

基于 Solidworks 的芒果采摘机械手
机构设计与仿真

Design and Simulation of Mango
picking manipulator based on
Solidworks

摘要

我国仍然是目前世界上最大的果蔬种植生产和加工消费国,果蔬的年产量一直稳居世界第一。而果蔬的采摘和加工却是果蔬生产链中最为复杂耗时、费力的一个重要环节。实现果蔬的机械化采摘,对提高果蔬的市场竞争力等方面有重要的意义。本文以芒果为采摘对象,进行了芒果采摘机械手的结构设计,提出了一种四自由度连杆式机械臂的采摘机械手,并通过分析确定了结构方案。具体研究内容如下:

(1)对芒果种植地的生长特点进行了分析,了解芒果园果树种植间距、行距等数据和芒果在果树上的分布区域;确定了采摘对象的物理性能参数;为设计芒果采摘机械手总体方案提供基础数据。

(2)根据芒果放种植地的环境特点,结合机械手采摘芒果的实际要求,选定采摘机械手的驱动方式、采摘机械手的自由度、末端执行机构的形式和采摘机械臂的结构方式,完成了芒果采摘机械手的总体设计方案,为采摘机械手的结构设计打好基础。

(3)根据芒果采摘机械手的总体设计方案,结合芒果的物理特性和对采摘机械手末端执行机构进行了具体的结构设计;之后对采摘机械手机械臂进行了结构设计;最后,根据机械臂的结构,对机械臂动力部分进行了设计,最后设计出可以使机械手自由行进的轮式底部结构,最终完成了采摘机械手的全部结构设计。

(4)对芒果采摘机械手手指进行静应力分析并对采摘机械手进行仿真分析。

设计出来的机械手能有效地提高芒果采摘的质量和效率,降低芒果采摘的劳动强度和成本,同时增强了芒果的市场竞争力。

关键词: 农业机械 机械手 芒果 采摘作业

Abstract

China is still the world's largest consumer of fruit and vegetable planting and processing, and its annual output of fruit and vegetables has consistently ranked first in the world. The picking and processing of fruits and vegetables is an important and time-consuming and laborious link in the fruit and vegetable production chain. The realization of the mechanized picking of fruits and vegetables is of great significance for improving the market competitiveness of fruits and vegetables. This article takes mango as the object of picking, carries out the structure design of mango picking manipulator, proposes a four-degree-of-freedom picking manipulator with link type manipulator, and determines the structural scheme through analysis. The specific research contents are as follows:

- (1) Analyze the growth characteristics of mango planting sites, understand the data such as planting spacing and row spacing of mango orchards, and the distribution area of mangoes on fruit trees; determine the physical performance parameters of picking objects; provide the overall plan for designing mango picking manipulators Basic data.
- (2) According to the environmental characteristics of the place where the mango is planted, combined with the actual requirements of the mango picking mango, analyze the driving mode of the selected picking manipulator, the degree of freedom of the picking manipulator, the form of the end actuator and the structure of the picking manipulator Completed the overall design plan of the mango picking manipulator, which laid a solid foundation for the structural design of the picking manipulator.
- (3) According to the overall design scheme of the mango picking manipulator, combining the physical characteristics of mango and the specific structural design of the end effector of the picking manipulator; afterwards, the structural design of the picking manipulator manipulator is carried out; finally, according to the structure of the manipulator, the manipulator The power part was designed, and finally the wheeled bottom structure that allowed the manipulator to travel freely was designed, and finally the entire structural design of the picking manipulator was completed

(4) The static stress analysis of the fingers of the mango picking manipulator and the

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