集装箱码头全自动化带来的新挑战

New Challenges Posed by Full Automation Of Container Terminal

IAPH Guangzhou 2019 World Ports Conference

青島港
PORT OF QINGDAO

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青岛港全自动化集装箱码头简介
Brief Introduction of Qingdao Port Fully Automated Container Terminal

- 码头岸线总长2088米，水深-20米，规划建设6个泊位，设计年通过能力520万TEU，可靠泊24000TEU及以上船舶
- Quay length of 2088 meters, water depth of - 20 meters, planning to build six berths with the designed capacity of 5.2 million TEU, berthing 24,000 TEU ships

青岛港全自动化集装箱码头简介
Brief Introduction of Qingdao Port Fully Automated Container Terminal

- 码头分三期建设，一期2013年10底启动，2017年5月投入商业运营，配备7台自动化桥吊，38台自动导引车，38台自动化高速轨道吊
- The first phase was started at the end of October 2013 and put into commercial operation in May 2017. It is equipped with 7 automatic quay cranes, 38 automatic guided vehicles and 38 automatic high-speed stacking cranes.

青岛港全自动化集装箱码头
Qingdao Port Fully Automated Container Terminal

全自动化集装箱码头的主要优势
Main advantages of fully automated container terminal

- 全自动化集装箱码头的主要优势
- Main advantages of fully automated container terminal

-节省人工 Labor Saving

-降低运营成本 Reduce Operating costs

-提高效率 Improve productivity

-安全可靠 Safe and reliable

-节能环保 Energy saving and Environmental

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集装箱码头全自动化带来的新挑战
New Challenges Posed by Full Automation Of Container Terminal

- 平面布局规划 Layout Planning
  - -AGV运行区设计 AGV area design
  - -冷藏箱区设计 Reefer area design
  - -外集卡倒车区域设计 Landside external truck reverse area design
- 土建设计 Civil Construction Design
  - -地面承载力要求及施工工艺 Requirements of Ground bearing capacity(Standard) and Construction process
  - -码头平面度要求 Standard of terminal surface flatness
  - -码头不均匀沉降控制（标准、规范）How to control uneven sedimentation of terminal(Standard)
  - -轨道平面度及安装施工工艺 ASC track flatness and installation & construction technique

集装箱码头全自动化带来的新挑战
New Challenges Posed by Full Automation Of Container Terminal

- 设备设计与制造 Equipment design and manufacturing
  - -制造精度要求 Manufacturing accuracy requirements
  - -制造刚度要求 Manufacturing stiffness requirements
  - -可靠性原则及标准 Principles and standards of reliability
  - -可维护性及免维护 Maintainability and maintenance-free
- IT系统开发与测试 IT system development & testing
  - -智能算法多，开发难度大 Intelligent algorithms development
  - -系统接口多，测试周期长 Many interfaces and long testing cycle
  - -IT基础架构设计 IT infrastructure design
  - -工控网络安全 Industrial control network security

集装箱码头全自动化带来的新挑战
New Challenges Posed by Full Automation Of Container Terminal

- 自动化工艺流程设计 Automated Process Flow design
  - -自动化流程 Automation process
  - -堆场策略设计 Yard stacking strategy design
- 项目管理及人员配备 Project Management and staffing
  - -多家供应商协调管理 Coordination management of multiple suppliers
  - -人员技能水平 Skill Level of Personnel
- 安全管理 Safety Management
  - -设备无人化带来的新挑战 New Challenges Posed by Unmanned Equipment
    - 人体感知缺失 Absence of human perception
    - 漏摘集装箱扭锁 Missing of Container Twist Lock

集装箱码头全自动化带来的新挑战
New Challenges Posed by Full Automation Of Container Terminal

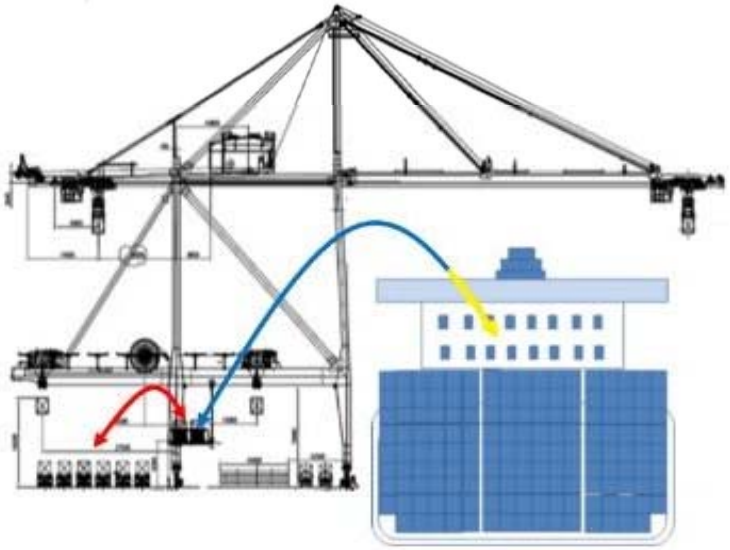
- 码头运营管理
  - -人员岗位设置及其职能描述（与自动化生产流程及管理方式相适应）
    Personnel post setting and function description (adapted to automated production process and management mode)
  - -人员配置及培训 Staffing and training
  - -薪酬体系建立 Establishment of Compensation System
  - -公司架构及部门设置 Corporate Structure and Departmental Settings
  - -如何在船舶大型化的背景下实现更高的码头效率?
  - -How to achieve higher terminal efficiency under the background of large-scale ships?

如何在船舶大型化的背景下实现更高的码头效率?
How to achieve higher efficiency under the background of Megaships?

- 船舶大型化趋势 Trend of Mega Ships
  - -超过2万标箱的大型集装箱船舶 Mega Ships with Over 20,000 TEU
  - -对港口的装卸效率要求越来越高 Higher and Higher Requirements for Port Handling Efficiency
  - -需开发高效自动化桥吊 Need to Develop High Efficiency Automatic Quay Crane

如何在船舶大型化的背景下实现更高的码头效率?
How to achieve higher efficiency under the background of Megaships?

- 青岛港自动化码头的桥吊结构及参数
- Quay Crane Structure and Parameters of Qingdao Port Automated Terminal



主小车承担船到平台的装卸作业

门架小车承担平台到AGV装卸作业

单起升双小车桥吊，起重量70吨，前伸距70米，起升高度50+22米，主起升速度90/180米/分钟，主小车速度240米/分钟。

高效自动化桥吊 High-efficiency automated STS

- 对吊具的有效控制是提升作业效率的最有效途径
  Effective control of spreader is the most effective way to improve operation efficiency

  -国外有轨道吊采用机械方式实现对吊具的刚性控制，但无法应用在桥吊上Overseas ASC users use mechanical methods to achieve rigid control of spreaders, but can not be applied to QC

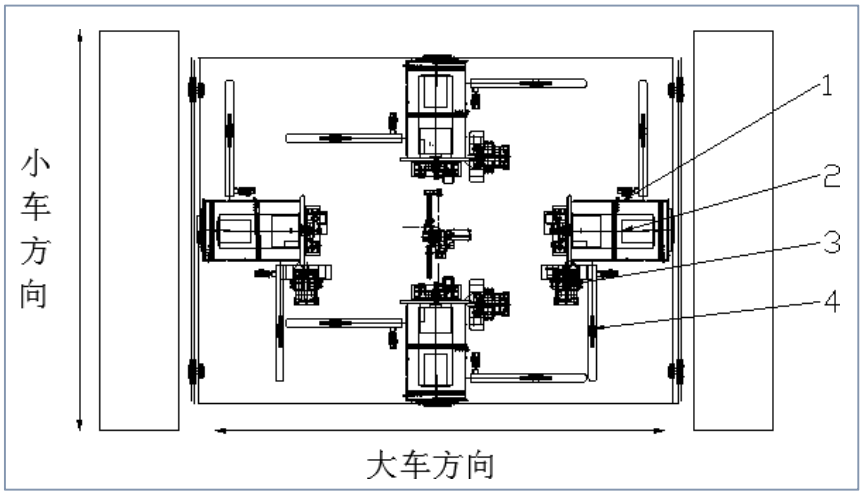
高效自动化桥吊 High-efficiency automated STS

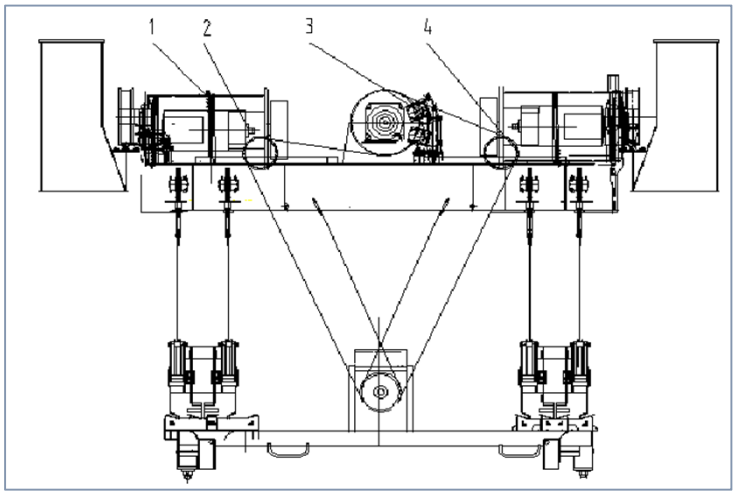
-拟采用大扭矩低速永磁电机替代现有的三相异步电机、减速箱和钢 丝绳卷筒 It is proposed to replace the existing three-phase asynchronous motor, reducer and wire rope drum with large torque and low speed permanent magnet motor

-将起升机构从机房移至主小车上，从而实现可分离八绳结构，最终实现对吊具的有效控制 The hoist mechanism is moved from the engine room to the main trolley, thus realizing the separable eight-rope structure, and ultimately realizing the effective control of the spreader.

高效自动化桥吊 High-efficiency automated STS

桥吊八绳吊具防摇系统
eight-rope anti-swing structure





实现对吊具的有效控制，防止摇动扭摆
Ultimately realizing the effective control of the spreader and anti-swing

自动化集装箱码头的优化方向
The Optimization Direction of Fully Automated Container Terminal

- 提升自动化码头生产管理系统的智能化水平 Promoting the Intelligent Level of Terminal Operating Management System of Automated Terminal
- 运用5G技术实现堆场轨道吊直流母线供电模式 Using 5G technology to realize DC bus power supply mode of track crane in yard
- 大型设备智能监测系统 Intelligent Monitoring System for Large Equipment
- 物联网可视化监控平台 Internet of Things Visual Monitoring Platform
- 冷藏箱插拔电自动化Automation of reefer plug-in and pull-out

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谢谢大家!

Thank You!

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