

附件 4:

## 控制科学与工程国际硕士研究生培养方案

授予学位类别:

一级学科 (专业类别) 代码名称:

0811 控制科学与工程

二级学科 (专业领域) 代码名称:

081100 控制科学与工程

081101 控制理论与控制工程

081102 检测技术与自动化装置

081103 系统工程

081104 模式识别与智能系统

081105 导航、制导与控制

0811Z1 电路与系统控制

0811Z2 电力电子与传动控制

制订单位: 自动化学院 (牵头) (参与)

培养方案版本号: 2020 版

### 一、学科概况

Control Science and Engineering is a discipline of control theory, methods, techniques and engineering applications. This discipline is famous for its strong comprehensiveness, broad coverage,

solid foundation of its graduates and wide adaptivity. The discipline of control science and engineering of Central South University originated in 1958 and became one of the first master degree granting disciplines in China in 1978. It became a doctor's degree granting discipline in control theory and engineering in 1993. The control theory and control engineering was approved as a state key discipline in 2007, and was approved to be a national defense characteristic discipline in 2017 and was assessed as A- in the fourth round of the China Discipline Ranking. This discipline has an academican of Chinese Academy of Engineering, national famous teachers, winners of national fund for Distinguished Young Scholars, Chang Jiang Scholars, IEEE fellows and other academic leading talents. Relying on the innovation research group of NSFC, national teaching team, 111 Discipline Innovation and Intelligence Introduction Base, Innovation Team of the Ministry of Education, Engineering Research Center of the Ministry of Education, Key Laboratory of Hunan Province, Engineering Research Center of Hunan Province, Innovation and Entrepreneurship Education Center of Hunan Province and other discipline platforms, and

closely concentrating on the major needs of the country, great achievements have been made in the fields of non-ferrous metallurgy intelligent optimization manufacturing, power electronic system control, artificial intelligence system theory and technology, rail transit information and control, etc. It has formed distinct research characteristics and academic advantages in the field of non-ferrous metallurgy automation, and has successively won four second prizes of national science and technology progress and one second prize of national natural science, and made important contributions to the national economic and social development and scientific and technological progress.

## 二、研究方向

(1) Process Industry Intelligent Optimization Manufacturing This research direction focuses on the automation and intelligent production of process industry, mainly including: intelligent integrated modeling and optimization control method of complex industrial process, industrial big data analysis and processing method, industrial image processing and analysis, knowledge automation system, multi-phase

and multi field coupling numerical simulation and visualization of industrial process, digital metallurgy and virtual implementation, industrial digital twin system and so on. (2) Advanced Detection Technology and Process Monitoring This research direction aims to meet the demand of intelligent sensing and high-end automation devices in the industrial field. The research is based on intelligent photoelectric measurement technology, machine vision, multi spectral analysis, process data, new optical imaging technology, advanced optical devices, information processing and analysis of flexible sensing technology, application of intelligent sensing technology, development of advanced detection instruments and automation devices, etc. The research focuses on the safety of complex manufacturing process, and carries out process monitoring and fault diagnosis research to ensure the green, efficient and stable operation of complex manufacturing process. (3) Artificial Intelligence Technology and System In order to meet the needs of the new generation of artificial intelligence, and to help the high-quality development of the national economy, this research focuses on intelligent control and intelligent system analysis, computational

intelligence and optimization decision-making, pattern recognition and machine learning, image understanding and computer vision, unmanned system environment perception and intelligent decision-making system, industrial robot agile perception and intelligent control, etc. (4) Advanced Control Theory and System This research direction focuses on the difficulties and hot issues of complex system control, including complex dynamic system analysis and design, nonlinear control optimization theory and application, multi-agent system distributed optimization and control, aircraft control and optimization, complex electromechanical system collaborative optimization control theory and technology, quantum control, etc. (5) Control of Modern Power Electronic System In order to meet the urgent need of high efficiency and reliability operation of modern power electronic systems such as smart micro grid, energy internet, power internet of things, etc., this research direction focuses on advanced power electronic equipment optimization control, power electronic power network modeling, micro grid multi machine synchronous control and decentralized collaborative control, energy network optimization control, power data analysis based on machine learning, etc. (6) Rail

Transit Information Sensing and Control In order to meet the automation and intelligent requirements of collection, transmission, processing and control of railway, urban rail and other traffic information, this research direction focuses on the rapid and precise detection technology and equipment of rail transit, fault diagnosis and intelligent operation and maintenance of high-speed train information system, signal processing and safety monitoring of rail transit, operation control and dynamic dispatching of high-speed railway, etc. (7) Industrial Internet and Digital Twins Focusing on the demand of the deep integration and development of the new generation of information technology and manufacturing, this direction carries out research of industrial internet system architecture, industrial intelligent network, industrial Internet of Things, multi-source heterogeneous data fusion, edge computing, distributed data storage and processing, industrial big data analysis and modeling, industrial mechanism and data joint driving method, application development and micro-service architecture, industrial APP design and application, industrial process virtual simulation, and industrial digital twin, etc.

### 三、培养目标

The objectives are to inculcate the students with the high-level discipline as well as the specialized skills to pursue scientific research, technological development and engineering applications in the area of Control Science and Engineering and in other related fields. Through the program, the students should build a solid foundation of Control Science and Engineering.

### 四、学制和学习年限

Basic length of schooling is 3 years and the longest period of schooling cannot exceed 5 years till August 31th of the end year. The management of graduate students whose schooling is beyond the study duration limit shall be in accordance with “The Regulations on Graduate Student Status Management of Central South University”. The length of course study is 1 academic year. Master students with excellent comprehensive quality can apply for graduation half year ahead of schedule, and the relevant requirements and procedures for graduation

ahead of schedule refer to “The Regulations on Graduate Student Status Management of Central South University” and “The Regulations on the Application for Graduation ahead of Schedule of Doctoral and Postgraduate Students of School of Automation, Central South University” .

## 五、培养方式

(1) The guiding group training system in which the supervisor is responsible is implemented. The combination of the supervisor guidance and the collective guidance of the guiding group is adopted. The members of the guiding group should assist the supervisor to ensure the quality of each training stage.(2) The supervisor’ s professional guidance, ideological education and academic integrity education are organically combined to guide the ideological and academic morality of postgraduates, and comprehensively cultivate and improve the comprehensive quality of postgraduates.(3) Supervisors guide graduate students to make personal training plans, select courses, read scientific materials, participate in academic exchanges and social practice, choose research topics, perform scientific research, etc.(4) The discipline shall establish the elimination mechanism in the training process, and strictly adapt to it in the training process. Those postgraduates who fail to pass the assessment shall be reexamined or dismissed.

Specifically, it shall be implemented in accordance with “The Regulations on Graduate Student Status Management of Central South University” and “The Regulations on Works for Graduate Training Links of Central South University” .

## 六、课程设置与学分要求

课程类别	学分要求	课程类别	学分要求
公共学位课	5	学科基础课	11
专业课	4	选修课	4
学术交流与研讨	2	培养环节	3
补修课	0		
总学分	29		
学分说明	The course credits should be no less than 24. The training courses (including Academic Exchange and Discussion as well as Training Courses) credits should be no less than 5.		

类别	课程编号	课程（环节）名称	学时	学分	开课学期	说明
选修课	46080802D03	可再生能源与智能电网集成控制技术	32	2	春秋季	No less than 2 or choose courses in other disciplines
选修课	46081104D01	智能故障诊断	32	2	春季	No less than 2 or choose courses in

						other disciplines
公共学位课	10000003A01	中国概况	32	2	春秋季	Compulsory
公共学位课	11000003A01	汉语	64	3	秋季	Compulsory
学科基础课	21070103A04	数值分析	48	3	秋季	Compulsory
学科基础课	46081102B01	线性系统理论	32	2	秋季	Compulsory
学科基础课	46081102B04	人工智能与模式识别	32	2	秋季	Compulsory
学科基础课	46081103B02	论文写作与学术规范.	32	2	春秋季	Compulsory
学科基础课	46081103C02	多智能体系统与应用	32	2	秋季	Compulsory
学术交流与研讨	99000003F03	学术交流与研讨 (学术学位硕士生)		2	春秋季	Compulsory
专业课	46081102B03	光学检测技术	32	2	秋季	Compulsory
专业课	46081102C03	预测控制	32	2	春季	Compulsory
培养环节	02	开题报告		1		
培养环节	99000003F08	社会实践		1		
培养环节	99000003F09	科研训练		1		

## 七、学术研讨与学术交流

In the condition that master students have obtained the necessary credits for those required, optional and training courses, it is encouraged to

improve the weight of research discussion and communication in the master program credits. On one hand, it is necessary to give more time to the master students and their supervisors, in order to actively promote the interaction between the students and their supervisors. On the other hand, it is necessary for the international master students to participate in high-level academic exchange activities, in order to improve those students' academic performance. An academic annual conference will be held each year for research discussion and cooperation between foreign graduate students and Chinese graduate students. Each foreign graduate student must submit a full paper to this seminar for getting a certain credit, which is a summary of the research work done. The seminar is open to all the graduate students of the whole departments. Several advisors will be invited to attend the seminar for giving direct tutoring. For the "Academic Exchange and Discussion", the specific requirements are as follows. (1) 1 credit will be given to those master students, who attend academic reports 20 times. (2) Each master student must submit a paper to the Academic Annual Conference organized by School of Automation. The accepted papers will be counted as 1 credit. Another 1 credit

will be given to those master students, who are recommended to be excellent candidates in the conference. (3) 2 credits will be given to those master students, who attend an international academic conference and do presentation. (4) 1 credit will be given to those master students, who attend conference organized in China and do presentation. (5) 1 credit will be given to those master students, who submit a qualified report according to the academic reports. (6) 1 credit will be given to those master students, who attend summer school, organized by domestic or international universities, and obtain course certificate or other verified documents.

## 八、博士生资格考试

无

## 九、学位论文开题报告

Under the guidance of supervisors, master students should determine the research direction of their dissertations, make a public topic selection report and determine research topics on the basis of consulting a large number of literatures. Master

students should read more than 60 research papers, of which more than one third should be written in foreign language. The opening report shall be completed before the end of the third semester after the admission. Thesis topics should be based on the forefront of the discipline, and can make innovative achievements in theory or technology, which has great practical value or potential value. For those who fail to pass the first topic selection report, the students will have a second chance to give a reopening report. However, the time interval between the two sessions shall not be less than 6 months. The topic selection report of master students shall be held in public within the discipline. Graduate students fill in the online report on the topic selection of graduate thesis of Central South University on the "Graduate Education Management Information System". After the topic selection report is reviewed and approved, it will be submitted to the Graduate Management Office for archival purpose. The details shall be implemented in accordance with "The Regulations on Works for Graduate Training Links of Central South University" and "The Detailed Rules for the Implementation of the Graduate's Thesis Proposal of School of

Automation”.

## 十、中期考核

无

## 十一、科研训练、专业实践和社会实践

Research Training is a required course for master students. Each master student should participate in at least one research project. The purpose of this training is to enforce international master students to obtain the right research method, develop their capability to conduct research or special technique. The credit will be given to students once their supervisors approve that they have met the requirement. “Social practice” is required for full-time graduate students. The University encourages postgraduates to use their professional cultural knowledge and skills to carry out social practice in science and technology, management, law and other aspects, explore or solve the technical or management problems in the social and economic development, so as to continuously improve their innovative practice ability. See the measures for “The Administration of

Social Practice Credits of Postgraduates of Central South University” for specific assessment methods.

## 十二、学年总结与考核

A comprehensive summary, evaluation and assessment will be carried out at the end of each academic year, including social performance, course scores, and academic achievements. The examination results will be used to adjust the scholarships and bursaries. Students who fail in the examination will be required to quit the master program.

## 十三、学位论文工作

(1) Requirements on Academic Papers The requirements on academic achievement must be in accordance with the Degree Awarding Standard of the Control Science and Engineering, Central South University and other relevant documents. (2) Thesis The thesis shall be written in Chinese or English according to the requirements of the school. Under the guidance of the supervisor, it shall be completed independently by the graduate student himself. The working time of the graduate student engaged in the

thesis shall not be less than 1 year. The thesis shall be carefully written in accordance with the uniform format requirements of the University's dissertation, and strictly in accordance with the specification for writing postgraduate thesis of Central South University. The content of the paper should reflect the author's ability to solve practical engineering problems by using basic theory and professional knowledge, and show that the graduate students have reached the requirements of training objectives. (3) Thesis Review, Defense and Degree-granting Acting on "Degree-granting Rules of Central South University", "Rules of Dissertation Defense of Central South University", "Rules of Dissertation Review of Central South University", the basic requirements of the dissertation shall be implemented in accordance with the regulations on the work of degree awarding of Central South University. After the thesis is written as required, the thesis pre-defense shall be carried out. Two experts with senior professional and technical positions in their own discipline shall review the thesis. The one who passes the review can apply for the dissertation defense with the consent of the supervisor and the examination of the college. The thesis must have

correct viewpoint, clear organization, reliable argument, sufficient argumentation, rigorous reasoning, strong logicality and smooth writing, which indicates that the graduate students have meet the requirements of training objectives. Postgraduates who have passed the oral defense of their dissertations shall apply to the degree evaluation subcommittee of the school. After being examined by the degree evaluation subcommittee and submitted to the degree evaluation committee of the University for discussion and approval, they can be awarded a degree and issued a degree certificate.

#### 十四、毕业论文工作

(1) Requirements on Academic Papers The requirements on academic achievement must be in accordance with the Degree Awarding Standard of the Control Science and Engineering, Central South University and other relevant documents. (2) Thesis The thesis shall be written in Chinese or English according to the requirements of the school. Under the guidance of the supervisor, it shall be completed independently by the graduate student himself. The working time of the graduate student engaged in the

thesis shall not be less than 1 year. The thesis shall be carefully written in accordance with the uniform format requirements of the University's dissertation, and strictly in accordance with the specification for writing postgraduate thesis of Central South University. The content of the paper should reflect the author's ability to solve practical engineering problems by using basic theory and professional knowledge, and show that the graduate students have reached the requirements of training objectives. (3) Thesis Review, Defense and Degree-granting Acting on "Degree-granting Rules of Central South University", "Rules of Dissertation Defense of Central South University", "Rules of Dissertation Review of Central South University", the basic requirements of the dissertation shall be implemented in accordance with the regulations on the work of degree awarding of Central South University. After the thesis is written as required, the thesis pre-defense shall be carried out. Two experts with senior professional and technical positions in their own discipline shall review the thesis. The one who passes the review can apply for the dissertation defense with the consent of the supervisor and the examination of the college. The thesis must have

correct viewpoint, clear organization, reliable argument, sufficient argumentation, rigorous reasoning, strong logicality and smooth writing, which indicates that the graduate students have meet the requirements of training objectives. Postgraduates who have passed the oral defense of their dissertations shall apply to the degree evaluation subcommittee of the school. After being examined by the degree evaluation subcommittee and submitted to the degree evaluation committee of the University for discussion and approval, they can be awarded a degree and issued a degree certificate.

附：修订专家名单

桂卫华、阳春华、王雅琳、徐德刚、陈晓方、蒋朝辉、王勇、黄科科等。