

# 上海交通大学研究生专业课程信息收集表

## Information Form for SJTU Graduate Profession Courses

| 课程基本信息 Basic Information                        |  |                                  |                              |  |
|---|--|----------------------------------|------------------------------|--|
| <b>*课程名称</b><br>Course Name                     | (中文 Chinese) 焊接结构力学  |                                  |                              |  |
|   | (英文 English) Mechanics of Welding Structure  |                                  |                              |  |
| <b>*学分</b><br>Credits                           | 2  | <b>*学时</b><br>Teaching Hours     | 32 (1 学分=16 课时)              |  |
| <b>*开课学期</b><br>Semester                        | 春季学期 Spring  | <b>*是否跨学期</b><br>Cross-semester? | 否 No                         | 跨 Spanning over 个学期 Semesters (含夏季学期)。 |
| <b>*课程类型</b><br>Course Type                     | 专业选修课 Program Elective Course  | <b>*课程分类</b><br>Course Type      | 全日制课程 For full-time students |  |
| <b>*课程性质</b><br>Course Category                 | 专业课 Specialized Course   | 课程层次<br>Targeting Students       | 硕博共用 All graduates           |  |
| <b>*授课语言</b><br>Instruction Language            | 中文 Chinese   | 主要授课方式<br>Teaching Method        | 课堂教学 In class teaching       |  |
| <b>*成绩类型</b><br>Grade                           | 等第制 Letter grading   | 主要考核方式<br>Exam Method            | 考查 Tests                     |  |
| <b>*开课院系</b><br>School                          | 材料科学与工程学院  |                                  |                              |  |
| 所属学科<br>Subject                                 | 材料科学与工程  |                                  |                              |  |
| <b>负责教师</b><br>Person in charge                 | 姓名 Name  | 工号 ID                            | 单位 School                    | 联系方式 E-mail                            |
|   | 芦凤桂  |                                  | 材料科学与工程学                     | Lfg119@sjtu.edu.cn                     |
|   | 徐济进  |                                  | 材料科学与工程学                     | xujijin_1979@sjtu.edu.cn               |
| 课程扩展信息 Extended Information                     |  |                                  |                              |  |
| <b>*课程简介</b><br>(中文)<br>Course Description      | <p>(分段概述课程定位、教学目标、主要教学内容、先修课程等；不少于 200 字。)</p> <p>焊接结构力学是现代焊接结构设计、制造、安全评定的重要基础。该课程属于焊接学科与力学的交叉课程。本课程面向材料科学与工程专业本硕博贯通培养，属于技术基础课。本课程根据学生已有的材料科学基础、材料力学的基本概念，从力学角度介绍了焊接接头的不均匀性特点，介绍焊接结构断裂、疲劳破坏的机理、影响因素、评价方法和改善措施，为焊接结构设计、完整性评定及失效分析提供基本理论知识与实验方法。通过对焊接结构设计、焊接结构强度、断裂、疲劳等力学行为及失效机理的认识，建立适合于焊接结构的评定方法是本课程的教学目标。同时，该课程在研究生阶段开展，利用本科阶段的焊接基本知识并扩充断裂力学相关知识来解决实际的焊接结构服役过程中的工程问题，以期为焊接学科培养高级专门人才提供培育课程。</p>   |                                  |                              |  |
| <b>*课程简介</b><br>(English)<br>Course Description | <p>(须与中文一致，翻译请力求信达雅。)</p> <p>The mechanics of welding structure plays an important role in modern welding structure design, manufacture and safety evaluation. As an interdisciplinary subject of welding science and mechanics, which opens to master &amp; doctor students of Materials Science and Engineering School. Basing on the early courses such as materials science foundation and materials mechanics, inhomogeneous mechanics characterize of welded joint will be delivered in this course. The related theory and experimental method of fracture, fatigue of welded structure will be introduced, provides basic theoretical knowledge and experimental method in design, assessment and failure analysis for welding structure. The establishment of suitable assessment method for welding structure is the main objective of this course based on the better understanding of the design of welding structure coupling with mechanical behavior. Meanwhile, the course is offered to the postgraduate student, combining with the welding knowledge studied in undergraduate process, the ability to solve practical engineering problems for welding structure in service will be improved. For the cultivating advanced talents of</p> |                                  |                              |  |

|                                | welding subject, the mechanics of welding structure is also needed.  |  |            |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|--------------------------------|--|--|------------|------------|------|-----------|-----------------------------------|---|---------|-----------|----------------------------|---|---------|-----------|-------------------------------|---|---------|-----------|--|---|---------|-----------|------------------------------|---|---------|-----------|-----------------------------------|---|---------|-----------|---|---|---------|-----------|------------------------------------|---|------------|-----------|-----------------------------------|---|------------|------------|-------------------------------------|---|------------|------------|-----------------------------|---|------------|------------|-------------------|---|---------|
| *教学大纲<br>(中文)<br>Syllabus      | (建议列表形式, 各列内容: 章节、主要内容、课时数、教学方式等)  |  |            |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
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|                                | 章节   | 主要内容   | 课时数        | 教学方式       |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第一章  | 焊接接头设计原则   | 2          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第二章  | 焊接应力分析   | 4          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第三章  | 焊接结构断裂   | 4          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第四章  | 有限元在焊接结构力学中应用  | 2          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第五章  | 焊接结构的疲劳  | 4          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第六章  | 焊接应力腐蚀   | 2          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第七章  | 焊接结构完整性评估  | 2          | 授课         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第八章  | 焊接断裂试验及分析  | 2          | 实验         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第九章  | 焊接接头疲劳测试及分析  | 2          | 实验         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | 第十章  | 焊接残余应力测试实验   | 2          | 实验         |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
| 第十一章                           | 焊接数值模拟   | 2  | 实验         |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
| 第十二章                           | 课程讨论   | 4  | 授课         |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
| *教学大纲<br>(English)<br>Syllabus | (须与中文一致, 翻译请力求信达雅。)  |  |            |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
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|                                | 章节   | 主要内容   | 课时数        | 教学方式       |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 1  | Design principle of welding joint                                | 2          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 2  | Analysis of welding stress                                       | 4          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 3  | Fracture of welding structure                                    | 4          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 4  | Application of the finite element in welding structure mechanics | 2          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 5  | Fatigue of welding structure                                     | 4          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 6  | Welding stress corrosion cracking                                | 2          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 7  | Integrity assessment of welding structure                        | 2          | Lecture    |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 8  | Welding fracture test and analysis                               | 2          | Experiment |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 9  | Welding fatigue test and analysis                                | 2          | Experiment |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
|                                | Chapter 10   | Welding residual stress measurement                              | 2          | Experiment |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
| Chapter 11                     | Modeling on welding process  | 2  | Experiment |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |
| Chapter 12                     | Course discussion  | 4  | Lecture    |            |      |           |                                   |   |         |           |                            |   |         |           |                               |   |         |           |  |   |         |           |                              |   |         |           |                                   |   |         |           |   |   |         |           |                                    |   |            |           |                                   |   |            |            |                                     |   |            |            |                             |   |            |            |                   |   |         |

|   |   |
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| <p>*课程要求<br/>(中文)<br/>Requirements</p>      | <p>(课程考核方式、考核标准等; 不少于 50 字)</p> <p>作业(10%)+课堂表现(20%)+大作业(70%)<br/>Homeworks (15%) +Class performance (15%) Project analysis report (70%)</p> <ol style="list-style-type: none"> <li>1. 查阅资料, 针对不同焊接接头进行设计 (作业);</li> <li>2. 焊接断裂性能测试及分析 (作业);</li> <li>3. 焊接残余应力演化过程推导 (作业);</li> <li>4. 分析报告及答辩 (考试)。</li> </ol>   |
| <p>*课程要求<br/>(English)<br/>Requirements</p> | <p>(须与中文一致, 翻译请力求信达雅。)</p> <ol style="list-style-type: none"> <li>1. Different welding joints design according to literatures (homework)</li> <li>2. Test and analysis of weld fracture performance (homework)</li> <li>3. Derivation of welding residual stress evolution process (homework)</li> <li>4. Analysis report and defense (exam)</li> </ol>   |
| <p>*课程资源<br/>(中文)<br/>Resources</p>         | <p>(教材、教参、网站资料等。)</p> <ol style="list-style-type: none"> <li>1. 焊接结构的断裂行为及评定, 霍立兴, 机械工业出版社, 2000 年 2 月</li> <li>2. 焊接力学及结构完整性原理, 张彦华, 北京航空航天大学出版社, 2007 年 8 月</li> <li>3. 焊接结构学, 方洪渊, 机械工业出版社, 2008 年 5 月</li> <li>4. Fracture and fatigue of weld joints and structures. Kenneth A. Macdonald, Woodhead Publishing Limited, 2011</li> </ol>  |
| <p>*课程资源<br/>(English)<br/>Resources</p>    | <p>(须与中文一致, 请力求信达雅。)</p> <ol style="list-style-type: none"> <li>1. Fracture behavior and evaluation of welded structure, Huo Lixing. China Machine Press, 2000.</li> <li>2. Welding mechanics and principle of structural integrity, Zhang Yanhua, Beihang University Press, 2007.</li> <li>3. Welding structure, Fang Hongyuan. China Machine Press, 2008.</li> <li>4. Fracture and fatigue of weld joints and structures. Kenneth A. Macdonald, Woodhead Publishing Limited, 2011.</li> </ol> |
| <p>备注<br/>Note</p>                          |   |