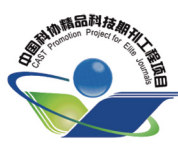


《中文核心期刊要目总览》收录  
Ei Compendex(核心版)收录  
百种中国杰出学术期刊  
RCCSE中国权威学术期刊



ISSN 1002-6819  
CN 11-2047/S  
CODEN NGOXEO  
www.tcsae.org

# 农业工程学报

NONGYE  
GONGCHENG  
XUEBAO

TRANSACTIONS OF THE CHINESE SOCIETY  
OF AGRICULTURAL ENGINEERING

2022年 04  
第38卷 VOL. 38

中国科学技术协会 主管

中国农业工程学会 主办

# 农业工程学报

2022 年 2 月 第 4 期 (总第 428 期) 第 38 卷

## 目次

### • 农业装备工程与机械化 •

- 液压机械无级变速装载机工况在线识别方法 ..... 杨树军, 褚捷豪, 彭增雄, 李学良, 史正旭, 张志林 (1)
- 玉米收获机断秸导流装置设计与试验 ..... 贾洪雷, 谭贺文, 马中洋, 周淑辉, 王 刚 (12)
- 勺链式大蒜播种机漏取种检测与补种装置设计及试验  
..... 李天华, 张海阔, 韩相龙, 李玉华, 侯加林, 施国英 (24)
- 基于机器学习的离心泵气液两相压升预测 ..... 贺登辉, 李芮林, 孙帅辉, 郭鹏程 (33)
- 带可调导叶的双向潜水贯流泵装置水力性能 ..... 孙壮壮, 于 杰, 葛恒君, 袁海霞, 汤方平 (42)
- 基于模糊 DEMATEL-ISM 的湖北省农业机械化可持续发展评价 ..... 李 治, 朱 明, 黄 凰 (51)

### • 农业水土工程 •

- 不同微纳米曝气滴灌入口压力下迷宫流道沿程微气泡行为特征 ..... 刘文倩, 王建军, 王国革, 刘燕芳, 司炳成 (59)
- 节水灌溉减施磷肥对黑土稻作产量及土壤磷利用与平衡的影响  
..... 张忠学, 孙 迪, 李铁成, 齐智娟, 杜思澄, 王 柏, 黄 彦 (67)
- 轻小型平移式喷灌机低压末端喷头改进设计与试验 ..... 张晓敏, 朱德兰, 葛茂生, 刘一川, 张 锐, 郑长娟 (75)
- 江苏沿海垦区暗管排水对冬小麦产量的影响模拟 ..... 罗 纨, 张 裕, 杨 星, 李印娟, 蔡思成 (83)
- 风力机运行对稀相颗粒输运特性的影响 ..... 李德顺, 林伟杰, 马高生, 刘念爽, 常吉祥, 霍春玉, 李仁年 (92)
- 太阳能光伏暗管排水系统能力提升 ..... 王少丽, 李益农, 陶 园, 李 军, 史灵利, 田军仓 (99)
- 基于高密度电阻率法的农田土壤表面干缩裂隙成像 ..... 李株丹, 孙伯颜, 农 睿, 朱 磊 (105)
- 高堆石坝砂砾石料的细观参数反演及三轴试验模拟 ..... 崔熙灿, 张凌凯, 王建祥 (113)
- 中国西北地区未来潜在蒸散发集合预估及不确定性归因 ..... 刘文斐, 栗晓玲, 张更喜, 孙爱立, 武连洲 (123)
- 新疆地区极端降水时空变化特征及对气温变化的响应  
..... 王卫平, 刘永强, 赵求东, 秦 艳, 孟湘尧, 张梦肖, 晋子振 (133)
- 基于多种算法的小安溪流域降雨侵蚀力时空演变特征 ..... 翁薛柔, 叶 琰, 叶 勇, 曾必顺, 龙训建 (143)
- 晋西黄土区蔡家川小流域切沟的空间分布及形态特征  
..... 赵宇辉, 张建军, 于 洋, 崔 燚, 孙若修, 李 阳, 胡亚伟 (151)

### • 农业信息与电气技术 •

- 基于物联网和 Deep-LSTM 的茶树净光合速率动态预测模型  
..... 高 鹏, 杨明欣, 周 平, 孙道宗, 谢家兴, 陆健强, 王卫星 (159)

基于多重特征增强与特征融合 SSD 的荔枝检测

.....彭红星, 李 荆, 徐慧明, 陈 虎, 邢 政, 何慧君, 熊俊涛 (169)

激光雷达实时提取甘蔗茎间导航线

.....杨 洋, 马强龙, 陈志桢, 温 兴, 张 刚, 张 铁, 董 祥, 陈黎卿 (178)

基于 SOLOv2 与点云空腔特征的奶牛瘤胃充盈度自动评分方法 .....姬江涛, 刘晓航, 赵凯旋 (186)

基于多尺度几何感知 Transformer 的植物点云补全网络

.....曾 安, 彭杰威, 刘 畅, 潘 丹, 蒋艳荣, 张小波 (198)

基于 GF-3 全极化 SAR 影像多特征优选的水产养殖塘提取 .....柳崇斌, 徐 佳, 王冬梅, 陈媛媛 (206)

时序滤波对农作物遥感识别的影响 .....张馨予, 蔡志文, 杨靖雅, 王 聪, 魏浩东, 胡 琼, 徐保东 (215)

基于无人机可见光影像与 OBIA-RF 算法的城市不透水面提取

.....叶章熙, 郭 倩, 张 健, 张厚喜, 邓 辉 (225)

#### • 农业生物环境与能源工程 •

CO<sub>2</sub> 气氛耦合粉煤灰催化生物质热解生油特性分析

.....洪文鹏, 张 钰, 姜海峰, 张敏策, 邓孙华, 陈 杰, 张 玲, 郭 帅 (235)

奶牛粪便与秸秆混合发酵过程通风工艺优化

.....沈玉君, 张卜元, 丁京涛, 孟海波, 周海宾, 程红胜, 张 曦, 王 健 (242)

基于 PIT 遥测技术的竖缝式鱼道过鱼效率及鱼类行为分析 .....金 瑶, 王 翔, 陶江平, 胡望斌 (251)

#### • 土地保障与生态安全 •

耕地多功能耦合协调发展时空格局与驱动力分析

.....卫新东, 林良国, 罗平平, 王筛妮, 杨 洁, 关嘉敏 (260)

论耕地利用可持续集约化与农户生计转型 .....彭文龙, 吕 晓, 牛善栋 (270)

目标差异化的双层级村庄分类与布局优化 .....耿艺伟, 陈伟强, 张金鑫, 杨一鸣, 马月红 (278)

#### • 农产品加工工程 •

包装机夹持卧带式拉伸膜供送成型装置设计与试验 .....郑兆启, 张 超, 侍炳鉴, 陈京辉, 杜志龙 (287)

仓储稻谷热湿耦合传递及黄变的数值模拟 .....王远成, 余 海, 杨开敏, 王 柯 (297)

缓沉性水产膨化饲料加工工艺参数优化

.....李军国, 刘子奇, 张嘉琦, 商 政, 李 俊, 董颖超, 商方方, 杨 洁 (308)

鸡蛋蛋壳膜超微结构与呼吸强度的相关关系 .....马逸霄, 田雅宁, 王巧华 (316)

纸盒无菌灌装包装材料灭菌工艺优化 .....董玉杰, 卢立新, 潘 嘹, 林自东, 厉夫满 (324)

致谢: 感谢福建农林大学张厚喜团队提供的封面图片“福州城市局部无人机‘鸟瞰视界’航拍图”。

**Transactions**  
**of the Chinese Society of Agricultural Engineering**  
**Vol.38 No.4 (Total No.428) Feb. 2022**  
**CONTENTS**

**• Agricultural Equipment Engineering and Mechanization •**

- Online identification method for wheel loader working conditions with hydro-mechanical continuously variable transmission  
..... *Yang Shujun, Chu Jiehao, Peng Zengxiong, Li Xueliang, Shi Zhengxu, Zhang Zhilin* (1)
- Design and experiment of the straw breaking and diversion device for maize harvesters  
..... *Jia Honglei, Tan Hewen, Ma Zhongyang, Zhou Shuhui, Wang Gang* (12)
- Design and experiment of missing seed detection and the reseeding device for spoon chain garlic seeders  
..... *Li Tianhua, Zhang Haikuo, Han Xianglong, Li Yuhua, Hou Jialin, Shi Guoying* (24)
- Prediction of gas-liquid two-phase pressure increment of a centrifugal pump based on machine learning  
..... *He Denghui, Li Ruilin, Sun Shuaihui, Guo Pengcheng* (33)
- Hydraulic performance of the bidirectional submersible tubular pump with adjustable guide vanes  
..... *Sun Zhuangzhuang, Yu Jie, Ge Hengjun, Yuan Haixia, Tang Fangping* (42)
- Evaluating the sustainable development of agricultural mechanization in Hubei Province based on fuzzy DEMATEL and ISM  
combined method ..... *Li Zhi, Zhu Ming, Huang Huang* (51)

**• Soil and Water Engineering •**

- Behavior characteristics of micro-bubbles along labyrinth channels under different inlet pressures of micro-nano aeration drip  
irrigation ..... *Liu Wenqian, Wang Jianjun, Wang Guocui, Liu Yanfang, Si Bingcheng* (59)
- Effects of water-saving irrigation and reducing phosphorus fertilizer on rice yield, phosphorus utilization and soil phosphorus  
balance in black soil ..... *Zhang Zhongxue, Sun Di, Li Tiecheng, Qi Zhijuan, Du Sicheng, Wang Bai, Huang Yan* (67)
- Improved design and testing of the low-pressure end sprinkler nozzles for light and small pan irrigation sprinklers  
..... *Zhang Xiaomin, Zhu Delan, Ge Maosheng, Liu Yichuan, Zhang Rui, Zheng Changjuan* (75)

Simulating the effects of subsurface drainage on winter wheat yield in coastal reclamation areas of Jiangsu, China	.....	<i>Luo Wan, Zhang Yu, Yang Xing, Li Yinjuan, Cai Sicheng</i> (83)
Influence of wind turbine operation on the transport characteristics of dilute phase particles	.....	<i>Li Deshun, Lin Weijie, Ma Gaosheng, Liu Nianshuang, Chang Jixiang, Huo Chunyu, Li Rennian</i> (92)
Capacity improvement of solar photovoltaic subsurface pipe drainage system	.....	<i>Wang Shaoli, Li Yinong, Tao Yuan, Li Jun, Shi Lingli, Tian Juncang</i> (99)
Imaging dry shrinkage cracks on farmland soil surface using electrical resistivity technology	.....	<i>Li Zhudan, Sun Boyan, Nong Rui, Zhu Lei</i> (105)
Inversion of meso parameters and triaxial test simulation of the gravel materials for high rockfill dam	.....	<i>Cui Xican, Zhang Lingkai, Wang Jianxiang</i> (113)
Ensemble projection and uncertainty attribution of potential evapotranspiration in northwest China in the future	.....	<i>Liu Wenfei, Su Xiaoling, Zhang Gengxi, Sun Aili, Wu Lianzhou</i> (123)
Spatiotemporal characteristics of extreme precipitation and its response to temperature change in Xinjiang, China	.....	<i>Wang Weiping, Liu Yongqiang, Zhao Qiudong, Qin Yan, Meng Xiangyao, Zhang Mengxiao, Jin Zizhen</i> (133)
Spatiotemporal characteristics of rainfall erosivity in Xiaonanxi Basin using multiple algorithms	.....	<i>Weng Xuerou, Ye Yan, Ye Yong, Zeng Bishun, Long Xunjian</i> (143)
Spatial distribution and characteristics of the gullies in Caijiachuan watershed in loess region of Western Shanxi Province, China	.....	<i>Zhao Yuhui, Zhang Jianjun, Yu Yang, Cui Yi, Sun Ruoxiu, Li Yang, Hu Yawei</i> (151)

## • Agricultural Information and Electrical Technologies •

Dynamic prediction model for the net photosynthetic rate of tea plants based on Internet of Things and Deep-LSTM	.....	<i>Gao Peng, Yang Mingxin, Zhou Ping, Sun Daozong, Xie Jiaying, Lu Jianqiang, Wang Weixing</i> (159)
Litchi detection based on multiple feature enhancement and feature fusion SSD	.....	<i>Peng Hongxing, Li Jing, Xu Huiming, Chen Hu, Xing Zheng, He Huijun, Xiong Juntao</i> (169)

Real-time extraction of the navigation lines between sugarcane ridges using LiDAR

..... *Yang Yang, Ma Qianglong, Chen Zhizhen, Wen Xing, Zhang Gang, Zhang Tie, Dong Xiang, Chen Liqing* (178)

Automatic rumen filling scoring method for dairy cows based on SOLOv2 and cavity feature of point cloud

..... *Ji Jiangtao, Liu Xiaohang, Zhao Kaixuan* (186)

Plant point cloud completion network based on multi-scale geometry-aware point Transformer

..... *Zeng An, Peng Jiwei, Liu Chang, Pan Dan, Jiang Yanrong, Zhang Xiaobo* (198)

Extracting aquaculture pond using multi-feature optimization of GF-3 PolSAR Imagery

..... *Liu Chongbin, Xu Jia, Wang Dongmei, Chen Yuanyuan* (206)

Impacts of temporal smoothing methods on crop type identification

..... *Zhang Xinyu, Cai Zhiwen, Yang Jingya, Wang Cong, Wei Haodong, Hu Qiong, Xu Baodong* (215)

Extraction of urban impervious surface based on the visible images of UAV and OBIA-RF algorithm

..... *Ye Zhangxi, Guo Qian, Zhang Jian, Zhang Houxi, Deng Hui* (225)

## • Agricultural Bioenvironmental and Energy Engineering •

Characteristics of bio-oil generated from biomass pyrolysis catalyzed by coal fly ash under CO<sub>2</sub> atmosphere

..... *Hong Wenpeng, Zhang Yu, Jiang Haifeng, Zhang Mince, Deng Sunhua, Chen Jie, Zhang Ling, Guo Shuai* (235)

Optimization of the ventilation technology for the mixed fermentation of cow manure and crop straw

..... *Shen Yujun, Zhang Buyuan, Ding Jingtao, Meng Haibo, Zhou Haibin, Cheng Hongsheng, Zhang Xi, Wang Jian* (242)

Fish passage efficiency and fish behavior analysis in the vertical slot fishway using the PIT telemetry technology

..... *Jin Yao, Wang Xiang, Tao Jiangping, Hu Wangbin* (251)

## • Land Security and Ecological Safety •

Spatiotemporal pattern and driving force analysis of multi-functional coupling coordinated development of cultivated land

..... *Wei Xindong, Lin Liangguo, Luo Pingping, Wang Shaini, Yang Jie, Guan Jiamin* (260)



Sustainable intensification of cultivated land use and farming households' livelihood transition

.....*Peng Wenlong, Lyu Xiao, Niu Shandong* (270)

Two-level village classification and layout optimization with differentiated objectives

.....*Geng Yiwei, Chen Weiqiang, Zhang Jinxin, Yang Yiming, Ma Yuehong* (278)

### • Agricultural Produce Processing Engineering •

Design and experiment of the clamping horizontal belt type stretch film feeding and forming device for packaging machines

.....*Zheng Zhaoqi, Zhang Chao, Shi Bingjian, Chen Jinghui, Du Zhilong* (287)

Numerical simulation of coupled heat and moisture transfer and yellowing of stored rice during storage in silo

.....*Wang Yuancheng, Yu Hai, Yang Kaimin, Wang Ke* (297)

Optimization of the process parameters for slow-sinking extruded aquatic feed

.....*Li Junguo, Liu Ziqi, Zhang Jiaqi, Shang Zheng, Li Jun, Dong Yingchao, Shang Fangfang, Yang Jie* (308)

Correlation between eggshell membrane ultrastructure and respiration intensity

.....*Ma Yixiao, Tian Yaning, Wang Qiaohua* (316)

Optimization of the packaging material sterilization process for roof-box aseptic filling machines

.....*Dong Yujie, Lu Lixin, Pan Liao, Lin Zidong, Li Fuman* (324)