同行专家业内评价意见书编号: 20240858113

附件1

浙江工程师学院（浙江大学工程师学院）
同行专家业内评价意见书

姓名： 王嘉铖

学号： 22160110

申报工程师职称专业类别（领域）： 能源动力

浙江工程师学院（浙江大学工程师学院）制

2024年03月26日

一、个人申报

（一）基本情况【围绕《浙江工程师学院（浙江大学工程师学院）工程类专业学位研究生工程师职称评审参考指标》，结合该专业类别(领域)工程师职称评审相关标准，举例说明】

1.专业基础理论知识和专业技术知识掌握情况
了解无线充电系统的研究背景和重要意义，并在阅读了大量无线充电系统研究文献后进一步理解了无线充电系统耦合模型。从特殊应用工况的角度，对无线充电系统中的几种常见的补偿网络进行对比分析，选择合适的电路拓扑。针对水下环境空间限制的特性，对搭建出来的无线充电原理系统进行空间优化，多次迭代硬件设计方案以符合水下高温高压工作条件。在确定了系统的整体参数，尤其是耦合机构的自感互感系数，以及材料物理尺寸之后，从高压和绝缘两个方面对耦合机构进行特殊化处理。用有限元仿真软件 ANSYS
对无线充电水下损耗特性进行仿真，对互感以及耦合系数的变化情况进行记录，并最终确定耦合机构的优化设计。基于 STM32
的硬件平台，加深对硬件设计的理论知识。编写控制和通信程序，提高了自己嵌入式能力。在于企业沟通交流中实际了解了工业生产的需求，对无线充电的应用于技术指标有了全新的了解。

2.工程实践经历
研究内容：在水陆两栖特种车辆的应用场景下，提供一种能够完成无线充电的系统。
方案及技术路线：
1).与企业沟通，获取企业产品需求与技术指标，查阅资料，制定方案。
2).仿真验证，在 MATLAB\SIMULINK
上搭建仿真模型，确定无线充电系统设计方案。在ANSYS
中模拟水下环境系统损耗，优化系统结构
3).硬件开发与测试。设计硬件原理图，完成硬件制作与调试，针对调试过程中发现的问题进行修改。
4).软件编写。以 STM32 为控制器， 设计无线充电控制与通信系统。
5).整体测试。制作原型机进行水下测试。
团队分工：
一人负责总体方案和技术路线制定；一人负责硬件系统总体设计；
一人负责软件系统总体设计；一人负责充电系统机械结构设计。
本人承担的任务与完成情况：1).在 MATLAB
上仿真验证无线充电基本拓扑，确定系统电参数。 用 ANSYS
进行损耗分析，对水下耦合机构进行优化仿真，提高系统整体效率；
2).编写基于 STM32
的无线充电驱动和通信程序，实现无线充电基本功能。根据水下特殊工况对系统进行优化设计；
3).完成水下原型机验证调试。

3.实际工作中综合运用所学知识解决复杂工程问题的案例
利用 STM32F407 和 STM32F103
系列芯片分别作为1kW，85%效率的无线充电系统的原边和副边控制器，制作了能够承受水下特殊工作环境的水陆两栖车辆高效率无线充电系统。解决了在特殊环境有限空间和散热条件下的大功率无线充电问题。该工程问题属于电气、机械和材料等多领域复合交叉的复杂问题。
小功率电子设备无线电能传输技术已经比较成熟，大功率无线电能传输技术是当今研究的热

点。无线充电有别于传统插拔充电方式，首先无需导电材质进行物理接触；其次不存在裸露的金属因而降低了充电设备腐蚀损坏率等。这些特性使得水下充电成为一种可能。但与传统陆上在电动汽车等领域快速发展的无线充电技术不同的是，水下无线充电因为受到水下环境的限制而充满挑战。

本次研究的是特殊工况下的无线充电系统，主要是对整体系统、耦合机构以及通讯方式进行优化，提升系统在水下尤其是水陆两栖特种车辆的这种特殊工况下的效率以及耦合机构的传输能力。无线充电系统除了应具有普通电气传动系统的共性外，还应具备以下特点：充电可靠性高，满足高温高压环境下静态充电需求；功能实用性高，可以极大程度地提高特殊车辆的工作时间和能力；安全性要求高，在高压条件和功能运行时保证安全可靠；电磁兼容性要求高，满足车辆电气要求；体积功率密度高，系统应高度集成化，减少水下空间占用。

反映在无线充电系统上，就是要基于 STM32 的控制器实现高频的 PWM

逆变控制，响应时间要短，精度要高；同时在水下高温高压潮湿的工作环境内，实现稳定可靠的充电。耦合机构不能在水介质中损失过多的能量。通过硬件器件的选型，选择高裕量的无线充电系统来保证特殊工况下的运行稳定性。对耦合机构进行高压和绝缘特殊处理。设计具有特殊结构的密封耐压耦合机构，保证存在水下扰动的情况下，无线充电的原边线圈和副边线圈也能够拥有一定的耦合系数。通过将驱动电路板进行空间布局优化，在硬件设计上减少了空间占用，减少整个水下部分的体积所导致的成本；通过硅钢片与金属耐压仓的组合，提升了系统的散热性能，使得无线充电系统可在更高功率的工况下工作。无线充电系统的副边为车辆端，原边为电源供应端。通过检测原边电压电流，实时计算整个系统的负载情况。当副边不存在，即负载为水时，自动降低原边发射功率，减小系统损耗。当检测到副边存在阻抗等效增大，即车辆准备充电时，提高原边输出功率。通过这种方式实现原副边通信的简化，副边充电根据自身情况即停即走，极大地提高了充电的便捷度。

制作1kW特殊工况无线充电系统一套。对特殊工况无线充电系统进行了水下测试，完成了与企业具体需求的对接，并在不断测试中，对系统进行逐步完善。

（二）取得的业绩（代表作）【限填3项，须提交证明原件（包括发表的论文、出版的著作、专利证书、获奖证书、科技项目立项文件或合同、企业证明等）供核实，并提供复印件一份】					
1. **公开成果代表作【论文发表、专利成果、软件著作权、标准规范与行业工法制定、著作编写、科技成果获奖、学位论文等】**					
成果名称	成果类别 [含论文、授权专利（含发明专利申请）、软件著作权、标准、工法、著作、获奖、学位论文等]	发表时间/授权或申请时间等	刊物名称/专利授权或申请号等	本人排名/总人数	备注
A Reconfigurable Modular Vehicle Control Strategy Based on an Improved Artificial Potential Field	国际期刊	2022年08月13日	ELECTRONICS	2/6	SCI**期刊收录**
Design and Optimization of a Wireless Power Transfer System with a High Voltage Transfer Ratio	国际期刊	2022年07月06日	ELECTRONICS	2/7	SCI期刊收录
Design, Fabrication, and Control Algorithm of Self-Reconfigurable Modular Intelligent Vehicles	国际期刊	2022年07月07日	APPLIED SCIENCES-BASEL	2/7	SCI期刊收录

2.其他代表作【主持或参与的课题研究项目、科技成果应用转化推广、企业技术难题解决方案、自主研发设计的产品或样机、技术报告、设计图纸、软课题研究报告、可行性研究报告、规划设计方案、施工或调试报告、工程实验、技术培训教材、推动行业发展中发挥的作用及取得的经济社会效益等】

<table>
<tr><td colspan="2">（三）在校期间课程、专业实践训练及学位论文相关情况</td></tr>
<tr><td>课程成绩情况</td><td>按课程学分核算的平均成绩： 85 分</td></tr>
<tr><td>专业实践训练时间及考核情况(具有三年及以上工作经历的不作要求)</td><td>累计时间： 1.2 年（要求1年及以上）
考核成绩： 90 分（要求80分及以上）</td></tr>
<tr><td colspan="2">本人承诺</td></tr>
<tr><td colspan="2">个人声明：本人上述所填资料均为真实有效，如有虚假，愿承担一切责任，特此声明！

申报人签名：王嘉铖</td></tr>
</table>

22160110

二、日常表现考核评价及申报材料审核公示结果

日常表现 考核评价	非定向生由德育导师考核评价、定向生由所在工作单位考核评价： ☑优秀 □良好 □合格 □不合格 德育导师/定向生所在工作单位分管领导签字（公章）：沈 2024年 3月27日
申报材料 审核公示	根据评审条件，工程师学院已对申报人员进行材料审核（学位课程成绩、专业实践训练时间及考核、学位论文、代表作等情况），并将符合要求的申报材料在学院网站公示不少于5个工作日，具体公示结果如下： □通过 □不通过（具体原因： ） 工程师学院教学管理办公室审核签字（公章）： 年 月 日

中共浙江大学工程师学院委员会

浙 江 大 学 研 究 生 院

攻读硕士学位研究生成绩表

学号：22160110	姓名：王嘉铖	性别：男	学院：工程师学院	专业：电气工程	学制：2.5年
毕业时最低应获：26.0学分		已获得：28.0学分		入学年月：2021-09	毕业年月：2024-03
学位证书号：1033532024602162			毕业证书号：103351202402600388		授予学位：能源动力硕士

学习时间	课程名称	备注	学分	成绩	课程性质	学习时间	课程名称	备注	学分	成绩	课程性质
2021-2022学年秋季学期	学科前沿选论		2.0	88	专业学位课	2021-2022学年冬季学期	车辆控制理论与技术		3.0	87	专业学位课
2021-2022学年秋季学期	电子电力系统电磁兼容设计基础		2.0	83	跨专业课	2021-2022学年夏季学期	研究生英语基础技能		1.0	免修	公共学位课
2021-2022学年秋季学期	智能控制与智能系统		2.0	87	跨专业课	2021-2022学年夏季学期	研究生英语		2.0	免修	公共学位课
2021-2022学年冬季学期	车辆信息传感与通信技术		2.0	84	专业学位课	2021-2022学年夏季学期	自然辩证法概论		1.0	89	公共学位课
2021-2022学年秋冬季学期	中国特色社会主义理论与实践研究		2.0	85	公共学位课	2021-2022学年春夏季学期	车辆工程专业课程设计与实践		4.0	88	专业学位课
2021-2022学年冬季学期	工程中的有限元方法		2.0	90	专业选修课	2021-2022学年夏季学期	工程伦理		2.0	92	公共学位课
2021-2022学年秋冬季学期	研究生论文写作指导		1.0	86	专业学位课	2021-2022学年夏季学期	电气装备健康管理		2.0	90	专业选修课

说明：1.研究生课程按三种方法计分：百分制，两级制（通过、不通过），五级制（优、良、中、及格、不及格）。

2.备注中“*”表示重修课程。

学院成绩校核章：

成绩校核人：张梦依

打印日期：2024-04-02

applied sciences

Article

Design, Fabrication, and Control Algorithm of Self-Reconfigurable Modular Intelligent Vehicles

Jing Zhou [1,2,3], Jiacheng Wang [1,3], Jiazhong He [1,3], Jian Gao [3], Aixi Yang [3], Sideng Hu [1,*] and Qiang Li [4]

[1] College of Electrical Engineering, Zhejiang University, Hangzhou 310027, China; jingzhou@zju.edu.cn (J.Z.); 22160110@zju.edu.cn (J.W.); 21960041@zju.edu.cn (J.H.)
[2] Hainan Institute, Zhejiang University, Sanya 572025, China
[3] Polytechnic Institute, Zhejiang University, Hangzhou 310058, China; g017016@zju.edu.cn (J.G.); yangaixi@zju.edu.cn (A.Y.)
[4] Department of Mechanical Engineering, Zhejiang University of Science and Technology, Hangzhou 310018, China; liqiang@zust.edu.cn
* Correspondence: husideng@zju.edu.cn

Abstract: Self-reconfigurable vehicles are able to transform into new formations on the basis of mutual communication and positioning so as to adapt to a new environment and new tasks. Compared with fixed-formation vehicles, reconfigurable vehicles feature multifunction and high reliability. First, a modular vehicle with a Mecanum wheel is designed, and a motion control method of a modular vehicle is derived through the establishment and analysis of its kinematics model. Afterwards, a visual positioning system based on AprilTag is designed, and the reconfiguration experiment of modular vehicles is completed in order to validate the feasibility of the proposed control method. A hardware control platform is built, which is able to realize the omnidirectional movement of the vehicle in the plane. The proposed modular vehicles with the corresponding control method successfully completes centralized perception, trajectory planning, and self-reconfiguration, which can be potentially applied in various scenarios, such as orientation guidance and logistics handling.

Keywords: modular; reconfiguration; motion control; multipoint communication

check for updates

Citation: Zhou, J.; Wang, J.; He, J.; Gao, J.; Yang, A.; Hu, S.; Li, Q. Design, Fabrication, and Control Algorithm of Self-Reconfigurable Modular Intelligent Vehicles. *Appl. Sci.* **2022**, *12*, 6886. https://doi.org/10.3390/app12146886

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1. Introduction

With the development of computer technology, machine vision, and micro/nano manufacturing, the study of intelligent vehicles is developing towards miniaturization and modularization and has come into application in various fields [1,2]. Intelligent vehicles can carry various sensors to detect the external environment, and they are able to perform logistics services, detection, and other functions. For instance, an AGV vehicle (Figure 1) can be utilized to sort logistics.

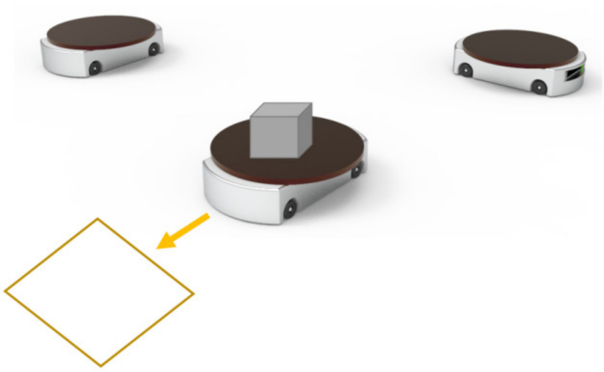

Figure 1. AGV for logistics sorting.

electronics

Article

Design and Optimization of a Wireless Power Transfer System with a High Voltage Transfer Ratio

Jing Zhou [1,2], Jiacheng Wang [2], Pengzhi Yao [2], Yanliang Lu [3], Aixi Yang [2], Jian Gao [2] and Sideng Hu [1,*]

[1] College of Electrical Engineering, Zhejiang University, Hangzhou 310027, China; jingzhou@zju.edu.cn
[2] Polytechnic Institute, Zhejiang University, Hangzhou 310015, China; 22160110@zju.edu.cn (J.W.); 21960049@zju.edu.cn (P.Y.); yangaixi@zju.edu.cn (A.Y.); g017016@zju.edu.cn (J.G.)
[3] Ningbo Jintai Rubber & Plastic Co., Ltd., Ningbo 315609, China; yanliang@jintai-cn.com
* Correspondence: husideng@zju.edu.cn

Abstract: With the development of the logistics industry, low-voltage systems, such as intelligent logistics vehicles, have also started to propose application scenarios for wireless power transfer systems. As most logistics vehicles use lithium batteries for energy supply, the wireless charging system has to adapt to the charging characteristic curve of lithium batteries. In this paper, a dual-transmitter single-receiver compound resonant compensation topology with a high voltage ratio is proposed, and a corresponding magnetic coupler is designed and optimized through finite element analysis, which guarantees adaptive output curves according to the working state. A 1 kW experimental platform is established to verify the theoretical analysis, which realizes a high voltage transformation ratio with 90.3% efficiency. Throughout the whole charging process, the output curve agrees with the charging profile of the lithium battery, which can greatly extend the service life of lithium batteries.

Keywords: wireless power transfer; high voltage ratio; optimization

Citation: Zhou, J.; Wang, J.; Yao, P.; Lu, Y.; Yang, A.; Gao, J.; Hu, S. Design and Optimization of a Wireless Power Transfer System with a High Voltage Transfer Ratio. *Electronics* **2022**, *11*, 2115. https://doi.org/10.3390/electronics11142115

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1. Introduction

In recent years, environmental pollution and the energy crisis have attracted increasing attention from the public. Meanwhile, the capacity and stability of batteries have been further developed. Compared with traditional fuel vehicles, electric vehicles have a higher energy efficiency. Considering this background, electric vehicles have found wider applications, which has resulted in the charging technology of electric vehicles becoming more and more important. The traditional charging scheme adopts the wired charging method with a fixed charging pile. However, because of the mechanical contact between the charging gun and the vehicle battery interface, there is a risk of electric shock or causing personal injury. Moreover, operating the charging device in extreme weather also poses a certain threat to the safety of staff. Compared with wired charging, wireless charging features no electrical contact, high safety, and high reliability, which has become a hot research topic.

In 2007, the MIT research group lit up a bulb 2 m away using magnetic resonant power transmission technology, and corresponding research work was published in *Science* [1]. J. R. Smith, at Washington University, utilized similar power transmission methodology, and the transferred power was increased to 60 W with 75% system efficiency. The research team also found out that, when the distance between two coils was too close, the "frequency splitting" phenomenon happened in the system. They also built a four-coil wireless power transfer system, and further put forward the concepts of over coupling, under coupling, and critical coupling. In terms of the control algorithm, the team proposed a frequency adjustment method, which was able to adjust system output in an adaptive way [2].

The Korean Academy of Science and Technology also conducted research on the WPT system with multiple groups of transmission coils, and analyzed the influence of system parameters on transmission efficiency [3,4]. Since 2007, the team has had three sets of complete experimental systems, which have been applied to buses, golf carts, and other

electronics

MDPI

Article

A Reconfigurable Modular Vehicle Control Strategy Based on an Improved Artificial Potential Field

Jing Zhou [1,2], Jiacheng Wang [1,2], Jiazhong He [1,2], Jian Gao [2], Aixi Yang [2] and Sideng Hu [1,*]

[1] College of Electrical Engineering, Zhejiang University, Hangzhou 310027, China
[2] Polytechnic Institute, Zhejiang University, Hangzhou 310027, China
* Correspondence: husideng@zju.edu.cn

Abstract: The reconfigurable modular vehicle group can transform into different configurations according to different requirements to be competent for various tasks and scenarios and to facilitate the utilization of robots in unstructured scenarios. Efficient and effective reconfiguration strategies and path planning are essential for improving the performance of modular vehicle groups. First, a multi-sensing four-wheel-drive Mecanum vehicle was built, which was equipped with UWB positioning (based on wireless carrier communication technology), communication based on ESP8266 modules, ultrasonic ranging and a magnetic structure. Second, concerning the indoor storage environment, a UWB two-way bilateral ranging and positioning system was designed, and the experimental accuracy for positioning could reach ±0.1 m. Third, a path planning strategy based on the improved artificial potential field method was adopted. According to the target configuration as well as the obstacle avoidance requirements, the motion space was converted into a gravitational field and a repulsive force field, and the vector superposition of the gradients was used for the path planning of each vehicle in turn. Depending on the reconfiguration command and the connection matrix, the magnetic structure would strengthen or disconnect the vehicle group configuration. Finally, the vehicle reconfiguration from the stochastic dispersion state to the target configuration and the transition between different configurations were accomplished using the proposed strategy in both simulations and experiments.

Keywords: modular; reconfiguration; path planning; UWB positioning

Citation: Zhou, J.; Wang, J.; He, J.; Gao, J.; Yang, A.; Hu, S. A Reconfigurable Modular Vehicle Control Strategy Based on an Improved Artificial Potential Field. *Electronics* **2022**, *11*, 2539. https://doi.org/10.3390/electronics11162539

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1. Introduction

At present, most factories still use manual transportation, which features low automation. From the perspective of the entire production cycle, more than 90% of the time is used for loading and unloading, transshipment, etc., and inefficient manual transportation significantly limits production efficiency. An Automated Guided Vehicle (AGV) is automated transportation equipment that integrates machinery, electricity, control and sensing, which has been widely used in automobiles, manufacturing, logistics, storage and other fields. Compared with manual transportation, an AGV has the advantages of a lower cost, higher efficiency, higher accuracy and easier management [1].

For complicated unstructured spaces, a smaller and more flexible reconfigurable modular vehicle group can effectively increase the utilization of the whole system and further improve the overall automation level. Compared with traditional AGVs, the reconfigurable modular vehicle group can change the configuration of the group according to the requirements of special tasks and scenarios, which increases the diversity of configuration and adaptability to unknown environments.

With the goal of moving freely in a small space, many companies have designed a variety of omnidirectional mobile vehicles. This kind of vehicle usually has three degrees of freedom and can move freely in all directions, including moving forward and backward, rotating, multi-angle lateral movement, etc. [2].

经检索《Web of Science》的《Science Citation Index Expanded (SCI-EXPANDED)》数据库，下述论文被《SCI-EXPANDED》收录。（检索时间：2023 年 11 月 21 日）

第 1 条，共 3 条

标题:A Reconfigurable Modular Vehicle Control Strategy Based on an Improved Artificial Potential Field

作者: Zhou, J(Zhou, Jing);Wang, JC(Wang, Jiacheng);He, JZ(He, Jiazhong);Gao, J(Gao, Jian);Yang, AX(Yang, Aixi);Hu, SD(Hu, Sideng);

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地址:

[Zhou, Jing; Wang, Jiacheng; He, Jiazhong; Hu, Sideng] Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

[Zhou, Jing; Wang, Jiacheng; He, Jiazhong; Gao, Jian; Yang, Aixi] Zhejiang Univ, Polytech Inst, Hangzhou 310027, Peoples R China.

通讯作者地址:

Hu, SD (corresponding author), Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

电子邮件地址:husideng@zju.edu.cn

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第 2 条，共 3 条

标题: Design and Optimization of a Wireless Power Transfer System with a High Voltage Transfer Ratio

作者: Zhou, J(Zhou, Jing);Wang, JC(Wang, Jiacheng);Yao, PZ(Yao, Pengzhi);Lu, YL(Lu, Yanliang);Yang, AX(Yang, Aixi);Gao, J(Gao, Jian);Hu, SD(Hu, Sideng);

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地址:

[Zhou, Jing; Hu, Sideng] Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

[Zhou, Jing; Wang, Jiacheng; Yao, Pengzhi; Yang, Aixi; Gao, Jian] Zhejiang Univ, Polytech Inst, Hangzhou 310015, Peoples R China.

[Lu, Yanliang] Ningbo Jintai Rubber & Plast Co Ltd, Ningbo 315609, Peoples R China.

通讯作者地址:

Hu, SD (corresponding author), Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

电子邮件地址:jingzhou@zimedu.cn; 22160110@zju.edu.cn; 21960049@zju.edu.cn;yanliang@jintai-cn.com; yangaixi@zju.edu.cn; g017016@zju.edu.cn;husideng@zju.edu.cn

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标题: Design, Fabrication, and Control Algorithm of Self-Reconfigurable Modular Intelligent Vehicles

作者: Zhou, J(Zhou, Jing);Wang, JC(Wang, Jiacheng);He, JZ(He, Jiazhong);Gao, J(Gao, Jian);Yang, AX(Yang, Aixi);Hu, SD(Hu, Sideng);Li, Q(Li, Qiang);

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地址:

[Zhou, Jing; Wang, Jiacheng; He, Jiazhong; Hu, Sideng] Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

[Zhou, Jing] Zhejiang Univ, Hainan Inst, Sanya 572025, Peoples R China.

[Zhou, Jing; Wang, Jiacheng; He, Jiazhong; Gao, Jian; Yang, Aixi] Zhejiang Univ, Polytech Inst, Hangzhou 310058, Peoples R China.

[Li, Qiang] Zhejiang Univ Sci & Technol, Dept Mech Engn, Hangzhou 310018, Peoples R China.

通讯作者地址:

Hu, SD (corresponding author), Zhejiang Univ, Coll Elect Engn, Hangzhou 310027, Peoples R China.

电子邮件地址:jingzhou@zju.edu.cn; 22160110@zju.edu.cn; 21960041@zimedu.cn;g017016@zju.edu.cn; yangaixi@zju.edu.cn; husideng@zju.edu.cn;liqiang@zust.edu.cn

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