# CONNECTOR 為基之模組化研究-以機械產品為例


## 張堂聖、曾懷恩

E-mail: 9126979@mail.dyu.edu.tw



**摘 要**

傳統的產品關聯網路中模組化形成的研究，皆是以所謂的零件關聯網路(LIAISON GRAPH)作模組化的 工作。此種模組化的結果，常常僅侷限於圖論上之關聯性，在工程上、實務上常常是不可行。為了解決 LIAISON GRAPH 為基之模組化工作的缺點，本研究利用了以功能觀點為出發點的CONNECTOR 描述方式， 來描述整個產品。本研究並且提出了一個CONNECTOR 的結構，此結構包含了：結合性、方向性、拆裝工 具與零件等工程資訊，希望藉由這些工程資訊，使得本模組化研究之結果能夠更符合工程實務上的需求。 除了考慮功能觀點外，本研究亦以單階及多階CONNECTOR 組裝網路圖作為本研究之輸入，並考慮了產品 變異性的觀點，作CONNECTOR 變異性分析，並將分析之結果賦予各CONNECTOR 權重值，在擁有了CONNECTOR 權重值之後，即利用這些變異權重值，作GOMORY&HU 網路切割演算法，以得到一個符合功能及變異觀點的 產品模組，有了各產品模組之後再根據CONNECTOR 的工程特性作零件歸併之依據，以完成整個模組化之研究。 本研究提出之模組化方法涵蓋了功能觀點、變異觀點以及工程上的專業知識，使得本研究之結果能夠較傳統 以LIAISON GRAPH為基的模組化結果更符合未來市場及工程上的需求。



關鍵詞 : 模組化、LIAISON GRAPH、CONNECTOR、產品變異、GOMORY&HU,演算法


**目錄**



**參考文獻**


英文部份: [ 1] AKAGI, F., H. OSAKI, AND S. KIKUCHI, " THE METHOD OF ANALYSIS OF ASSEMBLY WORK BASED ON THE FASTENER METHOD," BULLETIN OF THE JSME,23(184), PP.1670-1675. (1980) [ 2] COHEN, L., QUALITY FUNCTION DEPLOYMENT: HOW TO MAKE QFD WORK FOR YOU, ADDISON-WESLEY PUBLISHING COMPANY, NEW YORK. (1995) [ 3] CORMEN, T. H., C. E. LEISERSON, R. L. REVEST, INTRODUCTION TO ALGORITHMS, MCGRAW-HILL BOOK COMPANY, NEW YORK, PP.579-604.(1990) [ 4] DAS, S. K. ET AL., "AN APPROACH FOR ESTIMATING THE END-OF-LIFE PRODUCT DISASSEMBLY EF -FORT AND COST," INT. J. PROD. RES., VOL. 38, NO.3, PP.657-673. (2000) [ 5] DE FAZIO, L. T. AND D. E. WHITNEY, "SIMPLIFIED GENERATION OF ALL MECHANICAL ASSEMBLY SEQUENCE," IEEE JOURNAL OF ROBOTICS AND AUTOMATIONS, 3(6), PP.640-658. (1987).

[ 6] DE FAZIO, L. T., A. C. EDSALL, R.E GUSTAVSON, J. HERNANDEZ, P. M. HUTCHINS, H.-W. LEUN -G, S. C. LUBY, R. W. METZINGER, J. L. NEVINS, K.TUNG AND D. E. WHITNEY, "A PROTOTYPE OF FEATURE-BASED DESIGN FORASSEMBLY," TRANSTRACTIONOF THE ASME JOURNAL OF MECHANICAL DESIGN,115, DECEMBER, PP.723-734. (1993) [ 7] GU, P. AND D.H. NORRIE, INTELLIGENT MANUFACTURING PLANNING,CHAPMAN & HALL. (1995) [ 8] HE D.W. AND A. KUSIAK, "PERFORMANCE ANALYSIS OF MODULAR PRODUCTS," INT. J. PROD. RES., VOL. 34, NO. 1, 253-272,(1996).

[ 9] KROLL, E., B. BEARDSLEY AND A. PARULIAN, " A METHEDOLOGY TO EVALUATE EASE OF DISASSEMB -LY FOR PRODUCT RECYCLING," IIE TRANSACTION, 28,PP.837-845 (1996).

[10]KUSIAK, A., INTELLIGENT MANUFACTURING SYSTEMS, PRENTICE-HALL INTERNATIONAL EDITIONS. (1990)

[11]KUSIAK, A., AND C. C. HUANG, "DEVELOP COMPONENT OF MODULAR PRODUCTS,"IEEE TRANSACTIONS ON

COMPONENTS PACKGING AND MANUFACTURING TECHNOLOGY, PART A VOL. 19. N0. 4 DECEMBER (1996) [12]KUSIAK, A., "COMPUTATIONAL INTELLIGENCE IN DESIGN AND MANUFACTURING,"JOHN WILEY & SONS, INC, PP.294-346. (2000) [13]KUO, T. C., "DISASSEMBLY SEQUENCE AND COST ANALYSIS FORELECTROMECHANICAL PRODUCTS", ROB -OTICS AND COMPUTER INTEGRATED MANUFACTURING, 16, PP43-54. (2000) [14]KUO, T. C. ET AL., "DISASEMBLY ANALYSIS FOR ELECTROMECHANICAL PRODUCTS: A GRAPH-BASED HEURISTIC APPROACH", INT. J. PROD. RES., VOL. 38, NO. 5, PP993-1007.(2000) [15]MANTYLA, M., AN INTRODUCTION TO SOLID MODELING, COMPUTER SCIENCE PRESS, INC.(1988) [16]MARTIN, M. V., AND ISHII, K., "DESIGN FOR VARIETY: A METHODOLOGY FOR DEVELPING PRODUCT PLATFORM ARCHITECTURES 2000 ASME DESIGN THEORY AND METHODOLOGY CONFERENCE. BALTIMORE, MD. SEPTEMBER.(2000) [17] MARTIN, M. V. DESIGN FOR VARIETY: A METHODOLOGY FOR DEVELOPING PRODUCT PLATFORM ARCH -ITECTURES, PHD DISSERTATION, STANFORD UNIVERSITY IN MECHANICAL ENGINEERING. (2000) [18]NEVINS AND WHITNEY, "A STRATEGY FOR THE NEXT GENERATION IN MANUFACTURING," CONCURRENT DESIGN OF PRODUCTS & PROCESS, NEW YORK: MCGRAW-HILL (1989).
[19]ONG N. S. AND Y. C. WONG, "AUTOMATIC SUBASSEMBLY DETECTION FROM A PRODUCT MODEL FOR DISASSEMBLY SEQUENCE GENERATION," INT J ADV MANUF TECHNOL, 15, PP.425-431(1999).
[20]OTTO, K. AND WOOD, K., PRODUCT DESIGN, PRENTICE HALL. (2001) [21]PAHL,G. AND W. BEITZ, ENGINEERING DESIGN-A SYSTEMATIC APPROACH,2ND EDN., SPRING-VERLAG, LONDON. (1996) [22]PNUELL, Y. AND E. ZUSSMAN, "EVALUATING THE END-OF-LIFE VALUE OF A PRODUCT AND IMPROVING IT BY REDESIGN," INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH, VOL.35, NO.4, PP.921-942 (1997) [23]PUGH, S. TOTAL DESIGN: INTEGRATED METHODS FOR SUCCESSFUL PRODUCT ENGINEERING, ADDISON- WESLEY PUB. (1991) [24]PUGH, S. CREATING INNOVATIVE PRODUCTS USING TOTAL DESIGN,ADDISON-WESLEY PUB. (1996) [25]TSENG, M. M. J. JIAO, "DESIGN FOR MASS CUSTOMIZATION", ANNALS OF THE CIRP, 45/1, PP. 153-156. (1996) [26]TSENG, M. M. J. JIAO, "A VARIANT APPROACH TO PRODUCT DESIGN DEFINITION BY RECOGNIZING FUNCTIONAL REQUIREMENT PATTERNS", JOURNAL OF ENGINEERING DESIGN, 8(4), PP.329-340. (1997) [27]TSENG, H. E. AND R. K. LI, "A NOVEL MEANS OF GENERATING ASSEMBLY SEQUENCES USING THE CONNECTOR CONCEPT," JOURNAL OF INTELLIGENT MANUFACTURING (ACCEPTED IN 1998).
[28]TSENG, H. E., A METHOD OF CONNECTOR-BASED APPROACH FOR ASSEMBLY PLANNING, PHD DISSRT -ATION, NATIONAL CHIAO TUNG UNIVERSITY IN INDUSTRIAL ENGINEERING. (1998) [29]VOHRA T., D. S. CHEN, J. C. CHANG, AND H. C. CHEN, "A NETWORK APPROACH TO CELL FORM -ATION IN CELLULAR MANUFACTURING," INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH, VOL. 28, NO. 11, PP.2075-2084. (1990) [30]ZHANG, H. C., T. C. KUO AND H. LU, "ENVIRONMENTALLY CONSCIOUS DESIGN AND MANUFATURING : A STATE-OF -THE-ART SURVEY," JOURNAL OF MANUFACTURING SYSTEMS, VOL. 16/ NO. 5. (1997) [31]ZUSSMAN, E., A. KRIWET AND G. SELIGER, G., "DISSASSEMBLY ORIENTED ASSESSMENT METHODO -LOGY TO SUPPORT DESIGN FOR RECYCLING," ANNALS OF THE CIRP, 41(1), PP.473-476 (1994). 中文部份: [32] 江吉祥，以STEP 為基進行產品組裝與拆卸分析之推演架構，國立台灣科技大學機械工程系碩士論文，(2000) [33] 依日光，新設計學總合教材，復漢出版社印行，(2000) [34] 黃家祚，組裝理論在腳踏車之應用，私立大大學工業工程研究所碩士論文，(1999) [35] 賴耿陽編譯，機械設計製圖，復文書局，(1977)