

## 研究生课程教学大纲 (Syllabus)

课程代码 Course Code	EE7017	*学时 Teaching Hours	48	*学分 Credits	3
*课程名称 Course Name	高电压数字测量技术 Digital High-voltage Measurement Technology				
*授课语言 Instruction Language	中文				
*开课院系 School	电子信息与电气工程学院电气工程系				
先修课程 Prerequisite	电路基本理论，模拟和数字电子技术，电磁场				
授课教师 Instructors	姓名 Name	职称 Title	单位 Department	联系方式 E-mail	
	赵刚 ZHAO Gang	副教授 Associate Professor	电气工程系	nmzhaogang@sjtu.edu.cn	
*课程简介（中文） Course Description	<p>高电压数字测量系统的三要素是：转换装置，ADC（模拟数字转换器）和测量算法。有专门课程（《高电压试验技术》、《电气工程基础》等）讨论过高电压大电流转换装置。测量算法范围太宽泛，课时有限，难免挂一漏万。我们也注意到本科阶段数字和模拟电子技术类课程只讨论 ADC 的基本概念（终止在锯齿误差曲线），指导 ADC 的应用实践方面作用有限。</p> <p>本课程教学焦点包括：ADC 的动态特性测试方法<sup>[1]</sup>，量化统计理论<sup>[2]</sup>和测量不确定度评定<sup>[3]</sup>，这些理论知识能够解决高电压数字测量系统 ADC 的诸多应用关键问题。本学期课程沿两个方向展开教学：一个是探讨 ADC 动态特性的基本理论，师生编写 ADC 动态特性试验的仿真程序（MATLAB），在应用中深入理解理论；另一个是量化统计理论，向学生介绍类似时间域采样定理的幅值域采样定理。</p> <p>本课程旨在培养学生的理解理论和应用理论的能力，衡量是否真正理解理论的金标准是应用或验证，只有成功运用或验证才是理解的最好证明。</p> <p>ADC 动态特性方面，围绕正弦波形法测量 ADC 动态特性，详细讨论时域、频域算法以及直方图算法。为了促进学生深入理解基本概念，师生合作使用 MATLAB 实现 ADC 动态特性测量的虚拟实践。</p> <p>量化统计理论方面，围绕量化的统计理论，使用 MATLAB 虚拟实验的方法验证幅值域采样定理。</p> <p>测量不确定度评定方面，把分散性做抓手，讨论各不确定度分量合成的方法，并用 MATLAB 仿真程序验证。</p>				
*课程简介（English） Course Description	<p>The three aspects of a high-voltage digital measurement system are the transducer, the ADC (analog-digital converter) and the measurement algorithm. There are special courses ("High-voltage Test Technology", "Electrical Engineering Fundamentals", etc.) to discuss high voltage and high current conversion devices. The range of measurement algorithm is too broad, the class time is limited, it is inevitable to be far from complete. We also note that undergraduate digital and analog electronic technology courses only cover the basic concepts of ADC (terminating at the saw-tooth error curve) and have a limited role in guiding the application of ADC.</p>				

	<p>The teaching focus of this course includes: ADC dynamic characteristic testing method <sup>[1]</sup>, quantitative statistical theory <sup>[2]</sup> and measurement uncertainty evaluation <sup>[3]</sup>. These theoretical knowledge can help graduates to solve many key application problems of ADC in high-voltage digital measurement system.</p> <p>The course of this semester is carried out in two directions: one is to explore the basic theory of ADC dynamic characteristics. Teachers and students code and debug the simulation program of ADC dynamic characteristics test (MATLAB), and have an in-depth understanding of the theory in application; The other is quantitative statistical theory, introducing graduates to amplitude-domain sampling theorem similar to time-domain sampling theorem.</p> <p>This course aims to cultivate pupils' ability to understand and apply theories. The golden standard to measure whether a theory is truly understood is application or verification. Only successful application or verification is the best proof of understanding.</p> <p>In terms of ADC dynamic characteristics, the time-domain, frequency-domain and histogram algorithms are discussed in detail around the sinusoidal waveform method to measure ADC dynamic characteristics. In order to promote students' in-depth understanding of the basic concepts, teachers and students cooperate to implement the virtual practice of ADC dynamic characteristic measurement using MATLAB.</p> <p>As for quantitative statistical theory, the amplitude-domain sampling theorem is verified by using MATLAB virtual experiment method.</p> <p>In terms of measuring uncertainty evaluation, the dispersion is taken as the starting point, the synthesis method of each uncertainty component is studied, and verified by MATLAB simulation program.</p>
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	教学内容 Content	授课学时 Hours	教学方式 Format	授课教师 Instructor
*教学安排 Schedules	讨论教学理念、教学内容 高电压数字测量技术的三要素 ADC 的结构和应用	6	讨论	赵刚
	正弦试验系统结构与试验方法	6	讲课	赵刚
	时域和频域数据分析	6	讲课	赵刚
	正弦直方图试验	6	讲课	赵刚
	ADC 动态特性测试仿真代码	6	讨论	赵刚
	ADC 动态特性测试实例	6	讲课	赵刚
	量化统计理论	6	讲课	赵刚
	幅值域采样定理的仿真	6	讨论	赵刚
*考核方式 Grading Policy	出勤 10% 课堂表现(提问与回答) 20% 闭卷笔试 70%			
*教材或参考资料 Textbooks & References	[1] Dominique Dallet, Jose Machado da Silva. ADC 的动态特性. -影印版. - 北京:科学出版社, 2007.1 [2] Bernard Widrow, István Kollár. Quantization Noise. Cambridge University Press 2008 [3] ISO, A Guide to Expression of Uncertainty in Measurement			
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; 教学内容、进度安排等以表述清楚教学安排为宜, 字数不限。