aeronautics and Astronautics） |
| 先修课程（Prerequisite） | 空气动力学Ⅰ、Ⅱ （AerodynamicsⅠ&Ⅱ） |
| 授课教师（Instructor） | 田伟 (Wei Tian)陈方 (Fang Chen) | 课程网址(Course Webpage) |  |
| \*课程简介（Description） | 本课程是航空航天类院校飞行器设计专业本科教学计划中的专业选修课。本课程的内容主要分为粘性流体力学基础理论及其在航空航天领域的应用两部分：理论部分主要包括粘性流体力学基本概念、基本方程组的推导、粘性流体运动的精确解、不可压缩层流边界层、湍流的产生和稳定性理论、湍流基本运动、湍流边界层。粘性流体力学在航空航天应用部分主要包括飞机减阻、飞行器分离流、飞机大迎角前体非对称涡、扑翼飞行器、飞机总体气动设计、机翼机身设计、高超声速飞行器及飞艇。本课程的目的和任务是使学生掌握粘性流体的运动性质和基本规律以及解决分离流、涡旋流、湍流问题的基本方法和分析手段。使学生更加深入地了解航空航天领域的实际粘性流体力学问题，培养学生灵活利用理论知识解决实际问题的能力。 |
| \*课程简介（Description） | The Viscous Fluid Mechanics course is available for the students majoring in aircraft design disciplines of aeronautics and astronautics school/department. The content of this course is divided into two parts: the basic theory of viscous fluid mechanics and its application in aerospace. The theoretical part includes the principles of viscous fluid mechanics, the derivation of equations, some special solutions of viscous fluid, the incompressible laminar boundary layer, the theory of turbulence generation and stability and turbulent boundary layer. The application of viscous fluid mechanics in aerospace includes drag reduction of aircraft, aircraft flow separation, asymmetric vortices on aircraft fuselage at high angle of attack, flapping wing, aerodynamic design of aircraft, hypersonic vehicle aerodynamics and airship aerodynamics. By learning this course, students can rapidly apply fundamental principles of physics and appropriate aerodynamics models, and assess the applicability of various fluid mechanical models to solve practical problems in aerospace, thus making the basis for their future work on aerodynamics and aircraft design. |
| 课程教学大纲（Course Syllabus） |
| \*学习目标(Learning Outcomes) | 1．讲解粘性流体力学基本原理，使学生掌握粘性流体力学的理论体系、思维方式和研究方法（B1，B2）Students can understand the theoretical system, research methods and processes used in viscous fluid mechanics（B1，B2）2．结合理论知识讲解当前航空航天领域存在的典型粘性流体问题及其发展现状，培养学生利用基础理论知识解决实际问题的能力（B4，B6.2，D8），提升学生对航空航天行业的认知和兴趣（A3.1，A4，D8）Students can understand the practical viscous fluid problems in aerospace. Develop students' ability to solve practical problems by using theoretical knowledge（B4，B6.2， D8）and enhance students' interest in aerospace（A3.1，A4，D8）3．通过课堂互动的教学模式，培养学生从文献资料中发现问题并利用所学理论知识分析及解决问题的能力（B6.2，C3，D7）Improve the students' ability of finding problems from literature and using the theoretical knowledge to analyze and solve problems（B6.2，C3，D7）4．作业以理论分析和基本概念为主，培养学生熟练运用所学知识的能力及表达能力（B1，B2）Assignments are based on the basic concepts and theoretical analysis. Students can proficiently perform basic analysis by using their theoretical knowledge（B1，B2） |
| \*教学内容进度安排及要求(Class Schedule & Requirements) |

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| 教学内容 | 学时 | 教学方式 | 作业及要求 | 基本要求 | 考查方式 |
| 引论Intoduction | 3 | 课程教学Lecture |  |  |  |
| 粘性流体基本概念Basic concepts of viscous fluid mechanics | 3 | 课程教学Lecture |  |  |  |
| 粘性流体基本方程组Viscous fluid mechanics equations | 3 | 课程教学Lecture | 章节作业Assignments |  |  |
| 粘性流体方程精确解1Special cases for viscous fluid 1 | 3 | 课程教学Lecture |  |  |  |
| 粘性流体方程精确解2Special cases for viscous fluid 2 | 3 | 课程教学Lecture | 章节作业Assignments |  |  |
| 不可压缩层流边界层incompressible laminar boundary layer  | 3 | 课程教学Lecture |  |  |  |
| 湍流基本理论Basic theory of turbulence | 3 | 课程教学Lecture |  |  |  |
| 湍流边界层及分离流Turbulent boundary layer and flow separation | 3 | 课程教学Lecture | 章节作业Assignments |  |  |
| 飞机减阻Drag reduction of aircraft | 3 | 课程教学Lecture | 口头报告Oral presentation |  |  |
| 飞机流动分离High angle of attack aerodynamics-Flow separation | 3 | 课程教学Lecture |  |  |  |
| 大迎角前体非对称涡High angle of attack aerodynamics-Forebody asymmetric vortices | 3 | 课程教学Lecture |  |  |  |
| 扑翼空气动力学Flapping wing aerodynamics | 3 | 课程教学Lecture | 口头报告Oral presentation |  |  |
| 飞机总体气动设计Aerodynamic design of aircraft  | 3 | 课程教学Lecture |  |  |  |
| 机翼气动设计Wing aerodynamics | 3 | 课程教学Lecture |  |  |  |
| 机身气动设计Fuselage aerodynamics | 3 | 课程教学Lecture |  |  |  |
| 高超声速飞行器空气动力学Hypersonic aerodynamics | 3 | 课程教学Lecture | 口头报告Oral presentation |  |  |

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| \*考核方式 (Grading) | 最终成绩由以下四部分构成：(1) 课堂出席情况及课程笔记 10% (2) 口头报告 20% (每人20分钟) (3) 课后作业 30% (共3次, 每次10% ) (4) 期末课程报告 40%Four parts are included in the final grading： (1) Class participation and class notes 10% (2) Oral presentation 20% (20 minutes/person) (3) Assignments 30% (3 times, 10% for each) (4) Final report 40% |
| \*教材或参考资料(Textbooks & Other Materials) | 1.书名：粘性流体力学Title：Viscous Fluid Mechanics作者：朱克勤、许春晓Authors：Keqin Zhu, Chunxiao Xu出版社：高等教育出版社Publisher：Higher Education Press版次：1Edition：1书号：987-7-04-026261-2Book number：987-7-04-026261-22. Title：Fluid MechanicsAuthors：Frank M. WhitePublisher：McGraw Hill EducationEdition：7Book number：978-0-07-352934-93. Title：Foundamental of AerodynamicsAuthors：John AndersonPublisher：McGraw Hill EducationEdition：6Book number：978-1-259-12991-9 |
| 其它（More） |  |
| 备注（Notes） |  |

备注说明：

1．带\*内容为必填项。

2．课程简介字数为300-500字；课程大纲以表述清楚教学安排为宜，字数不限。