INTEGRATION OF THREE-AXIS ROBOT ARM AND THREE-AXIS FERROFLUID SEALS

黃子平、洪振義

E-mail: 9126575@mail.dyu.edu.tw

ABSTRACT

AUTOMATION BECOMES AN INEVITABLE TREND FOR INDUSTRIES TO ACHIEVE HIGH PRODUCTIVITY AND HIGH PRECISION IN THEIR PRODUCTION LINES CURRENTLY.THE USE OF ROBOT ARM IS ONE OF THE MOST EFFICIENT MEAN OF TRANSPORTATION OF MATERIALS AND PRODUCTS.THE OBJECTIVE OF THE RESEARCH IS TO DESIGN AND TO IMPLEMENT A ROBOT ARM WHICH CAN BE USED IN THE SEMI-CONDUCTOR PROCESS. GENERALLY, THE REQUIREMENTS OF THE WORKING ENVIROMENT OF THE SEMI-CONDUCTOR PROCESS ARE VERY STRICT, SUCH AS IN CLEAN ROOM OR IN A VOCUUM CHAMBER. THE ACTUATOR USED IN THE ROBOT ARM USUALLY CAUSE POLLUTION IN SEMI-CONDUCTOR MANUFACTURE. THEREFORE, IT IS NECESSARY USE FERROFLUID SEALS TO ISOLATE THE ACTUATORS FROM THE CLEAN ROOM OR THE VOCUUM CHAMBER. THEN, PULLEYS AND BELTS ARE USED TO DRIVE THE ROBOT ARM TO ACHIEVE THE DESIRED MOTION. IN A PREVIOUS RESEARCH, THE SOLIDWORKS2000 IS USED AS A TOOL TO DESIGN AND TO DRAW THE ROBOT ARM AND FERROFLUID SEALS. MOREOVER, THE DESIGNED ROBOT ARM AND FERROFLUID SEALS ARE MANUFACTURED AND SETUP IN OUR LABORATORY. IN THIS STUDY, THE SOLIDWORKS2001 IS USED AS A TOOL IN DESIGN MODIFICATION AND MANUFACTUREING OF THE ROBOT ARM AND FERROFLUID SEALS. THE TRANSMISSION OF POWER OF THE ROBOT ARM IS DONE BY USING BELTS AND PULLEYS. THE SERVO MOTOR -S ARE USED TO CONTROL THE MOTION OF THE ROBOT ARM THROUGHT THE BELTS AND PULLEYS. ALSO, A COMPUTER PROGRAM USING VISUAL BASIC, INCLUDING THE SERVO MOTOR CONTROL AND PATH PLANNING OF ROBOT ARM, IS DEVELOPED. THUS, THE ROBOT ARM CAN PERFORM ITS MOTION AS DESCRIBED. A COM -PUTER IS USED TO CONTROL THE SERVO MOTORS AS WELL AS THE ROBOT ARM THROUGHT A COMPUTER IN -TERFACE. MOREOVER, WITH THE CONTROLLED MOTION OF THE X-Y TABLE, THE MOUNTED CCD AND THE A -SSOCIATED IMAGE ACQUISITION SOFTWARE CAN HELP US TO MEASURE THE POSITIONING ERROR.FINALLY ,THE ROBOT ARM MOVES AS DESIRED AND THE OBJECTIVE AND ORIENTATION OF THIS WORK IS ACHIEVED. THE RESULTS OF THIS WORK LAY THE GROUND WORK FOR THE FUTURE RESEARCH, INCLUDING THE INTERG RATION OF THE ROBOT ARM AND TRI-AXIAL SHAFT SEAL USING MAGNETIC FLUID, THE OPTIMIMZATION O -F THE PATH CONTROL OF THE ROBOT ARM, THE FEEDBACK CONTROL OF THE ROBOT ARM, AND ETC. IN TWO SEPARATE SIDES (ONE IS VACUUM AND THE OTHER IS ATMOSPHERE),THE POWER TRANSMISSION USUALLY IS ACHIEVED THROUGH THE AID OF ROTATIONAL OR LINEAR FERROFLUID SEALS. THE PURPOSE OF THIS RESEARCH PROJECT IS FOCUSED ON THE INTEGRATION OF THE SYSTEM WHICH CONSISTS OF A ROBOT ARM DRIVEN BY SHAFTS WITH THE FERROFLUID SEALS, X-Y TABLE, CCD AND THE ASSOCIATED IMAGE DATA ACQUISITION SYSTEM.

Keywords : ROBOT ARM, FERROFLUID, MULTI-AXIS SEAL, VACUUM PROCESS,INTEGRATION

Table of Contents

REFERENCES

[1]JOHNJ. CRAIG, "INTRODUCTION TO ROBOTICS MECHANICS AND CONTROL", ADDISON-WESLEY PUBLISH -ING COMPANY, 1989, DENVER, USA。
[2]M. VUKOBRATOVIC.著, 趙平譯,"機械人的手-力學與運動", 臺隆書店, 1983。
[3]黃緒哲譯,"基本機械人學", 徐氏基金會, 1988 。
[4]郭俊良,王培士編譯,"機械人的機構與控制", 全華科技圖書股份有限公司, 1988 。
[5]江耀宗,林崇賢編譯,"機械人原理與系統", 全華科技圖書股份有限公司, 1991。
[6]何明哲,黃衍生編著,"WINDOW下之馬達控制入門", 全華科技圖書股份有限公司, 1999 。
[7]卓聖鵬編譯,"機械人控制", 全華科技圖書股份有限公司, 2000。
[8]黃美翠,"帶驅動式機械手靈巧操作之控制", 國立成功大學機械工程學系碩士論文, 1989。
[9]盧添福,"四軸機械臂之研製", 國立成功大學機械工程學系碩士論文, 1990。
[10]鄭榮宗,"三軸直接驅動機械手臂之研製", 國立台灣科技大學機械工程研究所碩士論文, 1998。
[11]武晉偉,"平面與球面三自由度並聯式機械人之正運動學分析", 國立台灣科技大學機械工程研究所 碩士論文, 1999。
[12]黃欲仁,"晶圓輸送機械手臂之機構分析及運動控制研究", 私立中原大學機械工程研究所碩士論文, 1999。
[13]何明果,"並聯式機械人之設計、開發與應用", 私立大同大學機械工程研究所, 1999。
[14]林俊諺,"三軸機械手臂之研製", 私立大葉大學機械工程學系碩士論文, 2001。
[15]黃忠良,"磁性流體理論應用", 復漢出版社, 1988。
[16]ROSENSWEIG,"FERROFLUID COMPOSITIONS AND PROCESS OF MAKING SAME", UNITED STATES PATENT 3,917,538, 1975。
[17]CHOGNON,"STABLE FERROFLUID COMPOSITIONS AND METHOD OF MAKING SAME", UNITED STATES PATE -NT 4,356,098, 1982。
[18]KULDIP RAJ, MERRIMACK, N. H.; RONALD E. ROSENSWEIG, SUMMIT, N. J.; LUTFUL M. AZIZ, NAS -HUA, N. H.,"STABLE POLYSILOXANE FERROFLUID COMPOSITIONS AND METHOD OF MAKING SAME", UNITED STATES PATENT 5,851,416, 1998 。
[19]GOWDA ET AL.,"FERROFLUID LINEAR SEAL APPARATUS", UNITED STATES PATENT 4,502,700, 1985。
[20]SATO,"MAGNETIC FLUID SEALING DEVICE", UNITED STATES PATENT 4,605,233, 1986。
[21]CHORNEY ET AL.,"HERMETIC SEALING WITH MAGNETIC FLUIDS", MACHINE DESIGN, VOL. 64, PP. 79-85, 1992。
[22]K. RAJ ET AL.,"ADVANCES IN FERROFLUID TECHNOLOGY", JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS, VOL.149, PP.174-180, 1995。
[23]HOSOYA,"MAGNETIC FLUID SEAL DEVICE", UNITED STATES PATENT 4,973,064, 1990。
[24]RAJ ET AL.,"STACKED POLE-PIECE FERROFLUID SEAL APPARATUS", UNITED STATES PATENT 5,018, 751, 1991。
[25]B.M. BERKOVSKY, V.F. MEDVEDEV, AND M.S. KRAKVO, " MAGNETIC FLUIDS ENGINEERING APPLICAT -IONS", 1ST ED. , 1993。
[26]RAJ ET AL.,"FERROFLUID PRESSURE SENSOR", UNITED STATES PATENT 5,429,000, 1995。
[27]STARKOVICH ET AL.,"ACTIVE CONTROLLED DAMPER", UNITED STATES PATENT 5,655,757, 1997。
[28]YANG ET AL.,"FERROFLUID SINK/FLOAT SEPARATORS FOR SEPARATING NONMAGNETIC MATERIALS OF DIFFERENT DENSITY", UNITED STATES PATENT 5,762,204, 1998。
[29]R. E. ROSENSWEIG,"FERROHYDRODYNAMICS", CAMBRIDGE UNIVERSITY PRESS, 1ST ED. , 1985。
[30]謝其昌,"磁流體軸封之應用研究", 私立大葉大學機械工程學系碩士論文, 1999。
[31]何長憲,"磁流體高速軸封之應用研究", 私立大葉大學機械工程學系碩士論文, 2000。
[32]宋旗桂,"智慧型避震器之應用研究", 私立大葉大學機械工程學系碩士論文, 2000。
[33]陳志安,"磁性流體三軸軸封之研究與應用", 私立大葉大學機械工程學系碩士論文, 2001。