

项目相关教研、科研论文

序号	发表时间	发表论文	第一作者	发表载体
1	2022	双师工作室产教融合培养装备制造人才的实践（已录用）	陆叶	轻工科技
2	2018	基于“仿、赛、做”与机器人创新的教学模式探讨	陆叶	机械研究与应用
3	2019	“工业机器人搬运应用”的信息化教学设计与实践	陆叶	机械研究与应用
4	2015	三维软件在机械专业课程教学中的应用	余凤燕	产业与科技论坛
5	2021	基于教师工作室“学赛研三维交互式”高职创新人才培养的实践探索	蔡美丹	湖北开放职业学院学报
6	2020	一体化教学在数控加工编程课程中的应用研究	袁智权	科技风
7	2020	以职业技能竞赛为抓手促进专业建设发展	王开	大众科技
8	2021	Multi-robot Automatic Production Line (EI 收录)	陆叶	IOP Conference Series Earth and Environmental Science
9	2021	Kinematics Analysis and Trajectory Planning of Polishing Six-axis Robot (EI 收录)	陆叶	IOP Conference Series Earth and Environmental Science
10	2021	Kinematics Analysis and Trajectory Planning of Dual-arm Pruning Robot (EI 收录)	陆叶	IOP Conference Series Earth and Environmental Science

陆叶同志:

您好!感谢您对本刊的信赖和支持!《轻工科技》杂志是由广西轻工科学技术研究院有限公司主办、国家新闻出版总署第一批认定的学术期刊。本刊国际刊号,ISSN 2095-3518,国内刊号,CN45-1385/TS,中国知网全文收录。

您投来的文章《基于双师工作室的产教融合培养装备制造业人才的探索》(论文编号为:20220536)经本刊编辑部初审,符合发表要求,拟于在本刊2022年的第5期上发表,5月中旬出版。编辑部按照规定向您收取审稿费、编辑费、出版

基于双师工作室的产教融合培养装备制造业人才的探索

陆叶王开

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摘要: 为了当前解决高职人才培养不能很好适应装备制造产业需求的问题,本文提出了校企联合搭建“教师+技师”双师工作室,以此为依托,开展了“学赛研融合式”人才培养实践,形成了“三化一体”工匠型人才实践创新能力培养体系,通过产学研“三对接”服务当地产业,取得一定的成效。经实践表明,基于双师工作室的产教融合培养,对人才培养质量的提升起到了较大作用,为粤东西北高职装备制造高端技能人才培养提供了新路径。

关键词: 双师工作室;产教融合;装备制造

Based on Double-teacher Studios to Explore the Talents Cultivation in Equipment Manufacturing Industry by Integration of Production and Education

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Abstract: In order to solve the problem that talent cultivation in higher vocational colleges can not meet the needs of equipment manufacturing industry well, building a "teacher + technician" double-teacher studio jointly by college and enterprises is proposed in this paper. Based on this, the talent cultivation practice of "integration of learning, competition and research" is developed, and the "three in one" craftsman talent practical innovation ability cultivation system is formed. Serving local industries through the "three docking" of production, education and research, and certain results has achieved. The practice shows that the integration of enterprises with vocational colleges based on the double-teacher studio plays a great role in improving the quality of personnel training, and provides a new path for the training of high-end skilled personnel of equipment manufacturing in Higher Vocational Colleges in the East and northwest of Guangdong Province.

Key words: Double-teacher studio; Integration of production and education; Equipment manufacturing industry

0 引言

当前高职人才培养和产业需求存在着匹配性差等问题,如何通过深化产教融合、校企合作来解决这些问题,是职业教育发展的重中之重。装备制造业在国民经济中起着极其重要的作用。但我国装备制造产业总体仍处于生产水平低、创新能力弱、制造高能耗、产品低端化的阶段。随着中国制造向中国智造迈进,对装备制造业人才提出了更高要求,培养一大批装备制造业高端技术技能型人才成为高职教育人才培养的当务之急。本文针对人才培养质量与装备制造产业人才需求不匹配、人才培养就业岗位适应性不高、服务粤西乡村振兴的装备制造人才不对接等问题,校企协同,搭建双师工作室育人平台^[1],开展“学赛研融合式”人才培养实践,初步形成了“三化一体”工匠型人才实践创新能力培养体系,并以工作室为依托,通过产学研“三对接”服务粤西乡村振兴,并以科技服务反哺教学,经实践探索,取得了一系列的成果,并在我校电气自动化技术、机械制造与自动化、工业机器人技术等专业进

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基于“仿、赛、做”与机器人创新的教学实践探讨

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摘要:为了应对当前机器人产业发展给高职机电类人才培养带来的新挑战,在分析当前高职机电类专业课程教学现状的基础上,提出了一种基于“仿、赛、做”与机器人创新相结合的教学模式,即采用“仿真”+“比赛”+“实践”的“仿、赛、做”模式教学,同时以机器人为载体开展协同创新能力培养,通过校企联合,以职业能力为主线,构建“能力递进、工作过程系统化”的课程体系。研究证明,该方案切实可行,为高职机电类专业教学改革提供了新思路,对培养具有工程意识、创新精神和专业技术能力的高素质机电类人才有一定的参考价值。

关键词:“仿、赛、做”;机器人;创新;高职;教学模式

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Discussion on Teaching Model Based on the "Simulation, Competition and Do" and the Robot Innovation

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Abstract: In order to cope with the new challenges brought by the current development of the robot industry to the training of mechanical and electrical talents in higher vocational colleges, the teaching method is presented which is based on the combination of "Simulation, Competition, and Do" and the robot innovation. The teaching model of "Simulation" + "Competition" + "Practice" is applied, while making the robot as a carrier to carry out the collaborative innovation ability training. The course system of mission-driven and ability to progress is constructed through the school-enterprise cooperation and professional ability as the main line. It is proved that the scheme is feasible and provides new ideas for the teaching reform of mechanical and electrical specialty in higher vocational colleges. It has certain reference value for cultivating high-quality mechanical and electrical talents with engineering awareness, innovative spirit and professional technical ability.

Key words: "Simulation, Competition and Do"; robot; innovation; higher vocational education; teaching model

0 引言

随着机器人产业的蓬勃发展,中国制造向“中国智造”转变,社会及企业对机电类技能人才的知识与技能结构提出了更新、更高的要求,同时机电类专业学生扩招,各种问题随之产生。一方面机器人设备造价比较高,仅依靠学校经费购买相关设备远不能满足教学的需求,加上很多教师以前没学过机器人,实践教学能力不足,造成学生的动手实践能力较弱,综合应用能力不足,毕业后还需要较长时间的培训才能适应企业的需求。另一方面由于许多高职学生基础较差,缺乏学习积极性,而工业机器人融合了机械、电子、计算机、控制等先进技术,高职学生学习难度大,教学质量不高。为提高教学效果,激发学生学习兴趣、培养学生综合能力,通过组装、搭建、运行教学机器人来进行的机器人教育是一种很好地提高学生综

合能力的方法手段。目前,机器人竞赛盛行,但是由于参赛费用昂贵、师资力量不足、机器人竞赛推广程度不够等原因,很多学校无法参与,总体效果甚微。如何进行教学环节的创新,推进教学改革,是高职机电类专业教学面临的重要课题^[1-2]。

1 基于“仿、赛、做”的教学模式

1.1 “仿”+“做”的教学改革

为满足机器人课程的教学,我校引进了一套ABB机器人生产线,校企合作共同开发了一套由四台富士康机器人和若干设备组成的手机组装生产线,建立了工业机器人实训室。但是在教学中,发现仍存在学生人数多、设备少、设备昂贵易损耗、实际操作中存在安全隐患等问题,为此,引入仿真软件教学,探讨仿真在专业教学中的研究和应用,进行了仿真教学与理论教学、实践教学相结合的“仿”+“做”的教学改

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“工业机器人搬运应用”的信息化教学设计与实践^{*}

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摘 要:以《工业机器人技术应用》课程的子任务“工业机器人搬运应用”为例,进行信息化教学设计与实践。通过传统的课堂教学与基于互联网的现代化教学相结合,采用“教、学、做、评+仿真软件+网络平台+技能竞赛+拓展训练”的多元混合教学模式,将信息化教学手段贯穿课前、课中、课后整个教学过程。实践教学表明,多元混合的教学模式、信息化的教学手段能激发学生学习的兴趣,帮助学生掌握重难点知识,提高学生动手能力和创新能力,达到很好的教学效果,可以为同类课程的信息化教学设计提供参考。

关键词:工业机器人;信息化教学;实践

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Information Teaching Design and Practice of “Industrial Robot Handling Application”

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Abstract: Taking the sub-task “Industrial Robot Handling Application” of the Industrial Robot Technology Application course as an example, the information teaching design and practice are carried out in the article. Through the combination of traditional classroom teaching and modern Internet-based teaching, the teaching method of “Teaching, learning, doing, commenting + simulation software + network platform + skill competition + expansion training” is adopted, and the information teaching method is used in the entire teaching process including before class, during class and after class. The practice teaching shows that multi-mixed teaching mode and the information teaching methods can stimulate the students’ learning interest, help the students to master the important and difficult knowledge, improve the students’ practical ability and innovative ability, and achieve good teaching results. It can provide reference for the information teaching design of the same type of courses.

Key words: industrial robot; information teaching; practice

0 引言

随着机器人在生产线的大量应用,工业机器人应用技术人才需求不断增加。工业机器人是一个典型的机电一体化载体,涉及到机械、电气、计算机等多项技术,而机电类专业高职学生学习积极性低、理论基础差、创新能力不足,采用传统教学方式的教学效果欠佳^[1-3]。为解决传统教学中学生人数多、机器人设备少,学生对机器人操作、编程理解较困难等问题,本文把信息技术与传统教学进行深度融合,进行了信息化教学设计与实践。

1 教学分析

1.1 教学内容

教学内容选自《工业机器人技术应用》课程的子任务“工业机器人搬运应用”,“工业机器人搬运应用”教学内容是依据高等职业学校专业教学标准,选

择高等教育机器人推荐教材,根据职业技能标准,同时参考近几年高职院校工业机器人赛项规程和机器人企业培训资料。内容包含四个子任务,课时安排四学时,授课方式教、学、做、评一体化。

1.2 教学目标

根据课程标准和职业岗位要求,确定知识目标、技能目标和职业素养目标三大目标。实现熟练使用仿真软件进行工业机器人搬运仿真;掌握工业机器人的搬运操作、编程与调试;掌握工业机器人安全操作的职业素养。

1.3 学情分析及教学重难点

学生基本掌握了电工电子的知识和 PLC 的编程技巧,对工业机器人的硬件结构有初步的了解。但同时存在理论基础薄弱、独立编程能力不高、创新能力不足等问题。教学重点为利用示教的方法操作机器

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三维软件在机械专业课程教学中的应用

□余凤燕

【内容摘要】机械类专业很多课程都涉及三维空间,在机械课程教学过程中,很多学校还主要以课本教学、黑板讲解为主,并以各种教学挂图和教学模型为辅助工具,导致教学过程中实例不足、课程枯燥,教学效果不好。在机械类课程中运用三维软件进行教学,增强了教学的直观性、趣味性,有效地提高了教学效果,提高学生掌握专业知识的能力。

【关键词】机械专业课程;三维空间领域;三维软件

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机械类专业很多课程都涉及到三维空间领域,很多学生都是刚接触这方面的知识,想象能力比较差,无法很好地解决学习中遇到的复杂多变的问题,给教学带来了很大困难。在机械课程教学过程中,很多学校还在采用以课本教学、黑板讲解为主,并以各种教学挂图和教学模型为辅助工具,导致教学过程中实例不足、课程枯燥,教学效果不好。随着计算机的广泛普及,三维造型软件的出现,机械专业不论是教学内容还是教学方法都有了深刻的变化。在机械类课程中运用三维软件进行教学,增强了教学的直观性、趣味性,有效地提高了教学效果,提高学生掌握专业知识的能力。

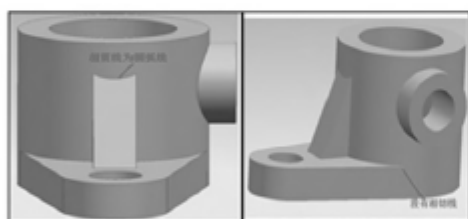


图1 三维实体中的相贯线 图2 三维实体中两实体相切

一、三维软件在《机械制图》教学的应用

《机械制图》是机械类专业的重要技术基础课程,是技术人员的启蒙课,被誉为“工程上的语言学”。熟练掌握机械图样的绘制、识读技能是对每个机械技术人员的基本要求。而如何提高课堂的授课质量,快速提高学生的三维空间想象能力,这一直是教师不断探索的问题。现阶段,许多学校的《机械制图》课程教学仍然是以挂图和模型为辅助工具,只能在平面内讲解,模型比较单一。采用三维软件进行教学,则可以利用软件的造型功能创建任意需要的实体形状,很好地解决了这些问题,更能纠正学生在制图中一些细节的错误画法,例如相贯线、实体相切等。画相贯线是机械制图中的难点,容易出错。两曲面立体相交,在其表面产生的交线叫相贯线。除了相贯线以外,实体相切也是机械制图中极易出错的内容。两实体相切,相切之处是没有相切交线,制图时,学生往往会想当然地加以相切交线。所以,用三维软件把实体画出来,让学生直接观看三维实体,学生会很快地认识到制图中的错误,很快地纠正相贯线和实体相切的画法。例如图

1中的相贯线和图2中的实体相切,学生很容易会画成如图3所示的视图。如果用三维软件把实体画出来,制图中错误的地方就一目了然,学生很快纠正不正确的画法,掌握正确的画法(如图4所示),而且印象深刻,教学效果很好。



图3 错误的画法 图4 正确的画法

二、三维软件在课程《夹具设计》教学的应用

《夹具设计》课程是机械类专业一门重要的专业课,主要内容是夹具中零件的定位和零件的夹紧机构的工作原理,通过学习本课程,学生获得工件的装夹基本理论知识和专用夹具设计方法,为学习后续专业课程奠定基础。本课程的理论性强,特别是工件定位、基准、定位误差等概念抽象,涉及到三维空间领域。很多知识点学生都无法通过推导计算,需要学生有很好的三维空间想象力才能理解和掌握。这样导致教师讲授起来困难,而学生学习起来感到难以理解,从而感觉枯燥、乏味,失去学习的兴趣。如果利用三维软件并充分发挥软件的三维特点,对那些学生难以理解、教师难以讲解的比较抽象的内容,制作三维分析环境,或制作一些简单的动画,生动形象地来演示复杂的变化过程,让学生通过肉眼直接观察和亲身体会,则教学效果会大大提高。例如图5所示,长方形以底平面定位,分析其定位情况:当实体沿 x 轴移动时(如图6所示),正视图下看,实体底面与定位平面重合(如图7所示),说明定位平面没有限制 x 轴的自由度。同理,当实体绕着 x 轴旋转时,正视图下看,实体底面与定位平面不重合(如图8所示),说明定位平面限制了 x 轴的旋转自由度。这样,学生通过肉眼直接观察和亲身体会,不仅加深了学生对相关知识的理解掌握,同时还活跃了课程气氛,激发学生的学习兴趣,充分调动学生学习的积极性和主动性。

基于教师工作室“学赛研三维交互式” 高职创新人才培养的实践探索

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[摘要]在创新驱动发展战略背景下,针对实训项目与生产实际脱节,难以调动学生学习积极性,创新意识不浓;不善于将所学的知识运用于实践中去解决实际问题,创新能力不高这一现状,依托教师工作室,采用“学赛研三维交互式”的人才培养改革,通过以师带徒,老生带新生,以点带面,师生合力,激发师生的科技创新热情和培养学生创新能力。

[关键词]创新驱动;教师工作室;学赛研三维交互式;创新人才

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一、引言

创新驱动发展战略是我国近年来提出的一大重要的战略部署,这就需要创新型人才,因此加强对大学生的创新意识、创新能力以及实践能力的培养,是现阶段中国高等教育应该承担的最为重要的职责。文章以茂名职业技术学院电气自动化技术专业为例,通过分析现状,进行创新人才培养的探索与实践,取得了较好的成效,为粤东西北地方高职学生的培养提供了新路径。

二、现状分析

我校地处粤西欠发达山区,基础弱、底子薄,针对学生的生源地、生源质量、生活环境、生活见识等实际情况,存在两方面的问題。

(一)创新意识不够、创新热情不大

我们的学生大约有三分之二来自于粤东西北的乡镇,见识较少,眼界不够开阔,对新事物、新技术、新工艺接触有限,缺乏创新的思维。加之受“死记硬背、题海战术”的中学应试教育影响较深,“两耳不闻窗外事,一心只愿死读书”,对认识、探究新鲜事物失去年轻人应有的敏感和激情,难以同频共振。同时,教学实训项目与生产实际脱节,难以调动学生学习积极性,创新意识不浓。

(二)创新经验不多、创新能力不高

由于欠发达地区学校条件所限,我们不少学生中小学期间还没真正参加过一次科普活动,对今日飞速发展中国科技创新信息、创新成果知之甚少。加上老师教学的重心都放在考、考、考上,参与创新对大多数学生来说只能是一种奢望,稍有不慎,还可能被扣上“无心向学”的帽子,仅余的一点奢望也会荡然无存。同时,00后的孩子生活条件相对较好,没过过什么苦日子,抗挫能力一般,又没啥大目标,激励不够,很难从“失败是成功之母”的创新实践中获取摔倒又爬起的内在动力,难以形成将所学的知识运用于实践中去解决实际问題能力。

三、创新人才培养的探索与实践

(一)职能引领,构建“以师带徒、以老带新,以点带面”的工作室人才培养模式

为把生产实践、人才培养、科学研究及社会服务有机结合,实现培养电气自动化技术专业高技能工匠型人才的目

标,集中人力、物力等优势资源创建了教师工作室。通过打造开放式的工作室,师生“双主体”共同运作管理,构建了“以师带徒、以老带新,以点带面”的工作室人才培养模式。在工作室人才培养模式中,高年级主要强化学生的综合专业技能,依托技能大赛和科研项目,采用老师指导学生培养方式,即“以师带徒”;低年级主要强化学生的专业基本技术技能,主要以高年级学生指导低年级学生,即“以老带新”;通过工作室培养的学生参加技能比赛、校企合作项目开发等活动,带动其他学生的学习积极性,实现了“以点带面”的效果。

(二)问题导向,构建了“学赛研三维交互式”创新人才培养模式

随着工业4.0与智能制造的发展,当今社会需要培养具备综合实践能力的电气自动化人才,通过学习、竞赛、科研相结合,构建了“学赛研三维交互式”创新人才培养模式,提供了新工科人才培养的新途径。

“学”指与实训、实习、理论教学融为一体的职业基本技能训练,使学生建立工程意识,掌握专业技能,激发学习兴趣。“学”主要采用“项目主导,行动实践”的方式来进行,利用微课、仿真软件、网络平台APP等多种教学手段,构建信息化课堂,实现师生线上线下互动。使用工作室教师与企业师傅共同开发的教材,以工作室与企业合作开发的项目为教学案例,为企业、行业量身定做所需人才,实现“教、学、做”一体化。

“赛”是指组织学生参加各种各样的技能竞赛,通过技能竞赛将基础知识与专业知识相结合,让学生了解相互之间的关系和各自的重要性,以竞赛项目为驱动,激发学生求知的欲望和学习热情。为此,学校设立职业技能竞赛组委会,负责学生技能竞赛、科技创新活动的组织、协调和规划。通过教师工作室每年组织校级职业技能竞赛,选拔学生参加各类国家级和省市级的专业比赛,实现“以赛促教、以赛促学、赛训结合”的目标,强化专业技能。构建常规竞赛平台,使常规教学活动融入竞赛内容、方式方法,突出学生主体地位,有力促进理论学习与实践应用能力培养的进一步融合。

“研”是指引导学生参与到科研实践活动中来,通过发挥工作室的作用,吸收优秀学生进入教师工作室的科研团队

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一体化教学在数控加工编程课程中的应用研究

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摘要: 本文根据传统数控加工编程课程教学以理论学习为主, 实践环节结合不足, 学生感性认识不强的弊端, 提出“教学做”有机结合的一体化教学方法, 并探讨了实施一体化教学的保证措施。

关键词: 数控加工编程; 实践; 感性认识; 一体化教学

数控加工编程是高职院校机械专业的一门必修课程, 实践性非常强。但传统的教学基本上都是以课堂教学为主, 理论性太强, 同步实践环节结合不足, 造成学生理解困难, 感性认识不足, 导致学习效率低下。因此, 研究以教学作为一体的教学方法, 探讨一种强化学生实践知识与能力为目标的过程和措施具有十分现实的意义。

1 一体化教学内涵

一体化教学是以融合“教学做”为一体, 把培养学生职业能力的理论与实践相结合的教学作为一个整体考虑, 旨在使学生将所学的理论知识和及时消化吸收以强化学生实践能力的一种教学模式。它打破了传统教学的束缚, 充分体现了以学生为主体, 工学结合的教学过程。它是把实践应用放在教学的第一位, 使学生可以边做边学, 学做一体, 反映了教学服务于实践的最终目的, 提高学生实践能力和解决实际问题的能力。

2 一体化教学过程

作者根据多年数控加工编程课程的教学经验, 总结如下的教学过程, 见下图。



数控加工课程一体化教学过程图

在课堂上老师根据数控加工编程的规律, 讲解编程指令的用法、格式和注意要点等, 由于学生缺乏运动的概念, 掌握欠透彻, 这时需要运用辅助教学软件如斯沃、宇龙等仿真加工系统进行模拟加工, 验证指令及程序的正确性, 提高学生的感性认识和学习兴趣, 加深对程序的理解。但这些还是停留在书本或虚拟层面, 要让学生真正明白和提高学习积极性的话, 还要将课堂进行延伸, 把车间的数控机床当作是课堂的一部分进行讲解, 这就是课内实践。这种在现场得来的知识比在课堂上被动去听要深刻得多。当课程讲完某个模块如常用的车削指令, 这时就需要安排适当的实训作为实践环节。实训跟课堂应该结合起来, 让学生及时运用刚学完的指令进行编程, 上机床操作, 完成零件的加工, 也便于老师在现场发现问题和解决问题。

3 一体化教学的保证措施

3.1 打造一支“双师型”的教师队伍

要保证一体化教学顺利进行, 教师的实践能力必不可少。数控加工把传统的手工操作变成了自动加工, 对人的依赖少了, 并不意味着要求降低了, 如果不懂材料、刀具和工艺, 就算理论再扎实也很难编出合理的科学的和有效率的程序。比如说, 粗加工与精加工的各种切削参数: 转速、进给率、背吃刀量、加工路线等有什么区别? 该如何选择? 配合件加工又该注意什么, 刀尖补偿用在什么场合, 等等, 这些都会影响到加工的质量和刀具的寿命。所以专任教师一定要具备加工的工作经验, 并考取相关的数控加工职业资格证, 成为一名既有扎实理论基础又有较强实践能力的“双师型”教师, 才能为保证一体化教学顺利进行打下基础。

3.2 编写一本适合一体化教学的校本教材

现行的数控加工编程方面的教材普遍都是以理论学习为

主, 系统性太强, 实战性案例缺乏, 学生学完了一大堆指令, 面对具体的零件仍然不会完整地编程, 不会把学过的各种代码指令有机地结合起来, 不能学以致用。要推行理实结合的“教学做”一体化模式, 一定要结合高职实际情况编写一本合适的校本教材, 以实际零件加工为导向, 从数控加工概念出发, 结合数控加工机床的工作原理, 由浅入深, 从简单加工指令到固定循环指令, 再到复杂的复合循环指令; 从 G 代码到 M 代码; 从动作编程到完整加工编程。每个知识点都结合具体的零件案例, 穿插讲解实际工艺, 以解决实际问题为主, 侧重学做结合。让理实结合的校本教材成为一体化教学最实际的指导书。

3.3 必要的数控仿真加工机房

对于实践性极强的数控加工编程教学, 如果没有“做”来支撑的话, 那么“学”的效果会削弱很多。但高职院校机械类专业普遍存在数控实训设备相对不足的状况, 实训时间也较少。为保证学生在实训之前对相关操作有一个比较清晰的概念, 减少真正实训时出现的各种差错, 引入数控加工仿真系统显得非常必要。现行的数控加工仿真系统可以提供互动操作的仿真资源, 可以给予学生自由探索学习的空间, 可以进行程序的输入、校验、对刀、仿真加工等多种功能。同时系统具有较好的容错机制, 错误操作会相应报警, 在保证安全的前提下, 还能演示错误的操作, 给予学生更丰富的情境体验。实践证明, 经过在机房进行仿真加工操作的学生, 相比其他学生学习兴趣更高, 更能适应真正的实操环境, 出错率大大减少。

3.4 及时开展以加工任务为导向的实训

作为数控加工编程的教学, 在完成一个项目任务后, 如车床编程或铣床编程, 就应该及时安排相应的实训, 制定实训指导书和任务书, 严格布置相应的接近工厂实际的典型工件加工任务, 保证学生在通过分析每一张零件图后, 能独立完成工艺规划、编程、加工仿真及实操加工等过程, 并通过实训及时回顾和重温课堂教学的编程理论, 变成真正属于自己的专业实践技能。授课教师根据学生的实训情况适当调整和完善数控加工课程标准及授课计划内容, 实现真正的一体化教学。

4 结语

中国智能制造 2025 已把发展高端数控机床作为重点产业来扶持, 数控加工已成为制造企业主要的加工方式, 未来受加工企业欢迎的一定是既有扎实数控编程理论, 又有过硬实操技能的复合型人才。对于实践性极强的数控加工编程课程, 只有把教学融入学生的实践中来, 学做一体, 才能把知识转化成为学生的一种实实在在的技能, 培养出符合企业要求的技能型人才。

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以职业技能竞赛为抓手促进专业建设发展

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【摘要】全国职业院校技能大赛是社会影响力最大的国家级职业院校技能赛事, 已经成为促进我国职业教育改革发展的重要抓手。文章以茂名职业技术学院电气自动化技术专业为例, 介绍了学院电气自动化技术专业和技能大赛的情况, 探讨了技能大赛在专业建设方面的影响与作用。

【关键词】技能大赛; 专业建设; 影响与作用

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Promoting Development of Professional Construction with the Grasping Hand of Vocational Skills Competition

Abstract: The national vocational college skills contest is the most influential national vocational college skills competition, which has become an important points to promote the development of vocational education reform in China. Taking Maoming Vocational and Technical College's electrical automation technology major as an example, this article introduces the situation of the college's electrical automation technology specialty and skills competition, and discusses the impact and role of the skills competition in professional construction.

Key words: skills competition; professional construction; influence and effect

《全国职业院校技能大赛章程》(教职成函〔2018〕4号)指出, 技能大赛是职业院校教育教学活动的一种重要形式和有效延伸, 是提升技术技能人才培养质量的重要抓手, 是对接产业需求、反映国家职业教育教学水平的学生技能赛事^[1]。近年来的参赛实践证明, 组织学生参加各级各类技能比赛是高职院校培养技能型人才的有效途径之一, 是深化职业教育改革, 推动产教融合、校企合作的重要手段, 对凸显专业特色、促进专业健康发展具有重要意义。本文以茂名职业技术学院电气自动化技术专业为例, 介绍了学院电气自动化技术专业和技能大赛的情况, 探讨了技能大赛在专业建设方面的影响与作用。

1 学院电气自动化技术专业和参加技能大赛的情况

一直以来, 机电系电气自动化技术专业坚持以赛促教、以赛促学、以赛促改, 促进了专业建设发展, 电气自动化技术于2007年开始招生, 2013年被确定为学院重点建设专业, 2015年通过重点建设验收, 2016年被确定为学院首批品牌(二类)建设专业。从2007级到2016级, 电气自动化技术专业学生获得省级三等奖以上奖项共29项, 其中获得国赛三等奖1项, 省赛金牌1项、银牌3项、铜牌2项、一等奖1项、二等奖5项、三等奖16项, 参赛项目有全国职业院校技能大赛、

中国“互联网+”大学生创新创业大赛、“挑战杯”全国大学生课外学术科技作品竞赛、粤台高校创新电子大赛等, 涵盖了电气自动化技术专业培养目标及能力要求。

2 学院电气自动化技术专业技能竞赛实践探索

2.1 构建系内竞赛活动长效机制, 激发学生参与热情

健全系内PK竞赛组织运行机制, 强化学生的参与意识、竞争意识、协作意识和荣誉意识, 设立系职业技能竞赛组委会, 负责学生科技竞赛创新活动的组织、协调和规划。实施大学生竞赛创新训练计划, 每年组织一次全系的职业技能竞赛, 要求学生人人参与, 全员覆盖。同时, 推进学科竞赛与学分认定互换计划, 实现第二课堂与第一课堂的有机结合。

2.2 构建以赛促学日常教学改革, 增强学生的主动性

以培养学生创新能力为抓手, 建立以技能竞赛典型案例为主要内容的课程体系, 在课程体系中落实赛教结合, 通过案例教学扩大创新教育普及范围, 激发兴趣、筑牢基础。把竞赛内容、方式方法巧妙融入常规教学活动中去, 把技能竞赛活动变成学生日常学习生活的有机组成部分, 突出学生主体地位, 培养他们主动参与、主动探索的自觉意识, 有力促进理论学习与实践应用、创新能力培养的进一步融合。

【收稿日期】2019-11-07

【作者简介】王开(1967—), 男, 广东电白人, 茂名职业技术学院副教授, 从事电气自动化技术专业教学与研究工作。

教育部武汉理工大学科技查新工作站
检索证明

委托单位	茂名职业技术学院		
委托人	陆叶		
检索要求	指定检索陆叶 2020 年发表 1 篇论文被 EI 数据库收录信息 论文题目为: Multi-robot Automatic Production Line		
检索结果			
数据库	论文收录		
SCIE			
EI	1 篇		
CPCI-S (原 ISTP)			
检索人		审核人	
 教育部科技查新工作站 (G09) 2021 年 3 月 4 日			

附件: SCIE、EI、CSCD、CPCI-S、其他数据库收录

1. Multi-robot automatic production line

Accession number: 20210809938260

Authors: Lu, Ye (1); Wang, Kai (1)

Author affiliation: (1) Department of Mechanical and Electrical Information, Maoming Polytechnic College, Maoming, China

Corresponding author: Lu, Ye(luye786@mmpt.edu.cn)

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Conference name: 2020 Asia Conference on Geological Research and Environmental Technology, GRET 2020

Conference date: October 10, 2020 - October 11, 2020

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Abstract: In order to make better research on the intelligent manufacturing process, the automatic production line based on multiple industrial robots is introduced. Firstly, the production line is constructed, and then the composition of each module in the line is described. Secondly, taking one of the six-axis robot as an example, the kinematics is analyzed with D-H method. The trajectory of the robot is planned and stimulated with the hybrid curve method as well as Matlab Robotics Toolbox. Finally, the communication and control process of the system is addressed. © 2021 IOP Conference Series: Earth and Environmental Science.

Number of references: 6

Main heading: Industrial robots

Controlled terms: End effectors - Environmental technology - Geology - Industrial research - Manufacture

Uncontrolled terms: Automatic production line - Communication and control - Curve method - D-H method - Intelligent Manufacturing - Multirobots - Production line - Six-axis robots

Classification code: 454 Environmental Engineering - 481.1 Geology - 537.1 Heat Treatment Processes - 731.5

Robotics - 731.6 Robot Applications - 901.3 Engineering Research

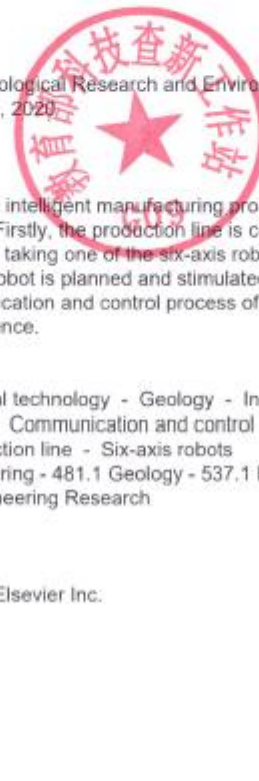
DOI: 10.1088/1755-1315/632/4/042063

Compendex references: YES

Database: Compendex

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Data Provider: Engineering Village



Multi-robot Automatic Production Line

Ye Lu*, Kai Wang

Department of Mechanical and Electrical Information, Maoming Polytechnic College,
Maoming, China

*Corresponding author: luye786@mmpt.edu.cn

Abstract. In order to make better research on the intelligent manufacturing process, the automatic production line based on multiple industrial robots is introduced. Firstly, the production line is constructed, and then the composition of each module in the line is described. Secondly, taking one of the six-axis robot as an example, the kinematics is analyzed with D-H method. The trajectory of the robot is planned and stimulated with the hybrid curve method as well as Matlab Robotics Toolbox. Finally, the communication and control process of the system is addressed.

1. Introduction

In manufacturing line, the processing and assembly of the products play an important role. However there are still some products processed manually, which bring the problems such as low efficiency, low qualification rate, and poor environment [1]. With the development of more new technology, industrial robots are widely applied in automatic production line which can solve those problems while meeting the requirements of production tasks. The application of industrial robot in the production line of motor shell is introduced [2]. Industrial robot applications based on intelligent manufacturing production line is proposed [3]. Automatic production line training system is controlled by PLC [4]. In this paper, the automatic production line based on multiple industrial robots is designed. The workpieces are transported, detected, polished and assembled by the industrial robots. The production line is controlled by PLC (Programmable Logic Controller) and HMI (Human Machine Interface). Through networked communication of PLC, touch screen, robot and the others, the human-machine interaction and real-time monitoring of the equipment can be carried out to realize the intelligent processing of the products.

2. Composition of multi-robot automatic production line

According to the processing, the automatic production line is composed of six modules and four industrial robots. PLC is taken as the control core by the control system of the line, and the network control is realized between the modules. The pneumatic control is adopted for the actuators of each module.

2.1. Feeding module & discharging module

The first module of the automatic production line is the feeding module. The workpieces are supplied by the feeding module, which comprises a frame, a sliding platform, the pallet support mechanism, a three-color alarm lamp, etc. The pallet support mechanism has two layers, and twelve workpieces per layer. When the workpieces on the upper pallet are emptied by the robot, the upper pallet is moved out as well as the lower pallet is moved in until all workpieces are transported. Three-color alarm light indicates



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**教育部武汉理工大学科技查新工作站
检索证明**

委托单位	茂名职业技术学院		
委托人	陆叶		
检索要求	指定检索陆叶 2021 年发表 1 篇论文被 EI 数据库收录信息		
检索结果			
数据库	论文收录		
SCIE			
EI Compendex	1 篇（第一著者）		
CPCI-S（原 ISTP）			
检索人		审核人	
<div style="text-align: right; margin-right: 50px;">  </div> <p style="text-align: center;">教育部科技查新工作站（G09） 2021 年 3 月 4 日</p>			



附件：SCIE、EI、CSCD、CPCI-S、其他数据库收录



1.

Accession number: 20210809946800

Title: Kinematics analysis and trajectory planning of polishing six-axis robot

Authors: Lu, Ye¹ ; Wang, Kai¹ 

Author affiliation: 1 Department of Mechanical and Electrical Information, Maoming Polytechnic College, Maoming; 525000, China

Corresponding author: Lu, Ye (luye786@mmzyb.com.cn)

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Conference name: 2020 Asia Conference on Geological Research and Environmental Technology, GRET 2020

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Publisher: IOP Publishing Ltd

Abstract: With the development of intelligent manufacturing, due to the low production efficiency and poor production environment of manual polishing, which is gradually replaced by the polishing robot. Take the polishing robot as the research object in this paper, a three-

dimensional model of the robot with the end effector is established. The kinematics is modeled, solved and simulated with the D-H method and MATLAB Robotics Toolbox. The trajectory planning of the robot in joint space and cartesian space is analyzed and simulated.

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Number of references: 7

Main heading: End effectors

Controlled terms: Environmental technology - Geology - Industrial robots - Kinematics - Polishing - Robot programming

Uncontrolled terms: Cartesian Space - Intelligent Manufacturing - Kinematics analysis - Polishing robots - Production efficiency - Production environments - Three-dimensional model - Trajectory Planning

Classification code: 454 Environmental Engineering - 481.1 Geology - 604.2 Machining Operations - 731.5 Robotics - 731.6 Robot Applications - 931.1 Mechanics

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Kinematics Analysis and Trajectory Planning of Polishing Six-axis Robot

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Department of Mechanical and Electrical Information, Maoming Polytechnic College, Maoming 525000, China.

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Abstract. With the development of intelligent manufacturing, due to the low production efficiency and poor production environment of manual polishing, which is gradually replaced by the polishing robot. Take the polishing robot as the research object in this paper, a three-dimensional model of the robot with the end effector is established. The kinematics is modeled, solved and simulated with the D-H method and MATLAB Robotics Toolbox. The trajectory planning of the robot in joint space and cartesian space is analyzed and simulated.

Key words: Polishing robot; kinematics; D-H model; trajectory planning.

1. Introduction

Polishing is often regarded as an important process of final surface treatment of the products, which is related to the final appearance, quality and cost of the products. With the development of the robot technology, the application of the polishing robots is widely used. The workpieces are polished by the articulated robot along the planned trajectory, and the workpieces are shaped under the polishing of the high-speed moving abrasive tool. The polishing robots have been reported in literature. An end effector of a polishing robot is designed [1]. The application of coordinate system in robotic automatic polishing equipment is studied [2]. The algorithm of on-line trajectory planning is proposed [3]. In this paper, the structure design of the end effector of the polishing robot is studied. The kinematics of the robot is modeled, simulated and verified. The trajectory of the robot is planned and simulated which can better meet the requirement of motion control.

2. Design and Analysis of Polishing Robot with End Effector


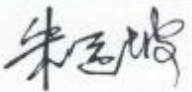

The body of the articulated robot is small, and the action space is large, which meets the requirements of the polishing operation. All the joints of the polishing robot are rotating joints, and the joint axes are perpendicular or parallel. The main motion of the polishing robot is realized by the motion of the arm and the wrist. The position is determined by the motion of the arm, and the spatial attitude is adjusted by the motion of the wrist. The arm and the wrist are composed of three joints respectively.

The end effector is connected to the end of the wrist, and adopts pneumatic transmission, including cylinder, solenoid valve, sensor and mechanical parts. There are two ends of the end effector. One is the polishing head, and the other is the two-finger claw to ensure that the robot completes the operation of



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**教育部武汉理工大学科技查新工作站
检索证明**

委托单位	茂名职业技术学院		
委托人	陆叶		
检索要求	指定检索陆叶 2021 年发表 1 篇论文被 EI 数据库收录信息		
检索结果			
数据库	论文收录		
SCIE			
EI Inspec	1 篇（第 1 著者）		
CPCI-S（原 ISTP）			
检索人		审核人	
 教育部科技查新工作站（G09） 2021 年 09 月 9 日			

附件：SCIE、EI、CSCD、CPCI-S、其他数据库收录

1. Kinematics Analysis and Trajectory Planning of Dual-arm Pruning Robot

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Authors: Ye Lu (1)

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Abstract: In order to overcome the disadvantages of manual pruning of tree branches, the dual-arm pruning robot is proposed in this paper. The structure of the dual-arm pruning robot is designed, and the three-dimensional model is established. Taking the dual-arm of the pruning robot as the study object, the D-H method is used to build the kinematics model so as to better research the process of the two arms cooperative pruning. The kinematics simulation is done by Matlab to verify the rationality of the D-H parameters. The workspace of the dual-arm is analyzed, as well as the trajectory planning in joint space. The torques of each joint are solved to determine the power of the driving motor. The research results provide the theoretical basis for the final prototype manufacturing.

Number of references: 0

Inspec controlled terms: manipulator kinematics - Matlab - mobile robots - motion control - trajectory control

Uncontrolled terms: trajectory planning - dual-arm pruning robot - manual pruning - kinematics analysis - three-dimensional model - two arms cooperative pruning - D-H parameters - driving motor - prototype manufacturing

Inspec classification codes: C3390M Manipulators - C3120C Spatial variables control - C3390C Mobile robots - E2230 Robot and manipulator mechanics

Treatment: Practical (PRA); Theoretical or Mathematical (THR)

Discipline: Computers/Control engineering (C); Manufacturing and production engineering (E)

DOI: 10.1088/1755-1315/769/4/042067

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Kinematics Analysis and Trajectory Planning of Dual-arm Pruning Robot

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Abstract. In order to overcome the disadvantages of manual pruning of tree branches, the dual-arm pruning robot is proposed in this paper. The structure of the dual-arm pruning robot is designed, and the three-dimensional model is established. Taking the dual-arm of the pruning robot as the study object, the D-H method is used to build the kinematics model so as to better research the process of the two arms cooperative pruning. The kinematics simulation is done by Matlab to verify the rationality of the D-H parameters. The workspace of the dual-arm is analyzed, as well as the trajectory planning in joint space. The torques of each joint are solved to determine the power of the driving motor. The research results provide the theoretical basis for the final prototype manufacturing.

Keywords: Dual-arm, pruning, robot.

1. Introduction

With the development of Informatization and intelligence in agricultural production, more and more new automation machinery has entered the field of agricultural production [1]. Pruning tool for the tree-branches close to electrical power lines is studied [2]. The urban landscape automatic pruning robot is designed and analyzed [3]. The key technology of the loquat pruning robot is addressed [4] and so on. By contrast, the automatic and intelligent operations of the pruning robot are more time-saving and convenient than the manual work of pruning tree branches. At present, comparing with the harvesting robots, the research and application of pruning robot are far from enough. Therefore, the development of pruning robots is necessary.

The human-like dual-arm pruning robot is addressed in this paper. The structure design of the robot is presented. The D-H mathematical model and simulation model of kinematics are studied to prove the accuracy of the structure. The workspace, the trajectory planning and the joint torque of the dual-arm are analyzed for solving the control problems.

2. Structure Design of Dual-arm Pruning Robot

Since the robot moves back and forth on the slope when pruning the branches of fruit trees, a chassis is needed for the robot that can support and drive the movement. Compared with the wheeled chassis, the turning radius of the crawler chassis is smaller. The ability to overcome obstacles is stronger, and the stability and reliability are higher. The body of the dual-arm pruning robot is installed on the crawler



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