

中国学术期刊综合评价数据库源刊  
中国学术期刊(光盘版)全文收录期刊  
中国核心期刊(遴选)数据库收录期刊  
广西机械工程学会会刊

广西十佳科技期刊

ISSN 1672-545X



EQUIPMENT MANUFACTURING TECHNOLOGY

# 装备制造技术

ZHUANGBEI ZHIZAO JISHU



用人品打造精品  
用精品奉献社会



中国重汽集团柳州运力专用汽车有限公司  
SINOTRUK Liuzhou Yunli Special Vehicle Co.,LTD.



中国重汽柳州运力官方微信订阅号

ISSN 1672-545X



本刊网址: [www.zbzzjsqk.com](http://www.zbzzjsqk.com)

7  
2020

<总第307期>



# 装备制造技术

月刊·公开发行

2020年第7期

(总第307期)

2020年7月出版

中国学术期刊综合评价数据库源刊  
中国学术期刊(光盘版)全文收录期刊  
中国期刊网入网期刊  
《CAJ-CD 规范》执行优秀期刊  
中国核心期刊(遴选)数据库收录期刊  
万方数据数字化期刊群全文收录期刊  
《中文科技期刊数据库》全文收录期刊  
Airiti Library 华艺线上图书馆收录期刊  
广西机械工程学会会刊

主管单位: 广西壮族自治区科学技术协会

主办单位: 广西机械工程学会

编委会:

主任: 熊有伦

副主任: 李尚平 李振雄 蔡敢为

温宗胤 黄其柏

委员: 陈定方 孔建益 竺志超 何汉武

吴昌林 钟毓宁 李文龙 陈绪兵

任国梁 邓三鹏 文代志 冯高山

杨华 黄相山 吕登红 刘国平

吴湘柠 杨胜锋 向金林 廖小平

高兴宇 李健 张政波 梁建和

主编: 梁建和

副主编: 李耀先 黄伟 慕朝师

编辑: 邓建新

外联部: 冯廷明 李玲

刊名题字: 周榕林

编辑出版: 《装备制造技术》编辑部

发行单位: 《装备制造技术》编辑部

地址: 南宁市民主路17号

电子信箱: jzbzzjs@163.com

网址: <http://www.zbzzjsqk.com>

邮政编码: 530023

电话(传真): (0771) 5602985 5876281

18934725185

印刷: 广西桂川民族印刷有限公司

广告经营许可证: 450102216

统一刊号: ISSN 1672-545X  
CN 45-1320/TH

国内定价: 16.00元

## 目次

### 方法与技术

- 三圆弧谐波齿轮传动啮合性能分析.....时志奇,黄彦彦,周青华,等 (1)
- 无线传感网络在桥渡装备故障检测系统中的应用  
.....申 玫,隋元松,李学礼,等 (7)
- 机器视觉影像测量技术在飞行器总装精测中的应用  
.....余 箫,袁鹏哲,罗天慧,等 (13)
- 边界润滑下硬脂酸盐的摩擦性能分析.....石 伟,卫朋冲,杨佳隆 (18)
- 基于轴类零件表面特征的加工工艺.....袁志华,郭首邑,袁 博 (23)
- 并联电动叉车同步作业控制器研究与算法设计  
.....蒲 宇,邵云杰,顾敏明 (26)
- 一种基于3-RPS并联机构的六自由度并串混联机器人的机构设计  
.....李 伟,李 峰,崔连涛,等 (30)
- 基于STM32与uC/OS-III多路步进电机控制系统设计.....严向文 (35)
- 六轮分布式驱动无人车直驶稳定性仿真研究.....赵晓强,封 硕 (39)
- 一种低成本货车盲区监测报警装置的设计.....黄锦超,陈逸凡,许俊杰 (43)
- 基于以太网通信的智能照明控制系统设计.....彭 威,郑晓婷 (46)
- 风电机组变桨系统抗台风设计分析及叶片自动锁定装置开发  
.....高文飞,霍仕环 (50)
- 小尺寸半导体桥雷管装药结构设计.....樊龙龙 (54)
- 基于平均应力的局部应力应变法疲劳寿命预测模型研究  
.....陈 明,邵 飞,俞海涛,等 (57)
- 基于顾客需求的包装机功能设计评价应用研究.....郑伟杰 (61)
- XK45-9/540型交流传动蓄电池式牵引电机车基础制动装置设计  
.....赵晓炎 (65)
- 基于halcon颜色识别分类的算法研究.....陈 亮,陈德龙,邓裕鹏 (68)
- 基于AGV的对中台设计.....刘参参,卢群英,郭 维 (71)
- LED照明设备中色温因素的分析.....周大伟,卢志椿 (75)

### 新产品

- 基于有色金属产品自动运输的激光叉车AGV的设计.....岑 华 (77)
- 水产养殖水质监测仿生机器鱼.....纪培国,李帅帅,汤华鹏,等 (82)
- SMT盘料存储设备设计与研究.....吕聪正,牛祯祖 (87)
- 基于华为Lite OS的智能终端设计.....王天昊,李诚远,顾敏明 (91)
- 一种用于多晶硅氯化反应器筒体的强化装置设计  
.....马兆泰,邵玉凌,滑小彤,等 (95)
- 一种用于装配驾驶室内部零件的流转小车设计.....张连举 (97)

### 应用与优化

- 弧齿锥齿轮三维参数化实体建模与虚拟装配.....蔡瑜瑜 (101)
- 浅谈新能源汽车车架有限元分析及优化.....蓝 丹,周 伟 (104)

期刊基本参数:CN45-1320/TH \* 1973 \* m \* 16 \* 236 \* zh \* P \* ¥ 16.00 \* 2000 \* 68 \* 2020-07

航空发动机螺栓扭矩失效探讨·····	邵俊	(106)
机器人去毛刺工业应用实例·····	黄永辉,孟庆帅,孟庆鹏,等	(108)
飞机直轴式变量柱塞液压泵最大压力小于规定值的原因分析及排除策略·····	杨安元,贾春鹏,李传良,等	(112)
轮式装载机推土作业效率分析及改进·····	覃忠平	(115)
推力盘与推力轴承在高速多级离心压缩机中的应用·····	郭茜,王中军	(118)
汽车三合一控制器异响故障的检查与排除·····	黄正午,杨琴,黎新福	(121)
地铁电客车升弓电路的优化设计·····	周凌昊	(125)
3D 打印件几何精度误差的成因分析·····	章彬	(128)
数控车工编程加工工艺设计技巧·····	姚映涵	(131)
基于 EtherCAT 现场总线的 PECVD 控制系统设计·····	龙会跃	(134)
摆放约束的二维装箱研究·····	周雨菁,陈国卫	(137)
汽车三元催化器支架安装分析及优化·····	陈丹华,谢玉琳,黎瑞平,等	(141)
汽车发动机冷却系统的常见故障及诊断方法·····	李钰珑	(144)
基于单片机感性电路功率因数提高的研究·····	潘元忠,谢佳宾,李吉生,等	(146)
后桥制动管路检漏方式的选择·····	覃明,李裕龙	(149)
火花塞的故障检修·····	劳俊元	(155)
浅谈机器人换枪盘在焊接自动线柔性化生产的应用·····	吴伟深,赵新平,邓志鹏,等	(158)
浅谈风行菱智汽车冷却液温度传感器致空调不制冷故障诊断与排除·····	李桂强	(161)
PLC 在变电站变压器自动化控制的应用研究·····	李瑞琦,胡凯	(164)
数控技术在箱体零件加工中的应用·····	丁锡志,农露宁,潘皆亦	(167)

## 制造工艺与材料

超强高韧 7000 系铝合金成分分析·····	刘方军,聂宝华,傅浩楠,等	(170)
复合材料——金属组合空间桁架结构优化及扭转刚度分析·····	杨军,邵飞,李峰,等	(173)

## 专论与综述

超声 TOFD 无损检测综述·····	林乃昌	(176)
非线性超声检测方法的研究进展·····	胡诗诚,朱云阳	(181)
CFRP 碳纤维增强树脂基复合材料超声辅助切削技术研究现状与展望·····	张宝磊,李聪,朱帅玲	(185)
基于模糊层次分析法的装备质量综合评价模型研究·····	高瑞,雷海亮,崔晓萍	(191)
数字化仿真技术在离散型生产企业规划布局中的应用·····	王雪	(194)
机械设计制造中机电一体化的应用·····	路全新	(196)

## 管理与人才培养

基于超星学习通平台的特种加工教学设计与实践·····	韩变枝,王栋	(198)
机械工程专业基于“四融合”应用型人才培养模式改革与实践·····	王力,赵建平,刘艳艳,等	(201)
基于 OBE 理念的《机电传动控制》信息化教学研究与实践·····	李俊敏	(204)
CAD/CAE 技术在液压传动课堂实践教学中的应用探析·····	朱节宏	(207)
基于工作过程的高职《数控机床装调维修技术》教学实践研究·····	沈剑峰	(211)
航空发动机课程计算机仿真教学研究·····	袁忠大,李航,张勇	(214)
基于赛教一体化教学孕育技能精英的探索·····	傅健玲,邱霞,黄龙鹏	(217)
高水平专业建设背景下专业课的课程思政改革与探索实践——以《机械制造技术》课程为例·····	徐媛媛,吴坚,李燕	(220)
依托“基地”平台创新新工科类专业人才培养模式·····	孙令真,叶烁,王秀敏,等	(223)
材料加工专业基础课程教学改革研究·····	张程程	(226)
工程机械 CKD 零件存储发运车间工艺布局研究·····	罗文宏	(228)
基于虚拟现实技术的工业机器人拆装实训课教学改革探索·····	梁洸强,廖容	(231)
冷藏车(高端药品(含疫苗))快速应对市场策略·····	张云玉	(234)

CONTENTS

Analysis on Meshing Performance of Three-arc Harmonic Gear  
.....SHI Zhi-qi, HUANG Yan-yan, ZHOU Qing-hua, et al (1)

Application of Wireless Sensor Network in Bridge and River-crossing  
Equipment Fault Detection System  
.....SHEN Mei, SUI Yuan-song, LI Xue-li, et al (7)

Application of Machine Vision Image Measurement Technique in Assembly  
Precision Test of Aircraft.....YU Xiao, YUAN Peng-zhe, LUO Tian-hui, et al (13)

Analysis of the Tribological Properties of Stearate Under Boundary Lubrication  
.....SHI Wei, WEI Peng-chong, YANG Jia-long (18)

Process Planning and Optimization Based on Surface Features of Shaft Parts  
.....YUAN Zhi-hua, GUO Shou-yi, YUAN Bo (23)

Research and Algorithm Design of Synchronous Operation Controller for Parallel  
Electric Forklift.....PU Yu, SHAO Yun-jie, GU Min-ming (26)

The Mechanism Design of a 6-DOF Parallel-serial Hybrid Robot Based on 3-RPS  
Parallel Mechanism.....LI Wei, LI Feng, CUI Lian-tao, et al (30)

Design of Multi-channel Stepping Motor Control System Based on STM32 and  
uC/OS-III.....YAN Xiang-wen (35)

Simulation Study on the Direct Driving Stability of Six-wheel Distributed Drive  
Unmanned Vehicle.....ZHAO Xiao-qiang, FENG Shuo (39)

The Design of a Low-cost Truck Blind Area Monitoring and Alarm Device  
.....HUANG Jin-chao, CHEN Yi-fan, XU Jun-jie (43)

Design of Intelligent Lighting Control System Based on Ethernet Communication  
.....PENG Wei, ZHENG Xiao-ting (46)

Analysis of the Pitch System of Wind Turbine in Typhoon Load Case and  
Development of the Automatic Locking Device for Wind Turbine Blade  
.....GAO Wen-fei, HUO Shi-huan (50)

Design of Charge Sstructure of Small Size Semiconductor Bridge Detonator  
.....FAN Long-long (54)

Research on Fatigue Life Prediction Model of Local Stress-strain Method Based  
on Average Stress.....CHEN Ming, SHAO Fei, YU Hai-tao, et al (57)

Application Research on Functional Design Evaluation of Packaging Machine  
Based on Customer Demand.....ZHENG Wei-jie (61)

Design of Foundation Braking Device for XK45-9/540 AC Drive Battery Traction  
Electric Locomotive.....ZHAO Xiao-yan (65)

Research on the Algorithm of Color Recognition and Classification Based on  
Halcon.....CHEN Liang, CHEN De-long, DENG Yu-peng (68)

Design of Centering Platform Based on AGV  
.....LIU Shen-shen, LU Qun-ying, Guo Wei (71)

Analysis of Medium Temperature Led Lighting Equipment  
.....ZHOU Da-wei, LU Zhi-chun (75)

Design of AGV for Laser Forklift Based on Automatic Transportation of  
Non-ferrous Metal Products.....CEN Hua (77)

Biomimetic Robotic Fish for Aquaculture Water Quality Monitoring  
.....JI Pei-guo, LI Shuai-shuai, TANG Hua-peng, et al (82)

The Design and Research of SMT Tray Storage...LV Cong-zheng, NIU Zhen-zu (87)

Intelligent Terminal Design Based on Huawei Lite OS  
.....WANG Tian-hao, LI Cheng-yuan, GU Min-ming (91)

Design of a Strengthening Device for Polysilicon Hydrogenation Reactor  
.....MA Zhao-tai, SHAO Yu-ling, HUA Xiao-tong, et al (95)

The Design of a Flow Car for Assembling the Inner Parts of the Cab  
.....ZHANG Lian-ju (97)

3D Parametric Solid Modeling of Spiral Bevel Gear and Virtual Assembly  
.....CAI Yu-yu (101)

本刊理事会成员单位名录

理事长单位:

广西机械工程学会

副理事长单位:

- (13) 东风柳州汽车有限公司
- 广西柳工集团有限公司
- (18) 广西玉柴机器股份有限公司
- (23) 广西制造系统与先进制造技术重点实验室
- 广西水利电力职业技术学院

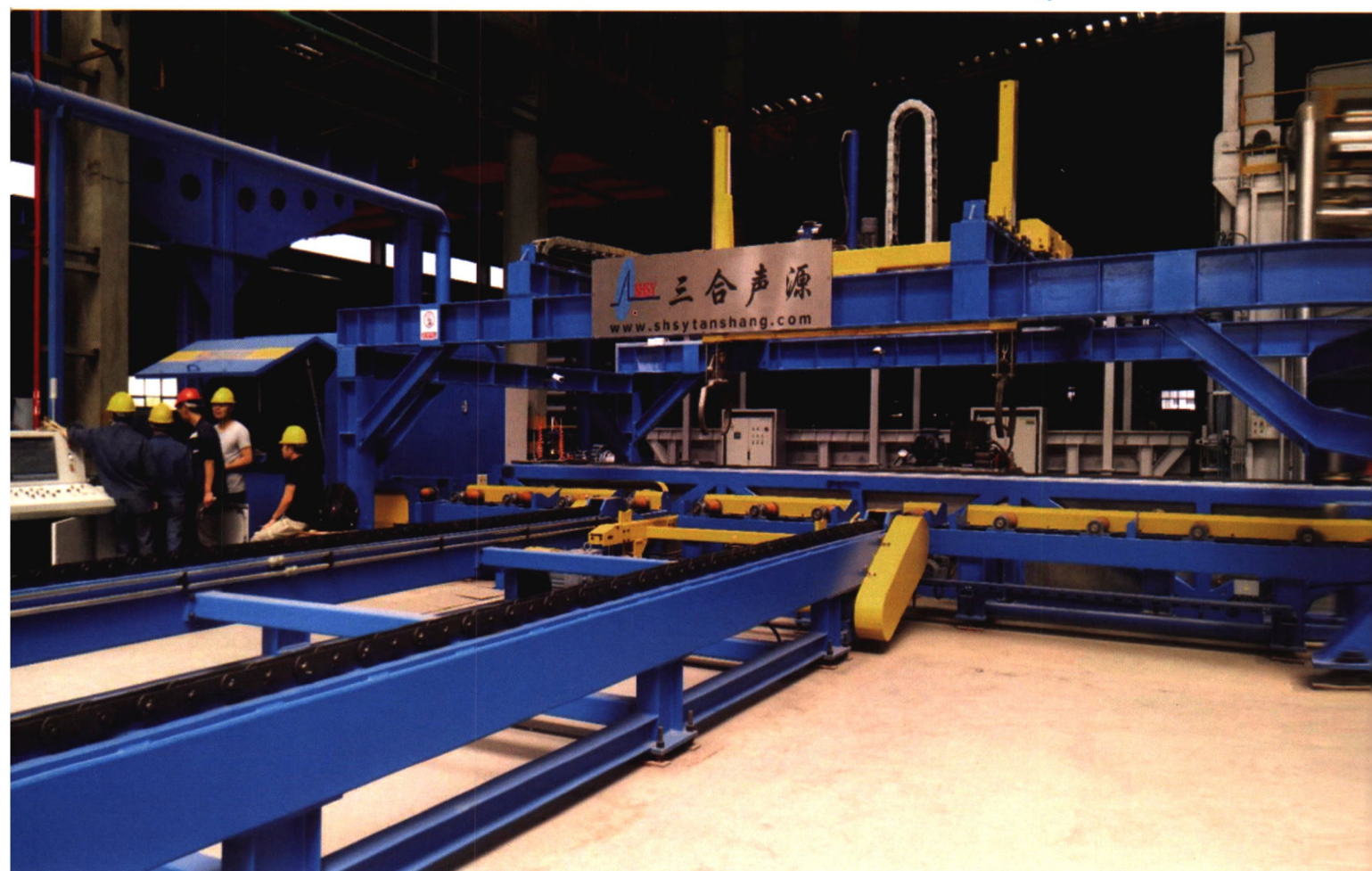
常务理事单位和理事单位:

- (39) 上汽通用五菱汽车股份有限公司
- 柳州五菱汽车工业有限公司
- (43) 桂林广陆数字测控有限公司
- 广西交通职业技术学院
- (46) 柳州五菱柳机动力有限公司
- 广西机电技师学院
- (50) 中国重汽集团柳州运力专用汽车有限公司
- (54) 广西玉柴机器配件制造有限公司
- 柳州钢铁集团有限公司工程技术公司
- (57) 广西机械工业研究院
- (61) 柳州铁道职业技术学院
- 广西建工集团建筑机械制造有限责任公司
- (65) 广西柳州职业技术学院
- (68) 广西农业机械研究院
- 桂林正菱第二机床有限公司
- (71) 柳州柳二空机械股份有限公司
- (75) 南宁神华振动时效技术研究所
- 广西钦州力顺机械有限公司
- (77) 广西职业技术学院

Finite Element Analysis and Optimization of New Energy Electric Vehicle Frame	LAN Dan, ZHOU Wei	(104)
Discussion on Bolt Torque Failure of Aeroengine	SHAO Jun	(106)
Industrial Application Examples of Robot Deburring	HUANG Yong-hui, MENG Qing-shuai, MENG Qing-peng, et al	(108)
Analysis of the Reason why the Maximum Pressure of Aircraft Straight Axis Variable Plunger Hydraulic Pump is Less than the Specified Value and the Elimination Strategy	YANG An-yuan, JIA Chun-peng, LI Chuan-liang, et al	(112)
Analysis and Improvement of Bulldozing Efficiency of Wheel Loader	QIN Zhong-ping	(115)
Thrust Disc with Thrust Bearing at High Speed Applications in Centrifugal Compressors	GUO Qian, WANG Zhong-jun	(118)
Inspection and Elimination of Abnormal Noise in Three in One Controller of Automobile	HUANG Zheng-wu, YANG Qin, LI Xin-fu	(121)
The Optimal Design of the Lifting Bow Circuit of Subway Electric Bus	ZHOU Ling-hao	(125)
Cause Analysis of Geometric Accuracy Error in 3D Printing Parts	ZHANG Bin	(128)
Design Skills of NC Lathe Programming Processing Technology	YAO Ying-han	(131)
Design of PECVD Control System Based on EtherCAT Fieldbus	LONG Hui-yue	(134)
Two Dimensional Packing with Placement Constraints	ZHOU Yu-jing, CHEN Guo-wei	(137)
Automobile ternary Catalyst Support Installation of Analysis and Optimization	CHEN Dan-hua, XIE Yu-lin, LI Rui-ping, et al	(141)
Common Fault and Diagnosis Method of Automobile Engine Cooling System	LI Yu-long	(144)
Research Improving Power Factor of Inductive Circuit Based on Single Chip Computer	PAN Yuan-zhong, XIE Jia-bin, LI Ji-sheng, et al	(146)
Selection of Leak Detection Method for Rear Axle Brake Pipeline	QIN Ming, LI Yu-long	(149)
Troubleshooting of Spark Plug	LAO Jun-yuan	(155)
Discussion on the Application of Robotic Tool Changer in Flexible Production of Welding Automatic Line	WU Wei-shen, ZHAO Xin-ping, DENG Zhi-peng, et al	(158)
A Brief Discussion on Fault Diagnosis and Elimination of Air Conditioning Caused by Temperature Sensor of Cooling Liquid in Faddish Lingzhi Automobile	LI Gui-qiang	(161)
Application of PLC in Substation Transformer Automation Control	LI Rui-qi, HU Kai	(164)
Application of CNC Technology in Box-type Parts Processing	DING Xi-zhi, NONG Lu-ning, PAN Jie-yi	(167)
Metallurgical Insights into Ultra-High Strength and Toughness 7000 Series Alloys	LIU Fang-jun, NIE Bao-hua, FU Hao-nan, et al	(170)
FRP-metal Space Truss Structure Optimization and Torsional Stiffness Analysis	YANG Jun, SHAO Fei, LI Feng, et al	(173)
Review of Ultrasonic TOFD Nondestructive Testing	LIN Nai-chang	(176)
Research Progress of Nonlinear Ultrasonic Testing Methods	HU Shi-cheng, ZHU Yun-yang	(181)
Research Status and Prospect of Ultrasonic Assisted Cutting Technology for CFRP Carbon Fiber Reinforced Resin Matrix Composite	ZHANG Bao-lei, LI Cong, ZHU Shuai-ling	(185)
Equipment Quality Evaluation Model Based on Fuzzy Analytic Hierarchy Process	GAO Rui, LEI Hai-liang, CUI Xiao-ping	(191)
Digital Simulation Technology in Discrete Production Application in Enterprise Planning Layout	WANG Xue	(194)
Application of Mechatronics in Mechanical Design and Manufacture	LU Quan-xin	(196)
Design and Practice of Special Processing Course Based on Chaoxing Learning Platform	HAN Bian-zhi, WANG Dong	(198)
Reform and Practice of Applied Talents Training Mode of Mechanical Engineering Specialty Based on "Four Integration"	WANG Li, ZHAO Jian-ping, LIU Yan-yan, et al	(201)
Research and Practice of Informatization Teaching of Electromechanical Drive Control Based on OBE Concept	LI Jun-min	(204)
The Implementation Path of CAD / CAE Technology in the Practice Teaching of Hydraulic Transmission	ZHU Jie-hong	(207)
Research on Teaching Practice of "CNC Machine Tool Assembly, Adjustment and Maintenance Technology" Based on Working Process	SHEN Jian-feng	(211)
Research on Computer Simulation Teaching of Aeroengine Course	YUAN Zhong-da, LI Hang, ZHANG Yong	(214)
The Exploration of Cultivating Skill Elites Based on the Integrated Teaching of Competition and Education	FU Jian-ling, QIU Xia, HUANG Long-peng	(217)
Reform and Practice of Ideological and Political Education in the Specialized Course against the Background of High-level Major Construction-Taking Mechanical Manufacturing Technology Course as an Example	XU Yuan-yuan, WU Jian, LI Yan	(220)
Relying on the "Base" Platform to Innovate the Training Model of New Engineering Professionals	SUN Ling-zhen, YE Shuo, WANG Xiu-min, et al	(223)
Research on Teaching Reform of Basic Courses of Material Processing Specialty	ZHANG Cheng-cheng	(226)
Study on the Process Layout of CKD Parts Storage & Delivery Workshop for Construction Machinery	LUO Wen-hong	(228)
Exploration on Teaching Reform of Industrial Robot Disassembly Training Course Based on Virtual Reality Technology	LIANG Guang-qiang, LIAO Rong	(231)
Quick Response to Market Strategy of Refrigerated Vehicles(High-end Drugs (Including Vaccines))	ZHANG Yun-yu	(234)



创新、诚信、质量、服务



**广西三合恩蒂梯(NDT)设备制造有限公司**

ISSN 1672-545X

CN 45-1320 / TH

万方数据

国内定价：16.00元