课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	EEE5348 控制系统参数化设计 **Parametric Control Systems Design**
2.	**课程性质** **Compulsory/Elective**	选修课
3.	**课程学分/学时** **Course Credit/Hours**	3/48
4.	**授课语言** **Teaching Language**	中文 Chinese
5.	**授课教师** **Instructor(s)**	段广仁
6.	**是否面向本科生开放** **Open to undergraduates or not**	**否**
7.	**先修要求** **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） **线性代数，线性系统理论**

8. **教学目标**
Course Objectives

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）
通过本课程的学习，要求学生能比较系统的掌握线性系统参数化设计体系中的基本概念，基本理论和系统分析设计的基本方法，同时了解和掌握关于控制系统参数化设计的基于 Matlab 的软件设计与应用，初步能利用这些知识研究和探索工程实际系统中的各种问题。
Through the study of this course, students are required to systematically master the basic concepts, theories and basic methods of system analysis and design in the scope of parametric designs of control systems, and at the same time to gain the ability to design Matlab-based software programs to solve numerically some control system parametric design problems. After all, the students are expected to be able to use the theories and techniques in their future research activities or practical control systems design applications.

9. **教学方法**
Teaching Methods

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）
本课程将采用多媒体、黑板讲授与讨论相结合的方式进行授课。课程内容紧密结合授课人的科研成果。
本课程为英文课件，中文授课。注重课堂效果，强调学生听课笔记与总结归纳的能力。不主张提前预习，鼓励每次课后复习所提供的相关资料。
This course will be taught in a combination of multimedia, chalk and blackboard deduction and on-class discussion. The content of the course is composed of mainly the research results of the lecturer.
The teaching language of the course is Chinese, but the course slides are in English. The classroom effect is particularly emphasized: the students are encouraged to take notes actively in lectures and pay attention to the ability of induction and summarization. It is not recommended that the students preview the materials in advance, but to review the relevant materials provided after each lecture.

10. **教学内容**
Course Contents
（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

Section 1	**准备工作** 1) 自共轭集和矩阵; 2) 可控性和可稳性; 3) 互质性; 4) 广义 Sylvester 矩阵方程.	**Preliminaries** 1) Self-conjugate sets and matrices; 2) Controllability and stabilizability; 3) Coprimeness; 4) Generalized sylvester matrix equation.

Section 2	**状态反馈广义特征结构配置** 1) 问题描述 2) 参数化解 3) 矩阵 F 为若当型的情况 4) 非退化特征结构分配 5) 基准测试示例	**GESA by State Feedback** 1) Problem statements 2) Parametric solution 3) Case of *f*-being jordan 4) Nondefective eigenstructure assignment 5) A benchmarking example
Section 3	**参数利用** 1) 最小增益问题 2) 模型匹配 3) 模态解耦 4) 鲁棒特征结构配置 5) 鲁棒极点配置	**Parameter Utilization** 1) The minimum gain problem 2) Model matching 3) Modes decoupling 4) Robust eigenstructrue assignment 5) Robust pole assignment
Section 4	状态反馈部分特征结构配置 1) 问题描述 2) 一般参数化解 3) 替换一对共轭特征值 4) 循环算法	**Partial ESA by State Feedback** 1) Problem statement 2) General parametric solutions 3) Replacing a pair of conjugate eigenvalues 4) The circulation algorithm
Section 5	**输出反馈广义特征结构配置** 1) 问题描述 2) 参数化解 3) 矩阵 F 为若当型的情况 4) 非退化特征结构配置 5) 一种改进方案 6) 参数利用 7) 动态补偿器特征结构配置	**GESA by Output Feedback** 1) Problem formulation 2) Parametric solutions 3) Case of *f*-being jordan 4) Nondefective eigenstructure assignment 5) Modified solution to nondefective GESA 6) Utilizing parameters 7) GESA by dynamical compensators
Section 6	**输出反馈部分特征结构配置** 1) 问题描述 2) 问题的解 3) 对偶问题的解 4) 保持部分开环特征结构 5) 参数利用	**Partial ESA by Output Feedback (I)** 1) Problem formulation 2) Solutions to the problem 3) Solution to the dual problem 4) Keeping partial open-loop eigenstructure 5) Utilizing parameters
Section 7	**Matlab 工具箱设计** 1) 鲁棒状态反馈控制 2) 鲁棒输出反馈控制 3) 状态观测器设计	**Matlab Toolbox Design** 1) Robust state feedback control 2) Robust output feedback control 3) State observer design

11. 课程考核 Course Assessment

（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

考勤（10%）+作业（20%）+期末试卷闭卷考试成绩（70%）
Attendance (10%) + homework (20%) + final exam (70%)

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

Guang-Ren Duan, Parametric Control, Lecture notes
段广仁，线性系统理论（第二版），哈尔滨工业大学出版社，2004
(Duan Guangren, Linear System Theory (Second Edition), Harbin Institute of Technology Press, 2004)
段广仁，线性系统理论（第三版），科学出版社，2016
(Duan Guangren, Linear System Theory (Third Edition), Science Press, 2016)