工業用機械手臂設計與專利分析

Industrial Robot Design & Patent Analysis

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關鍵詞

- 垂直關節型機械手臂 Articulated robot
- 水平關節型機械手臂 SCARA
- 工業用機械手臂 Industrial robot
- 諧和式減速機 Harmonic drive reducer
- 載重 Payload

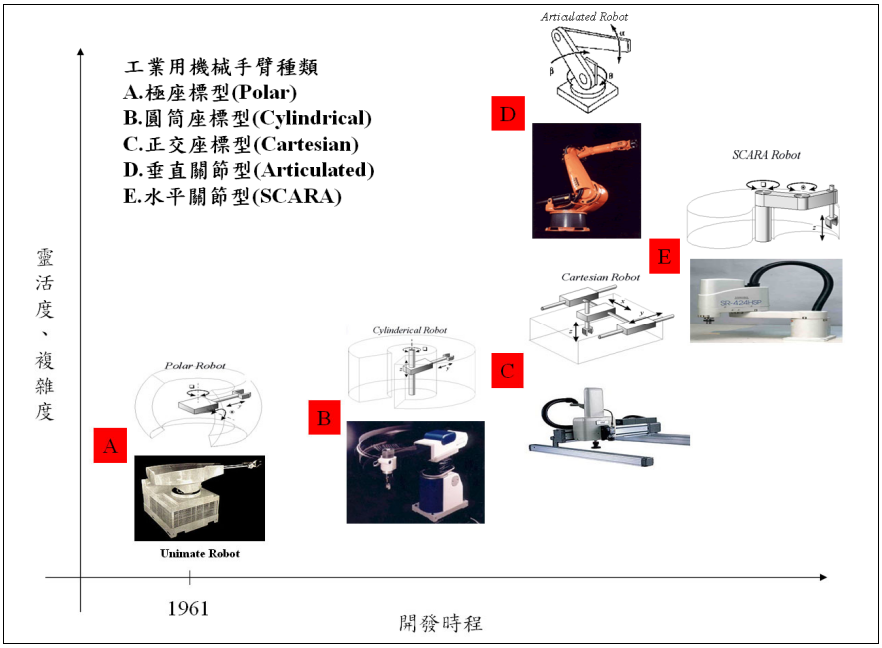
摘要

本文描述工業用機械手臂的種類與優缺點，藉由市面商品與專利資料分析，了解目前市場競爭大廠技術開發趨勢，並說明機械手臂設計考慮因素、各種減速機選用、結構設計、材料的選用與熱處理等，對機械手臂的影響。

This article studies the advantages and disadvantage of different industrial robots by analyzing the commercial products and patent data. In order to investigate the current market trends and development trends of competitive companies, it takes into considerations of robot design, reducer type selection, structural design, material selection and heat treatment for industrial robot.

前言

工業用機械手臂由 1961 年 Unimation 公司開發第一台 Unimate 機械手臂後[1]，演化至今機械手臂種類主要分爲極座標型(Polar)、圓筒座標型(Cylindrical)、正交座標型(Cartesian)、垂直關節型(Articulated)、水平關節型(SCARA)等五種類型[2]，如圖一工業用機械手臂種類，橫軸爲開發時程，縱軸爲靈活度與複雜度，垂直關節型是靈活度最高，也是控制最複雜的機械手臂。近年來隨著國際代工製造模式興起，製造工廠移向工資低廉地區的趨



圖一

工業用機械手臂種類[2]

表一　工業用機械手臂種類的優缺點[2]

ROBOTS	advantages	disadvantages	Commonly used for
Cylindrical	1.ability to do straight line insertions into furnaces 2.easy computation and programming 3.most rigid structure for given length	1.requires large operating volume 2.exposed guiding surfaces require covering in corrosive or dusty environments 3.can only reach front of itself axes hard to seal	1.pick and place work 2.assembly operations 3.handling machine tools 4.welding
Polar	1.ability to do straight line insertions into furnaces 2.easy computation and programming 3.most rigid structure for given length	1.requires large operating volume 2.exposed guiding surfaces require covering in corrosive or dusty environments 3.can only reach front of itselfaxes hard to seal	1.pick and place work 2.assembly operations 3.handling machine tools 4.welding
Cartesian	1.ability to do straight line insertions into furnaces 2.easy computation and programming 3.most rigid structure for given length	1.requires large operating volume 2.exposed guiding surfaces require covering in corrosive or dusty environments 3.can only reach front of itself 4.axes hard to seal	1.pick and place work 2.assembly operations 3.handling machine tools 4.welding
Articulated	1.all rotary joints allows for maximum flexibility 2.any point in total volume can be reached 3.all joints can be sealed from the environment	1.Extremely difficult to visualize, control, and program. 2.restricted volume coverage 3.low accuracy	1.pick and place work 2.assembly operations 3.Handling machine tools 4.welding 5.painting 6.handling at die casting
SCARA	1.high speed 2.height axis is rigid 3.large work area for floor space 4.moderately easy to program	1.limited applications 2.2 ways to reach point 3.difficult to program off-line 4.highly complex arm	1.pick and place work 2.assembly operations 3.Handing machine tools

勢，出現「生產線集中」以及「產業群聚」，繼而發生「當地勞動力」短缺現象，隨著勞動人力短缺與優惠政策改變，目前工業界在生產上逐漸利用工業用機械手臂來取代人力，降低人力成本、改善產品品質與工作安全等特性。

表一工業用機械手臂種類的優缺點，機械手臂的臂長限制運動的範圍，軸數則增加範圍內的靈活度，目前垂直關節型機械手臂以 6 軸型爲主，可應用搬運、組裝、去毛邊、焊接、噴塗等，爲所有工業用機械手臂種類內應用最廣。

更完整的內容
請參考紙本【機械工業雜誌】317 期・98 年 8 月號
每期 220 元・一年 12 期 2200 元
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