

DECLARATION OF JUNE ANN MUNFORD

1. My name is June Ann Munford. I am over the age of 18, have personal knowledge of the facts set forth herein, and am competent to testify to the same.
2. I earned a Master of Library and Information Science (MLIS) from the University of Wisconsin-Milwaukee in 2009. I have over ten years of experience in the library/information science field. Beginning in 2004, I have served in various positions in the public library sector including Assistant Librarian, Youth Services Librarian and Library Director. I have attached my Curriculum Vitae as Appendix CV.
3. During my career in the library profession, I have been responsible for materials acquisition for multiple libraries. In that position, I have cataloged, purchased and processed incoming library works. That includes purchasing materials directly from vendors, recording publishing data from the material in question, creating detailed material records for library catalogs and physically preparing that material for circulation. In addition to my experience in acquisitions, I was also responsible for analyzing large collections of library materials, tailoring library records for optimal catalog

search performance and creating lending agreements between libraries during my time as a Library Director.

4. I am fully familiar with the catalog record creation process in the library sector. In preparing a material for public availability, a library catalog record describing that material would be created. These records are typically written in Machine Readable Catalog (herein referred to as “MARC”) code and contain information such as a physical description of the material, metadata from the material’s publisher, and date of library acquisition. In particular, the 008 field of the MARC record is reserved for denoting the date of creation of the library record itself. As this typically occurs during the process of preparing materials for public access, it is my experience that an item’s MARC record indicates the date of an item’s public availability.
5. Typically, in creating a MARC record, a librarian would gather various bits of metadata such as book title, publisher and subject headings among others and assign each value to a relevant numerical field. For example, a book’s physical description is tracked in field 300 while title/attribution is tracked in field 245. The 008 field of the MARC record is reserved for denoting the creation of the library record itself. As this is the only date reflecting the inclusion of said materials within the library’s collection, it is my experience

that an item's 008 field accurately indicates the date of an item's public availability.

6. I have reviewed Exhibit EX1013, "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing" by Francis E.H. Tay, et al as published in Integrated Manufacturing Systems November 2001.
7. Attached hereto as Appendix TAY01 is a true and correct copy of the MARC record for Integrated Manufacturing Systems as held by the University of Pittsburgh Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix TAY01 accurately describes the title, publisher and ISSN number of Integrated Manufacturing Systems. The Location Items field present on page 2 of this record indicates the library's collection includes the November 2001 issue of Integrated Manufacturing Systems containing "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing".
8. Attached hereto as Appendix TAY02 is a true and correct copy of "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing" as published in Integrated Manufacturing Systems as held by the University of Pittsburgh Library. These scans were secured from the

library's collection. In comparing Exhibit EX1013 to Appendix TAY02, it is my determination that Exhibit EX1013 is a true and correct copy of "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing" by Francis E.H. Tay, et al as published in Integrated Manufacturing Systems.

9. The 008 field of the MARC record in Appendix TAY01 indicates the date of record creation. The 008 field of Appendix TAY01 indicates the University of Pittsburgh Library first acquired Integrated Manufacturing Systems as of August 20, 1998 and held the journal in perpetuity until the publication of "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing". Considering this information, it is my determination that Integrated Manufacturing Systems November 2001 and therefore "Distributed rapid prototyping - a framework for Internet prototyping and manufacturing" was made available to the public shortly after its initial publication in November 2001.

10. I have reviewed Exhibit EX1006, "The Development of Internet Accessible Rapid Prototyping System" by Ren C. Luo, et al as published in Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society.

11.Attached hereto as Appendix LUO01 is a true and correct copy of the MARC record for Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society as held by the Linda Hall Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix LUO01 accurately describes the title, publisher and ISBN number of Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society.

12.Attached hereto as Appendix LUO02 is a true and correct copy of "The Development of Internet Accessible Rapid Prototyping System" as published in Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society as held by the Linda Hall Library. These scans were secured from the library's collection. In comparing Exhibit EX1006 to Appendix LUO02, it is my determination that Exhibit EX1006 is a true and correct copy of "The Development of Internet Accessible Rapid Prototyping System" by Ren C. Luo, et al as published in Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society.

13.The 008 field of the MARC record in Appendix LUO01 indicates the date of record creation. The 008 field of Appendix LUO01 indicates the Linda Hall

Library first acquired Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society as of February 2, 2000. Considering this information, it is my determination that Proceedings of IECON '99: The 25th Annual Conference of the IEEE Industrial Electronics Society and therefore "The Development of Internet Accessible Rapid Prototyping System" was made available to the public shortly after February 2, 2000.

14. I have reviewed Exhibit EX1015, "Defect Detection in Indirect Layered Manufacturing" by Izzat Bakhadyrov, et al as published in Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics.
15. Attached hereto as Appendix BAKHADYROV01 is a true and correct copy of the MARC record for Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics as held by the Linda Hall Library. I secured this record myself from the library's public catalog. The MARC record contained within Appendix BAKHADYROV01 accurately describes the title, publisher and ISBN number of Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics.

16.Attached hereto as Appendix BAKHADYROV02 is a true and correct copy of "Defect Detection in Indirect Layered Manufacturing" as published in Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics as held by the Linda Hall Library. These scans were secured from the library's collection. In comparing Exhibit EX1015 to Appendix BAKHADYROV02, it is my determination that Exhibit EX1015 is a true and correct copy of "Defect Detection in Indirect Layered Manufacturing" by Izzat Bakhadyrov, et al as published in Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics.

17.The 008 field of the MARC record in Appendix BAKHADYROV01 indicates the date of record creation. The 008 field of Appendix BAKHADYROV01 indicates the Linda Hall Library first acquired Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics as of October 26, 1998. Considering this information, it is my determination that Proceedings of the 1998 IEEE International Conference on Systems, Man and Cybernetics and therefore "Defect Detection in Indirect Layered Manufacturing" was made available to the public shortly after October 26, 1998.

18. I have been retained on behalf of the Petitioner to provide assistance in the above-illustrated matter in establishing the authenticity and public availability of the documents discussed in this declaration. I am being compensated for my services in this matter at the rate of \$200.00 per hour plus reasonable expenses. My statements are objective, and my compensation does not depend on the outcome of this matter.

19. I declare under penalty of perjury that the foregoing is true and correct. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 12/12/2024

A handwritten signature in black ink, appearing to read 'June Ann Munford', written in a cursive style.

June Ann Munford

Appendix CV

June A. Munford
Curriculum Vitae

Education

University of Wisconsin-Milwaukee - MS, Library & Information Science, 2009
Milwaukee, WI

- Coursework included cataloging, metadata, data analysis, library systems, management strategies and collection development.
- Specialized in library advocacy, cataloging and public administration.

Grand Valley State University - BA, English Language & Literature, 2008
Allendale, MI

- Coursework included linguistics, documentation and literary analysis.
- Minor in political science with a focus in local-level economics and government.

Professional Experience

Researcher / Expert Witness, October 2017 – present
Freelance ● Pittsburgh, Pennsylvania & Grand Rapids, Michigan

- Material authentication and public accessibility determination. Declarations of authenticity and/or public accessibility provided upon research completion. Experienced with appeals and deposition process.
- Research provided on topics of public library operations, material publication history, digital database services and legacy web resources.
- Past clients include Alston & Bird, Arnold & Porter, Baker Botts, Fish & Richardson, Erise IP, Irell & Manella, O'Melveny & Myers, Perkins-Coie, Pillsbury Winthrop Shaw Pittman and Slayden Grubert Beard.

Library Director, February 2013 - March 2015
Dowagiac District Library ● Dowagiac, Michigan

- Executive administrator of the Dowagiac District Library. Located in

Southwest Michigan, this library has a service area of 13,000, an annual operating budget of over \$400,000 and total assets of approximately \$1,300,000.

- Developed careful budgeting guidelines to produce a 15% surplus during the 2013-2014 & 2014-2015 fiscal years while being audited.
- Using this budget surplus, oversaw significant library investments including the purchase of property for a future building site, demolition of existing buildings and building renovation projects on the current facility.
- Led the organization and digitization of the library's archival records.
- Served as the public representative for the library, developing business relationships with local school, museum and tribal government entities.
- Developed an objective-based analysis system for measuring library services - including a full collection analysis of the library's 50,000+ circulating items and their records.

November 2010 - January 2013

Librarian & Branch Manager, Anchorage Public Library ● Anchorage, Alaska

- Headed the 2013 Anchorage Reads community reading campaign including event planning, staging public performances and creating marketing materials for mass distribution.
- Co-led the social media department of the library's marketing team, drafting social media guidelines, creating original content and instituting long-term planning via content calendars.
- Developed business relationships with The Boys & Girls Club, Anchorage School District and the US Army to establish summer reading programs for children.

June 2004 - September 2005, September 2006 - October 2013

Library Assistant, Hart Area Public Library

Hart, MI

- Responsible for verifying imported MARC records and original MARC

cataloging for the local-level collection as well as the Michigan Electronic Library.

- Handled OCLC Worldcat interlibrary loan requests & fulfillment via ongoing communication with lending libraries.

Professional Involvement

Alaska Library Association - Anchorage Chapter

- Treasurer, 2012

Library Of Michigan

- Level VII Certification, 2008
- Level II Certification, 2013

Michigan Library Association Annual Conference 2014

- New Directors Conference Panel Member

Southwest Michigan Library Cooperative

- Represented the Dowagiac District Library, 2013-2015

Professional Development

Library Of Michigan Beginning Workshop, May 2008

Petoskey, MI

- Received training in cataloging, local history, collection management, children's literacy and reference service.

Public Library Association Intensive Library Management Training, October 2011

Nashville, TN

- Attended a five-day workshop focused on strategic planning, staff management, statistical analysis, collections and cataloging theory.

Alaska Library Association Annual Conference 2012 - Fairbanks, February 2012

Fairbanks, AK

- Attended seminars on EBSCO advanced search methods, budgeting, cataloging, database usage and marketing.

Depositions

2019 • Fish & Richardson

Apple v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282 and 39521-00421IP2)

2019 • Erise IP

Implicit, LLC v. Netscout Systems, Inc (Civil Action No. 2:18-cv-53-JRG)

2019 • Perkins-Coie

Adobe Inc. v. RAH Color Technologies LLC (Cases IPR2019-00627, IPR2019-00628, IPR2019-00629 and IPR2019-00646)

2020 • O'Melveny & Myers

Maxell, Ltd. v. Apple Inc. (Case No. 5:19-cv-00036-RWS)

2021 • Pillsbury Winthrop Shaw Pittman LLP

Intel v. SRC (IPR2020-1449)

2022 • Perkins-Coie

Realtek v. Future Link (IPR2021-01182)

2023 • Fish & Richardson

Neuroderm Ltd. v. Abbvie, Inc (Case No. PGR2022-00040)

2023 • Fish & Richardson

Nearmap US Inc. v. Pictometry International Corp. (IPR2022-00735)

Limited Case History & Potential Conflicts

Alston & Bird

- Ericsson
 - v. Collision Communications (IPR2022-01233)
- Nokia
 - v. Neptune Subsea, Xtera (Case No. 1:17-cv-01876)

Arnold & Porter

- Ivantis
 - v. Glaukos (Case No. 8:18-cv-00620)
- Samsung
 - v. Jawbone (Case No. 2:21-cv-00186)

Benesch Friedlander Coplan & Aronoff

- Voyis
 - v. Cathx (Case No. 5:21-cv-00077-RWS)

Erise I.P.

- Apple
 - v. Ericsson Inc. (IPR2022-00715)
 - v. Future Link Systems (IPRs 6317804, 6622108, 6807505, and 7917680)
 - v. INVT (Case No. 20-1881)
 - v. Navblazer LLC (IPR2020-01253)
 - v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)
 - v. Quest Nettech Corp (Case No. 2:19-cv-00118-JRG)
 - v. Telefonaktiebolaget LM Ericsson (IPR2022-00275)

- Fanduel
 - v. CGT (Case No. 19-1393)
- Garmin
 - v. Phillips North America LLC (Case No. 2:19-cv-6301-AB-KS)
- Netscout
 - v. Longhorn HD LLC (Case No. 2:20-cv-00349)
 - v. Implicit, LLC (Civil Action No. 2:18-cv-53-JRG)
- Sony Interactive Entertainment LLC
 - v. Bot M8 LLC (IPR2020-01288)
 - v. Infernal Technology LLC (Case No. 2:19-CV-00248-JRG)
- Unified Patents
 - v. GE Video Compression (Civil Action No. 2:19-cv-248)

Fish & Richardson

- Apple
 - v. AliveCor (3:21-cv-03958)
 - v. LBS Innovations (Case No. 2:19-cv-00119-JRG-RSP)
 - v. Koss Corporation (IPR2021-00305)
 - v. Masimo (IPR 50095-0012IP1, 50095-0012IP2, 50095-0013IP1, 50095-0013IP2, 50095-0006IP1)
 - v. Neonode (Case No. 21-cv-08872-EMC)
 - v. Qualcomm (IPR2018-001281, 39521-00421IP, IPR2018-01282, 39521-00421IP2)
- Dell
 - v. Neo Wireless (IPR2022-00616)

- Dish Network
 - v. Realtime Adaptive Streaming (Case No. 1:17-CV-02097-RBJ)
 - v. TQ Delta LLC (Case No. 18-1798)
- Evapco Dry Cooling
 - v. SPG Dry Cooling (IPR2021-00688)
- Genetec
 - v. Sensormatic Electronics (Case No. 1:20-CV-00760)
- Huawei
 - v. Bell Northern Research LLC (IPR2019-01174)
- Kianxis
 - v. Blue Yonder (Case No. 3:20-cv-03636)
- LG Electronics
 - v. Bell Northern Research LLC (Case No. 3:18-cv-2864-CAB-BLM)
- Metaswitch
 - v. Sonus Networks (IPR2018-01719)
- Microsoft
 - v. Throughputer Inc (IPR2022-00757)
- MLC Intellectual Property
 - v. MicronTech (Case No. 3:14-cv-03657-SI)
- Nearmap Inc
 - v. EagleView Technologies (IPR2022-01009)
- Neuroderm Ltd.
 - v. Abbvie, Inc (Case No. PGR2022-00040)
- Realtek Semiconductor
 - v. Future Link (IPR2021-01182)

- Quectel
 - v. Koninklijke Philips (Case No. 1:20-cv-01710)
- Samsung
 - v. Aire Technology (IPR2022-00877)
 - v. Bell Northern Research (Case No. 2:19-cv-00286-JRG)
 - v. Communication Technologies Inc (IPR2022-01221)
 - v. Jawbone Innovations (IPR2022-00865)
 - v. MemoryWeb LLC (IPR2022-00885)
 - v. Telefonaktiebolaget LM Ericsson (IPR2021-00615)
- Texas Instruments
 - v. Vantage Micro LLC (IPR2020-01261)
- Xilinx
 - v. Sentient Sensors LCC (Case No. 1:22-cv-00173)

Irell & Manella

- Curium

O'Melveny & Myers

- Apple
 - v. Maxell (Case No. 5:19-cv-00036-RWS)

Perkins-Coie

- Heru Industries
 - v. The UAB Research Foundation (IPR2022-01148)
- Realtek Semiconductor
 - v. Future Link (IPR2021-01182)

- Twitter Inc

- v. VOIP-Pal.com (Case No. 3:20-cv-02397-JD)

- TCL Industries

- v. Koninklijke Philips NV (IPR2021-00495, IPR2021-00496 and IPR2021-00497)

Pillsbury Winthrop Shaw Pittman

- Intel

- v. FG SRC LLC (Case No. 6:20-cv-00315)

- Gravel Rating Systems

- v. Costco (Case No. 4:21-cv-149)

- v. Lowe's Home Centers (Case No. 4:21-cv-150)

- v. T-Mobile USA (Case No. 4:21-cv-152)

- v. Kohl's Inc. (Case No. 4:21-cv-258)

- v. Under Armor (Case No. 4:21-cv-356)

Appendix TAY01

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035 ##$a(OLC)39722642
035 ##$a(CKB)954921413399
035 ##$a(CONSER)--2002238736
037 ##$bMCB University Press Limited, 60/62 Toller Lane, Bradford, West Yorkshire, England BD8 9BY
042 ##$apcc
050 00$aTS155.6
082 04$a670.285
130 0#$aIntegrated manufacturing systems (Online)
210 ##$aINTEGR MANUF SYST
210 ##$aINTEGRATED MANUFACTURING SYSTEMS IMS
245 10$aIntegrated manufacturing systems : $bIMS.
246 13$aIMS
246 13$aIMS magazine
260 ##$aBradford, England : $bMCB University Press, $c-2003.
310 ##$aEight no. a year, $b<2002->
321 ##$aFrequency varies
336 ##$atext $btxt $2rdacontent
337 ##$acomputer $bc $2rdamedia
338 ##$aonline resource $bcr $2rdacarrier
362 1#$aPrint began with vol. 1, no. 1 (Jan. 1990).
362 0#$a-v. 14, no. 8 (2003).
500 ##$aAbstracts for 1990- also available online.
538 ##$aMode of access: World Wide Web.
588 0#$aVol. 5, no. 1 (1994); title from introductory page (viewed July 18, 2002).
588 1#$aVol. 14, no. 8 (2003) (Emeraldinsight, viewed June 8, 2018).
650 #0$aComputer integrated manufacturing systems $vPeriodicals.
650 #0$aManufacturing processes $xAutomation $vPeriodicals.
650 #7$aComputer integrated manufacturing systems. $2fast $0(OLC)fst00872216
650 #7$aManufacturing processes $xAutomation. $2fast $0(OLC)fst01008141
655 #7$aPeriodicals. $2fast $0(OLC)fst01411641
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776 ##$x0957-6061
785 00$tJournal of manufacturing technology management $w(CKB)111076363736000 $w(DLC)2004255462 $x1758-7786
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853 20$81 $av. $bno. $u8 $vr $1(year) $w8
863 41$81.1 $a14 $b1 $i2002
906 ##$aJOURNAL

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v.3 (1992)



Item in place (0 requests)
v.4-5 1993-1994



Item in place (0 requests)
v.6 1995



Item in place (0 requests)
v.7 1996



Item in place (0 requests)
v.8 1997



Item in place (0 requests)



v.9 1998

Item in place (0 requests)
v.10 1999



Item in place (0 requests)
v.11 2000



Item in place (1 request)
v.12 2001



Item in place (0 requests)
v.13 2002



Item in place (0 requests)
v. 14 2003



Details

Title	Integrated manufacturing systems (Online)
Uniform title	Integrated manufacturing systems (Online) >
Other title	IMS IMS magazine
Contributor	MCB University Press >
Language	English
Frequency	Eight no. a year, <2002->
Publisher	Bradford, England : MCB University Press Print began with vol. 1, no. 1 (Jan. 1990). -v. 14, no. 8 (2003).
Date	-2003
Type	Journal
Journal Notes	Print began with vol. 1, no. 1 (Jan. 1990). -v. 14, no. 8 (2003).
Notes	Abstracts for 1990- also available online. Mode of access: World Wide Web.
Subject	Computer integrated manufacturing systems -- Periodicals > Manufacturing processes -- Automation -- Periodicals >
Genre	Periodicals >
Related titles	Earlier title : FMS magazine > Earlier title : International journal of agile management systems (Online) > Earlier title : World class design to manufacture (Online) > Available in other form: Link to related record > Later title : Journal of manufacturing technology management >
Identifier	LC : 2002238736 ISSN : 1758-583X OCLC : (OCoLC)39722642 ISSN : 0957-6061
Dedup Member Ids	999800713406236
Source	Library Catalog

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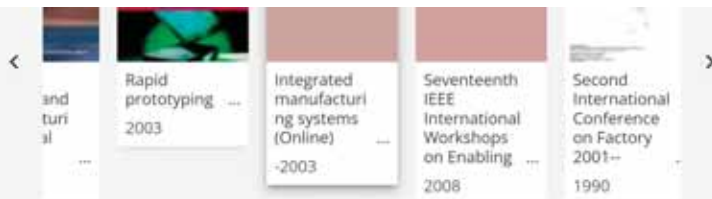
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Appendix TAY02



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VOL. 12
2001

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Title: Integrated manufacturing syste

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Integrated Manufacturing Systems

The International Journal of Manufacturing Technology Management

Volume 12, Number 6, 2001

This issue is part of a comprehensive multiple access information service comprising:



Paper format

Integrated Manufacturing Systems includes seven issues in traditional paper format. Please note that two issues of the journal are bound together consecutively within these covers. The contents of this issue are detailed below.



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See overleaf for full details of subscriber entitlements.

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<i>Ramazan Yaman</i></p> <p>409 Distributed rapid prototyping – a framework for Internet prototyping and manufacturing
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|--|---|



Integrated Manufacturing Systems online



An advanced knowledge resource for the entire organization

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Subscribers to this journal benefit from access to a fully searchable knowledge resource stretching far beyond the current volume and issue. *Integrated Manufacturing Systems* online is enhanced with a wealth of features to meet the need for fast, effortless, and instant access to the core body of knowledge. Furthermore, this user-friendly electronic library may be networked throughout the subscribing organization to maximize the use and value of the subscription. This is augmented with advanced search facilities and "choice of access" through a variety of online databases.

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A comprehensive range of resources are available online that help users learn how to effectively use online information resources and that help information professionals market resources to their users. For further information please go to <http://www.emerald-library.com/resources>

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Electronic access to this journal is available via a number of channels, enabling end users' libraries to reach the content through their preferred delivery system.

The Emerald Library – <http://www.emerald-library.com> – is the recommended means of electronic access as it provides fully searchable and high value-added access to the complete content of the journals. Refer to the next section for "how to access" via the Emerald Library.

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Minerva
<http://www.minerva.at/>
OCLC Firstsearch "Electronic Collections Online"
<http://www.uk.oclc.org/oclc/menu/eco.htm>
RoweCom's "Information Quest"
<http://informationquest.com>
SilverPlatter
<http://www.silverplatter.com>
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Abstracts & keywords

Development of a digital manual for a manufacturing system – a case study

Richard Greenough, Devendra Fakun and John Kay

Keywords Maintenance, Manufacturing, Information systems, Manuals

This paper describes the development and evaluation of an information system to identify spare parts associated with an automated assembly machine that is part of a Ford engine assembly line. The information system is a digital manual, similar to a class of document called an integrated electronic technical manual. The requirements of teams of users in the engine plant are described before explaining the use of multimedia tools to create a suitable information system. The result is a collection of digital documents connected by hyperlinks to form a digital manual. Usability trials indicated that maintenance technicians and line operators would actually use such a manual in the factory. Ford maintenance managers indicated that such a manual would benefit them and the benefits are presented in detail. A version of the manual was developed for data collection and it is suggested that, in future, such manuals might be the factory users' interface to a computerised maintenance management system.

Technology enablers for supply chain management

Nouredine Boubekri

Keywords Supply chain, Scheduling, Enterprise resource planning, Cycle time, Product life cycle, Logistics

This paper describes the current business conditions and the four key factors that need to be integrated in order to improve the supply chain. The paper discusses how enterprise resource planning (ERP) is increasingly being used as a technology enabler for supply chain management and problems associated with its implementation.

Establishment and use of virtual layouts for manufacturing

Ramazan Yaman

Keywords Manufacturing, Virtual reality, Factories, Production planning

This study offers a new type of manufacturing approach. This approach may be called virtual manufacturing layouts. The study concerns basic themes of the approach. These are descriptions, elements, and use of the virtual layouts. The approach has been exemplified with a case study. Advantages and disadvantages of this type of layouts have also been summarised.

Distributed rapid prototyping – a framework for Internet prototyping and manufacturing

Francis E.H. Tay, Yadav P. Khanal, Kwok Kuen Kwong and Kim Cheng Tan

Keywords Internet, Rapid prototyping, Manufacturing

This paper focuses on the development of a distributed rapid prototyping system via the Internet to form a framework of Internet prototyping and manufacturing for the support of effective product development. The proposed methodology is targeted at a wide audience using a disparate range of computer systems to access remotely located rapid prototyping facilities via the Internet for prototype fabrication. The methodology is useful for both educational research for teaching evolving rapid prototyping technologies and remote scientific visualization. This approach is based on the merger of object-oriented modular software architecture and client server communications for the remote control of rapid prototyping hardware (called fused deposition modeling) via the Internet. Other Web tools are used to allow the remote user to have higher interactivity with the server applications that have a direct link with the front-end terminals controlling the rapid prototyping hardware.

Distributed rapid prototyping – a framework for Internet prototyping and manufacturing

Francis E.H. Tay

National University of Singapore, Singapore

Yadav P. Khanal

National University of Singapore, Singapore

Kwok Kuen Kwong

Temasek Polytechnic, Singapore

Kim Cheng Tan

Temasek Polytechnic, Singapore

Keywords

Internet, Rapid prototyping, Manufacturing

Abstract

This paper focuses on the development of a distributed rapid prototyping system via the Internet to form a framework of Internet prototyping and manufacturing for the support of effective product development. The proposed methodology is targeted at a wide audience using a disparate range of computer systems to access remotely located rapid prototyping facilities via the Internet for prototype fabrication. The methodology is useful for both educational research for teaching evolving rapid prototyping technologies and remote scientific visualization. This approach is based on the merger of object-oriented modular software architecture and client server communications for the remote control of rapid prototyping hardware (called fused deposition modeling) via the Internet. Other Web tools are used to allow the remote user to have higher interactivity with the server applications that have a direct link with the front-end terminals controlling the rapid prototyping hardware.

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Introduction

Manufacturing and design technologies are gradually gravitating towards Internet integrated technology to cope with emerging challenges such as the need for shorter time to market, reduced lead time in the supply chain of new products, reduced cost and higher quality. The merging of Internet and manufacturing technologies has resulted in the bridging of the gap between engineering technology (such as rapid prototyping hardware system) and the information system to enable the remote control of engineering resources. As such, geographical constraints can be overcome. In order to realize this concept, more advanced support software such as Java (Siyan *et al.*, 1997) is being developed to integrate manufacturing technology (Jacobs and Prioleou, 1996) with the Internet so that various manufacturing processes can be controlled online. In particular Java has made it possible to integrate interoperable, modular and extensible distributed application together to monitor and control a physical environment (Grimaldi *et al.*, 1998). As to date, there are a number of researches in the application of Internet infrastructure for engineering purposes (Tan *et al.*, 1998; Brown *et al.*, 1998). Most of the research work is mainly focused on the utilization of this technology for virtual reality (Toung *et al.*, 1997) and for faster and effective communications only. However, these approaches cannot fully address the real life engineering problems where real models have to be formed as a result of synthesis of time and resources and where the global market competition of supplying better quality products is very crucial.

The concept of distributed systems has long been widely used in the manufacturing

and design industries to facilitate manufacturing and product development operations. However, traditional distributed systems are hardwired and limited to a particular location and resources and accessibility is limited to a particular location only. Recently, there is considerable interest in the area of Internet enabled distributed systems. Examples of these works include the application of the Internet infrastructure for virtual reality (Broll, 1997) and online measurement (Grimaldi *et al.*, 1998). The proposed methodology is different from others in that it focuses on the formation of physical models online via the Internet when a geographical distance separates the end user and the physical hardware. This approach is applicable for a wide spectrum of end users due to its interoperability, modular functionality and scalability. The targeted audiences include users in the educational sectors who can use the framework for online teaching of new manufacturing technology such as rapid prototyping technology, and secondly for parties involved in product development who can use the facility to view and analyze the prototyping concurrently. In addition, professional prototyping centers can serve as rapid prototyping service providers for low volume manufacturing organizations to utilize the rapid prototyping facilities. The potential applications are numerous and especially so as this technology advances and new challenges arise.

Distributed rapid prototyping via the Internet

In recent years, new technologies have emerged to facilitate the rapid prototyping of 3D CAD models so that complex and aesthetically shaped prototypes can be formed both for end use and for the analysis of design and manufacture as a part of the product development process. For efficient product development and fast return on

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investment, there is a need for a rapid product development cycle that is made possible by decreasing the cycle time for product design and analysis. Product design in the product development cycle is the most critical phase where iterative prototyping is required for various analyses. Traditional prototyping is very slow and ineffective in resources utilization. Consequently, new rapid prototyping technologies have emerged in the last few years and most of the cost-effective prototyping nowadays is carried out by rapid prototyping technique. Complex and aesthetically shaped models can be rapidly fabricated using these rapid prototyping technologies, which resulted in their extensive use by design and manufacturing organizations. However, no technology can stay successful in its stand-alone form in a dynamic and competitive global market. The same applies to the rapid prototyping technology as well. In order to enhance the accessibility of available rapid prototyping services to a broader community of users (organizations or individuals) involved in the product development, research or scientific visualization process either for educational or commercial purpose, an approach has been developed so as to integrate the rapid prototyping technology with the Internet. In this approach, use of interoperable, modular and platform independent application has been developed to integrate the rapid prototyping technology with the Internet infrastructure for integrating the global resources online.

This current effort aims at providing manufacturing facilities to geographically separated partners in low and high volume manufacturing organizations, research institutes and others involved in the field of product development or scientific visualization using rapid prototyping technologies by means of remote access via the Internet. The methodology is based on the principle of Internet based distributed system and is commonly termed as Internet Manufacturing (IMAN). The approach focuses on various aspects of manufacturing and design literature. Firstly, geographically disintegrated resources can be synthesized online for real-time manufacturing. Secondly, geographically separated product development team members can work concurrently for the new product development process. Thirdly, aesthetically shaped complex prototypes can be fabricated remotely for the purpose of rapid tooling, scientific visualization and analyses. Through IMAN, commercial organizations can be engaged in prototype development and customization through a professional rapid

prototyping center without the need for their own investment for setting up costly prototyping facilities.

Brief description of IMAN system

The Internet based distributed rapid prototyping architecture is a common client server model, which centers on object-oriented application model using Java and common Web tools. The four basic components of the approach are:

- 1 Internet: as the standard communications infrastructure;
- 2 Java: as the object-oriented implementation language both for client and server applications;
- 3 Other Web tools (e.g. Virtual Network Computing, Web Cam): as an access and configuration tool for a remote server system; and
- 4 Fused Deposition Modeling (FDM): as the rapid prototyping hardware.

A major benefit of choosing Java (Siyan *et al.*, 1997) is the achievement of portable and object-oriented software (i.e. the developed application is completely platform independent, easy to maintain and extend). Java implementation relies on native methods and driver libraries and the non-portable parts relate only to interface bus drivers of the rapid prototyping hardware. In addition, it delivers a platform neutral framework for the construction of the human computer interface (HCI) (Chen *et al.*, 1998).

Network speed is an important factor to be considered in order to fully harness the advantages of IMAN. With the current trend towards high-speed network development, the IMAN system performance will be better realized with the increasing high-speed network facilities. At this point the mechanism is kept simple to realize a sufficient performance level under the current commercial network links available. Nevertheless it has been ensured that the current architecture is general enough not to limit the potential application areas in the future with the continuous development of a high-speed network such as "Very High Speed Backbone Network Service" (vBNS) (IEEE Spectrum, 1998) that has higher bandwidth capability.

Though the concept has been developed using FDM, the same concept is applied to other rapid prototyping technologies such as Selective Laser Sintering (SLS), Stereo-Lithography Apparatus (SLA) and Laminated Object Manufacturing (LOM). A major benefit of choosing FDM as our test tool for IMAN is the capability of FDM to

make a complex and aesthetically shaped prototype and also because of its open architecture.

A general architecture (see Figure 1) of IMAN consists of a set of server and front-end terminals (only one is shown in Figure 1). The client and server applications are linked to one another via the Internet. In addition, other common Web tools, such as Web cam and video conferencing software that run independently of each other, are also incorporated in the rapid prototyping center. The client interface is also designed to be very transparent and user friendly so that the user does not need to download and install extra plug-ins to run the application. A general-purpose machine such as Win9x/NT or Sun Solaris with common Web tools installed will be sufficient to support IMAN.

A client interface is also designed to host, on demand, the human computer interface required for configuring and monitoring the remote prototyping system.

Object-oriented architecture of the IMAN system

A distinctive feature of the approach is the adoption of object-oriented software architecture for the development of the IMAN system on both the client and server side. The core module of client server interaction has been developed using Java and is completely object-oriented and platform independent. Java offers versatile,

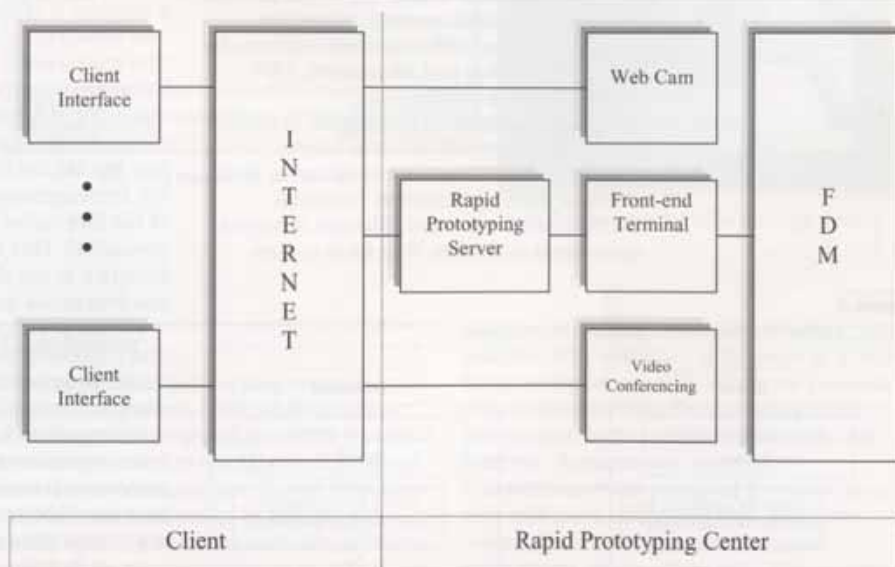
clean and type free object-oriented mechanisms for building the system. It also provides client/server-networking facilities for Internet based communications.

The IMAN system is a three-tier client server architecture consisting of the client interface, server applications and front-end terminal applications dedicated to the rapid prototyping hardware. The front-end terminal is directly connected to the rapid prototyping hardware and is dedicated to the hardware for its locally intensive data manipulation process.

The distributed rapid prototyping system consists of two major Java components, namely, the client application and server application. The client application has been developed using the Java Abstract Window Toolkit (AWT) package that furnishes the graphical user interface (GUI) services. During its lifetime, the client interface interacts with the server partner application running on the server (see Figure 2). The server component of the distributed rapid prototyping system relies on Java object-oriented mechanisms and on the capability of directly interfacing with the native methods of a standard interface driver library of the rapid prototyping hardware.

In reality, as one can see from Figure 2, an application is structured into two sub-components, namely, a Java Server component written in Java and listener threads within the server program. The server component is multi-threaded. It constantly runs and listens for a client asking

Figure 1
IMAN framework on the Internet



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for a connection to a port number representing a particular client instance to form a socket connection for bi-directional interactions with the client. The Internet protocol such as the transfer control protocol and Internet protocol (TCP/IP) is implemented for data transfer process. The receiver server socket is synchronized for each client instance. Until a client instance is completed, no other client's request will be processed.

From the viewpoint of the client application, the socket connection is active only for data transfer and invocation of the rapid prototyping hardware. Other audio and visual feedback from the remote location where the server and rapid prototyping hardware are resided can be obtained by the use of Web cam and video conferencing (see Figure 3). Normally, only one single client connection can exist at any one time to a given port. This complies with the constraint that only one single client request can be processed for using a given set of rapid prototyping hardware at any one time. Interference problems due to concurrent accesses to a shared bus of the rapid prototyping hardware can be handled by mutual exclusion mechanisms (synchronized methods). At the termination point of previous client operation, the socket connection is closed and the server can accept a new connection on the same port, thus starting a new instance of client server connection and so forth.

In a slightly different scenario, multiple clients could be allowed to watch the same fabrication process for discussion and analysis. This facility may be required in a distributed system where the active process needs to be instantaneously viewed by several people at different client stations for concurrency (Roy and Bharadwaj, 1997; Yoshimura *et al.*, 1998).

The client interface is designed to enable the client to interact with the server transparently. Clients are required to have common Web tools such as Netscape Communicator browser. The use of server component and other Web tools to run

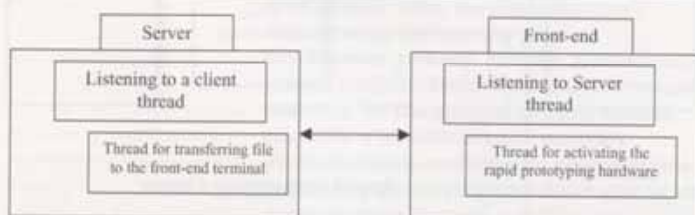
independently isolates the two kinds of tasks in the rapid prototyping center. These are critical tasks such as data transfer to the front-end terminal via the server and non-critical ones such as video conferencing and concurrently viewing of the rapid prototyping status. This kind of isolation frees up the burden of the server to handle extra loads for these lower value-added jobs while concentrating more on other server and front-end terminal intensive tasks such as data conversion to machine format with the QuickSlice. Access to the QuickSlice is synchronized for one client at a time. As a security measure the distributed rapid prototyping system is designed to disallow multiple user-access to a single or a limited number of physical hardware at anyone time.

Tests and results

Tests were carried out in collaboration with Osaka University (Osaka, Japan). The main concerns were to validate reliable data transfer (see Figure 4) and successful access to the remotely located server applications for data conversion to machine format, remote fabrication of prototype and validation of the quality of the fabricated prototype. To validate the reliability of data transfer, network performance reliability was monitored in the rapid prototyping laboratory. Figure 4 shows the average distribution of network traffic in a week recorded in the rapid prototyping laboratory. The Internet connection from the laboratory to Osaka University is via the Asia and Pacific Advanced Network (APAN) link with a nominal 2 Megabit per second bandwidth. The network route is as shown in Figure 4. The multi-routed connection had heterogeneous transfer mode in each hub and obviously it was much slower in the international traffic from Singapore to the hub 203.181.248.217 (Osaka, Japan). Despite the heterogeneous data transfer, the quality of the fabricated prototype was very consistent. This implies that the data integrity is not dependent upon the heterogeneous data transfer mode.

The main factor of the validation is the fact that the converted CAD data should maintain its integrity to avoid any flaws over the long distance transmission so that its conversion to the machine format by the QuickSlice translator is not misinterpreted to form a bad prototype. It is shown that the quality of the prototype fabricated using the IMAN system is not susceptible to varying conditions of the network link, especially the data transfer mode.

Figure 2
Client, server and front-end terminal interaction



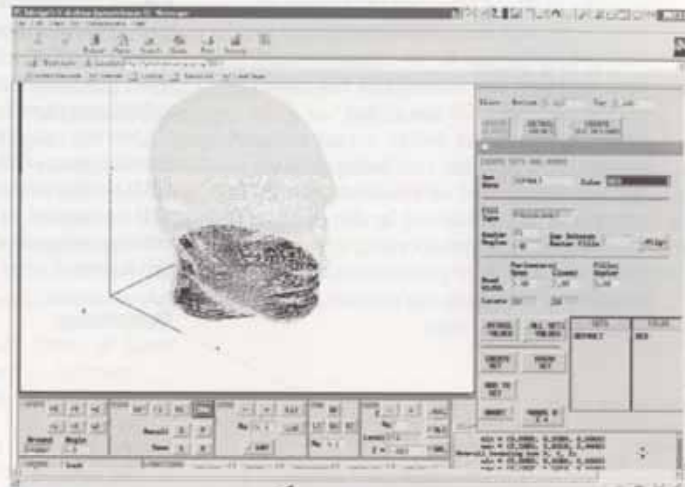
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Figure 3

(a) File conversion to machine format (b) Data transfer in the server (c) Remote viewing of prototyping status

(a) File conversion to machine format



(b) Data transfer in the server



(c) Remote viewing of prototyping status

Conclusion

Distributed rapid prototyping using the Internet is a powerful tool in the product development process and scientific visualization field to enable the distributed resources to communicate in real time both virtually and physically. In this project, IMAN, which is based on modular software architecture, was developed to enable

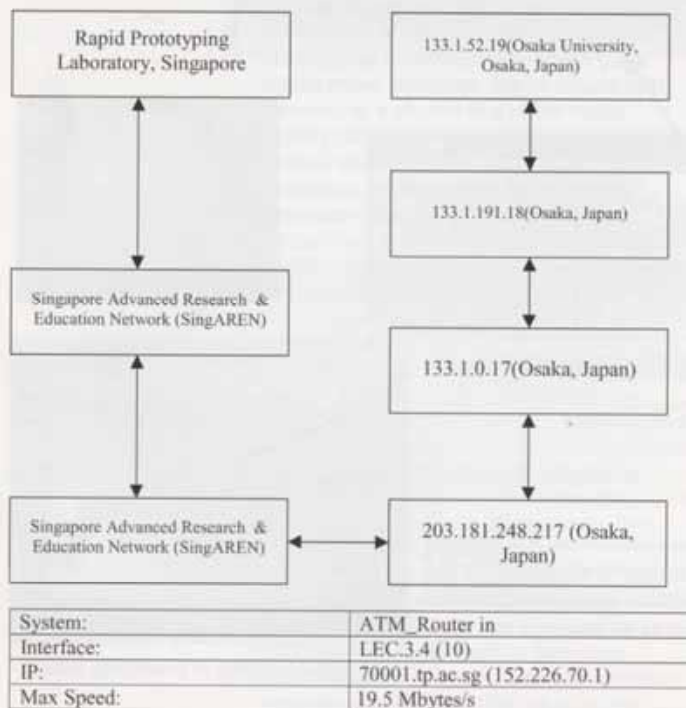
distributed rapid prototyping via the Internet. The approach is targeted at a wide range of audiences with disparate research and commercial interests in using rapid prototyping technologies remotely via the Internet. In particular, platform independency was a critical factor to ensure that end users using different computer systems can interact with the rapid prototyping center effectively. The modular

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software architecture for the IMAN system is also highly scalable for further research and development. With IMAN, it becomes possible to collaborate in real time between two geographically distributed resources (partners). More effective utilization of geographically distributed resources is realized using one at the cheapest source of data carrier – the Internet as the means of communications. In the global manufacturing and design arena, industrial competition through successful product development based on efficient prototyping can be further enhanced by the use of the distributed rapid prototyping system via the Internet for remote prototyping to considerably reduce the product development lead time.

Figure 4
Network link and performance reliability



The statistics were last updated on Friday, 12 February 1999 at 15:47, at which time the ATM_Router had been up for 10 days, 1:12:19.

Monthly Graph (2 Hour Average)

Max In:	3591.0 kb/s (2.3%)
Average In:	189.2 kb/s (0.1%)
Current In:	86.7 kb/s (0.1%)
Max Out:	2019.8 kb/s (1.3%)
Average Out:	41.2 kb/s (0.0%)
Current Out:	14.3 kb/s (0.0%)

Future research works

The proposed distributed rapid prototyping system is presently being developed for other prototyping hardware other than FDM. A highly interactive GUI will also be designed to communicate with the Programmable Logic Controller that will be connected to the front-end terminal to achieve more intelligent functions of the system remotely.

Current research work also involves the development of object-oriented collaborative CAD on the Internet. These two approaches will be merged in the near future to facilitate collaborative product development using the Internet.

References

- Broll, W. (1997), "Distributed virtual reality for everyone – a framework for networked VR on the Internet", *IEEE*, Los Alamitos, CA, pp. 121-8.
- Brown, S.M. et al. (1998), "A progress report on the manufacturing systems", *Journal of Manufacturing Systems*, Vol. 17 No. 5, pp. 389-98.
- Chen, K.H. et al. (1998), "An integrated graphical user interface (GUI) for concurrent engineering design of mechanical parts", *Computer Integrated Manufacturing Systems* Vol. 11 Nos 1-2, pp. 91-112.
- Grimaldi, D. et al. (1998), "Java-based distributed measurement systems", *IEEE Transactions on Instrumentation and Measurement*, Vol. 47 No. 1, pp. 100-3.
- IEEE Spectrum (1998), *vBNS: not your father's Internet*, pp. 38-46.
- Jacobs, P.F. and Prioleau, F. (1996), "STL and other RP and M technologies", *Dearborn, Mich.: Society of Manufacturing Engineers in cooperation with the Rapid Prototyping Association of SME*, ASME Press, New York, NY, pp. 349-57.
- Roy, U. and Bharadwaj, B. et al. (1997), "Product development in a collaborative design environment", *Concurrent Engineering: Research and Applications*, Vol. 5 No. 4, pp. 347-65.
- Siyan, K.S. et al. (1997), *Inside Java*, New Riders Publishing, Indianapolis, IN.
- Tan, K.C. et al. (1998), "Automation of prosthetic socket design and fabrication using computer aided design/computer aided engineering and rapid prototyping techniques", *The First National Symposium of Prosthetics and Orthotics*, Singapore, pp. 19-22.
- Toung, H.J. (Ed.) et al. (1997), "A World Wide Web based virtual factory model", *Engineering Design and Automation*, Vol. 3 No. 4, pp. 355-66.
- Yoshimura, M. et al. (1998), "Synergy effects of sharing knowledge during cooperative product design", *Concurrent Engineering: Research and Applications*, Vol. 6 No. 1, pp. 7-14.

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Further reading

- Bailey, M. (1995), "Tele-manufacturing: rapid prototyping on the Internet", *IEEE Computer Graphics and Applications*, pp. 20-6.
- Carrabine, L. (1998), "Merging CAD with IT", *Mechanical Engineering*, pp. 56-8.
- Crabtree, R.A., Fox, M.S. et al. (1997), "Case studies of coordination activities and problems in collaborative design", *Research in Engineering Design*, Vol. 9 No. 1, pp. 70-84.
- Hague, M.J. et al. (1998), "Tool for the management of concurrent conceptual engineering design", *Concurrent Engineering: Research and Applications*, Vol. 6 No. 2, pp. 111-29.
- IEEE Spectrum (1998), *Virtual Meetings with Desktop Conferencing*, pp. 47- 56.

- Java: a new tool for engineering, (1996), *Mechanical Engineering*, April, pp. 68-72.
- Layne, S.P. et al. (1998), "Mass customized testing and manufacturing via the Internet", *Robotics and Computer Integrated Manufacturing*, Vol. 14, pp. 377-87.
- Rapid Prototyping Report* (1998), CAD/CAM Publishing Inc., San Diego, CA, pp. 1-12.
- Smith, R.P. et al. (1998), "Experimental observation of iteration in engineering design", *Research in Engineering Design*, Vol. 10 No. 1, pp. 107-17.
- Valdes, B. (1998), "Surfing for virtual parts" *Mechanical Engineering*, July, pp. 75-82.
- Yan, Y. et al. (1998), "Study on multifunctional rapid prototyping manufacturing systems", *Integrated Manufacturing Systems*, Vol. 9 No. 4, pp. 236-41.

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110 2#$aIEEE Industrial Electronics Society. $bConference $n(25th : $d1999 : $cSan Jose, Calif.)
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246 31$aIndustrial electronics, instrumentation and control
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The Development of Internet accessible Rapid Prototyping System

Ren C. Luo, Wei Zen Lee, Jyh Hwa Tzou, and Hou Tin Leong

Intelligent Automation Laboratory

Department of Electrical Engineering, National Chung Cheng University

160 Shang-Shing, Ming-Hsiung, Chia-Yi, Taiwan 621, R.O.C

Email: luo@ia.ee.ccu.edu.tw, wlee@ia.ee.ccu.edu.tw

<http://www.ia.ee.ccu.edu.tw>

Abstract

Automated tele-control of Rapid Prototyping Machine via Internet for the application of tele-manufacturing system is presented. The main features of this system are that users just need a general-purpose computer and a World Wide Web browser, for commanding the rapid prototyping machine in a remote location through Internet and Home Page. Hardware configuration of this architecture includes a thermal extrusion based layer-deposition rapid prototyping machine and several controllers, each of them is able to communicate with others via computer network. Software design includes the user interface, model slicing process, model support generation, and tool path generation. The system has extensive capabilities for teleoperation and other multimedia services. The system allows users to directly control our rapid prototyping machine via the Internet and access our Home Page through a friendly user interface. Also the remote user can receive real time images e.g. the completed rapid prototyping model parts captured by a CCD camera that is mounted on the rapid prototyping machine.

Introduction

Various remote control systems had been performed for manufacturing, underwater manipulation, space exploration, satellite repair [2-3], etc. The control commands and remote sensing measurements.

As mentioned previously, RP machine becomes a powerful tool for increased productivity, however, rapid prototyping machine is still too expensive to offer many companies. Therefore, it can be very useful and effective if we can let RP manufacturing to the universal access via Internet and make prototype production cheaper and easier. The key feature of this system is to make it transparent and simple enough to give users good results each time [4]. User can upload STL (stereolithography Interface) files of models they

have designed to our WWW server remotely. There are several pre-processes need to be performed before building up model, which include model slicing, support creating, and the working path generation for the rapid prototyping machine. After completing these pre-processes, user can send a model building command to the server and the server can then control the rapid prototyping machine to build up a physical model locally. When the RP model is completed, the remote user can examine the RP model through live image via Internet transmitted from the CCD camera mounted on the RP machine.

2. Hardware System Configuration

The hardware system configuration of this system, as shown in Figure 1, includes thermal extrusion based Rapid Prototyping machine developed in the Intelligent Automation Lab at National Chung Cheng University, the WWW server, CCD cameras and remote computer accesses, several computers.

The Rapid Prototyping machine uses ABS powder as object building material. The main features of this system are to build up a physical object model through the deposition of filling materials extruded from the thermal barrel and processed layer by layer.

A general-purpose computer is used as a server which receives client's request from remote world wide network. World Wide Web users can use IBM PC, Macintosh, workstation, etc to communicate with the server via Internet.

2.1 Brief Description of The Thermal Extrusion Based Rapid Prototyping Machine

The basic hardware configuration of the Rapid Prototyping machine structure are illustrated in Figure 2. It includes three independent axes working table, a thermal extrusion head, a temperature control system,

and a PC-based control system. XYZ Three axes are equipped with high precision ball screw and are driven through AC servomotor.

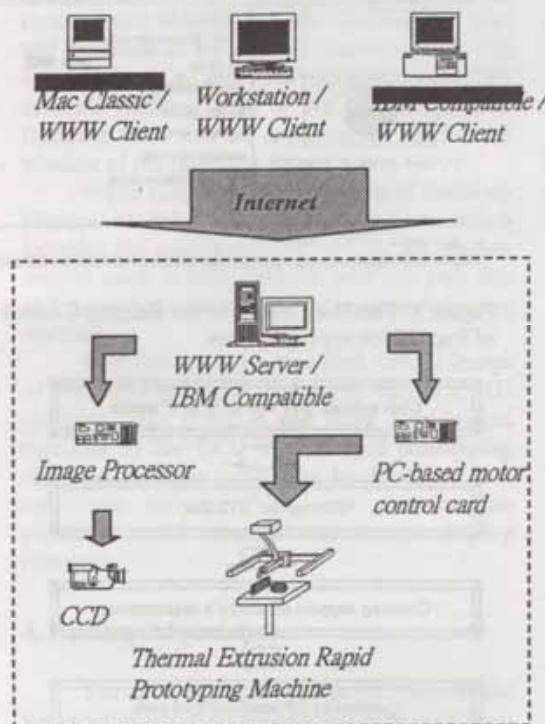


Figure 1. The Hardware Configuration of The Automated Tele-Manufacturing System.

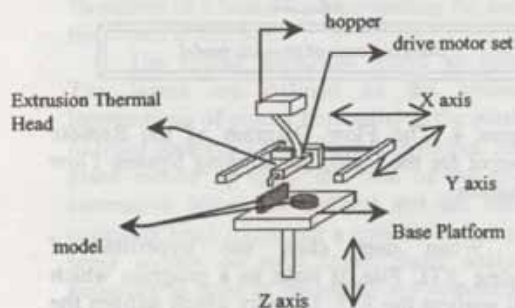


Figure 2. The Configuration of the Thermal Extrusion Based Rapid Prototyping System.

In order to mechanically build-up each successive layer, three AC servo motors are provided to selectively move the base platform and the thermal extrusion head relative to each other in a predetermined pattern along "X" and "Y" axes while the model building material is

being thermally extruded. Relative vertical movement along "Z" axis is carried out after the completion of each layer to achieve desired layer shape and thickness.

2.2 Motion Control System

We have used a PC-based motion control card to control the 3-axes motion of the working table of the RP machine. It consists of an intelligent motherboard populated with four intelligent plug-in function modules. There are on-board linear interpolation, circular contouring, and continuous path motion functions and dual-ported memory for high-speed communications.

2.3 Vision System

The vision hardware consists of an onboard image processor and a single camera mounted in Rapid Prototyping machine. The image processor is a 50MHz TMS320C44 DSP and it has a PCI supporting bus master mode for fast data transfers to the host PC. It allows us to perform all the computation of vision program on board. As a result, the vision algorithm will not occupy the time of main processor system.

3. Software Design

Based on the hardware configuration, software design of the system consists of the assignment of the server, communication between WWW Server and Rapid Prototyping Machine, and the user interface.

User just need to upload STL file of CAD model from remote site to our server. The STL file which is a standard format for transferring the CAD data to rapid prototyping machines uses a faceted description of the computer model. The STL file is a list of triangular facets representing the surfaces of the object to be built together with a unit normal vector associated with the outer surface of each triangle.

Our Rapid Prototyping machine requires that physical model be stabilized during layer fabrication to prevent the distortion of unsupported areas. Therefore, the fabrication processes require that a separate support structure be designed, added to the model geometry file, and then fabricated as a part of the physical model concurrently.

To start the model building process the three dimensional representation of the object

are converted into a series of thin cross sectional layers by intersecting a series of planes with the STL file representation in a process called "Slicing". Each two dimensional cross section is a set of closed areas that must be filled with a solid material. A physical model is formed by sequentially building and stacking the thin two dimensional layers to form a complete three dimensional object.

The motion control consists of Applications Programming Interface (API) which provides a high level function call interface to PC-based motion control card. The API can be programmed in C or C++.

3.1 Assignment of the WWW Server

The WWW server is responsible for the commands sent from remote user and call the CGI (Common Gateway Interface) programs correspond to the receiving command. The CGI programs is then executed to transmit the related commands to the RP softwares, such as slicing, support creating, path generation program, and motion control of rapid prototyping machine. During the model building process and after the completion of the physical RP model, the sever can transmit the image data through Internet to the remote Web browser.

3.2 User Interface

The user interface is shown is Figure 3 captured from a Web Browser of Microsoft Internet Explorer when we perform remote control via a LAN (Local Area Network). There are four major parts in the interface, which include Homepage Title, Model STL file or Slicing Illustration, Process Control Window, and Estimate Building Time of Physical Model. There are six hyperlinks which include Upload .STL File, Support Creating, Slicing .STL File, Generate Machine Working Path, Build up Physical Model, and Show Image of the Physical Model in the Process Control Window. The Flow Diagram of the remote control system is illustrated in Figure 4.

First, user clicks the hyperlink of Upload STL File and it links to a program, which will ask user to upload a STL file format and save it in the hard disk of the server. Then the STL file will be illustrated in left window of the interface. User can orient the STL file with moving, rotation or scaling commands and the illustration of STL file will be refreshed by the orienting.

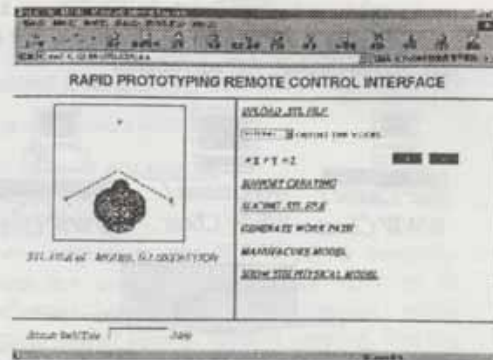


Figure 3. The User Interface for Remote Control of Rapid Prototyping System.

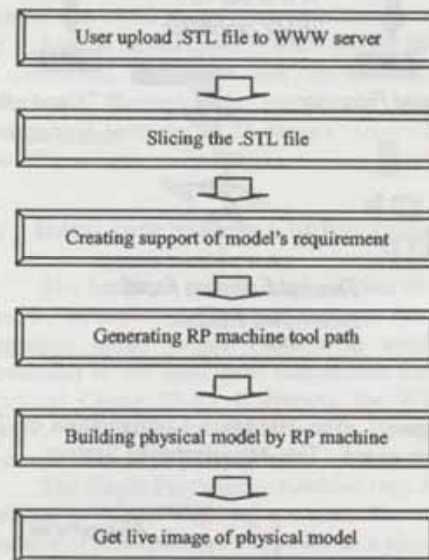


Figure 4. The Flow Diagram of the Remote Control for the Rapid prototyping System Flow Diagram.

When user click the hyperlink of Slicing .STL File, it links to a program which will analyze the STL file part which defines the model to be fabricated and slices the model into layer cross-sections. Each slice consists of one or more curves that follow the shape of the part at the particular height. The description of the slicing algorithm is briefly described in Section 4. The illustration of the STL file slicing illustration will be displayed in the left window of the interface.

User clicks the hyperlink of Create Support of Model and it links to a program, which can generate support required to build the physical model.

After performing Support Generation, user clicks the hyperlink of Generate Machine Tool Path and it links to a program, which makes up extrusion head's tool path which can fill the cross-section boundaries. The working path data and extrusion of the thermal extrusion head will be saved as a file. The program will also estimate building time of the physical model. Building time will be displayed in the bottom window of the Interface.

When user click the hyperlink of Build up Physical Model and it links to a program, which includes the motion control API for the motion control card. It will read the working path file and control the motion of the rapid prototyping machine.

User can click the hyperlink "Show Image of the Physical Model" and it will link to a CGI program. This program can show live images captured by the CCD in our rapid prototyping machine. And the image can be displayed in a new web browser. User can examine the physical model through the image display remotely.

4. Slicing Algorithm

The cross section boundaries required for the rapid prototyping process are generated from intersecting a plane with the STL file object. This is generally referred to as the slicing process. From a geometric modeling perspective, the intersection process should result in the formation of a boundary representing the wall of the object at that layer.

The slicing algorithm works as follows. The layers are defined as the geometric intersections of planes horizontal to the platform of rapid prototyping machine with object. As the plane moves up from the base of the object, successive layers are defined and the thermal extrusion head traces out a contour defining the cross section on each layer. Basic analytical geometry is used to determine the intersections, which are then stored in a dynamic array. Each facet that intersects the plane will form a directed line segment on the planar slice. These intersection lines will define the contour. The intersections are not found in any particular order, so the vectors must now be sorted in head-to-tail fashion in order to derive a closed contour on that slice.

5. Tool Path Generation

The generation of the tool path is the final

stage before fabricating the part. The first step in the process of generating the final tool path is to define a general path pattern; there are three types of tool path patterns: Linear, Zig-Zag and Spiral (Figure 5)

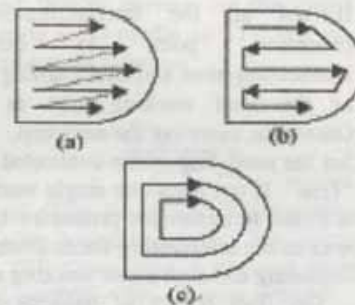


Figure 5. Three Types of Tool Path. (a)Linear; (b)Zig-Zag; (c)Spiral

[Tool Path Algorithm] Generation of Zig-Zag tool path

- (1) For each layer, put its contour edges in a single list.
- (2) For all contours in one layer, we define x_{min} as left boundary and x_{max} as right boundary. Make a set of successive infinite parallel lines in the region of $[x_{min}, x_{max}]$. The distance of the parallel lines is equal to the diameter of the deposited material(d).

infinite parallel lines: $x = x_{min} + d \cdot i$

where

$$x_{min} \leq x \leq x_{max}$$

$i \in \text{integer}$

- (3) Generate intersection points by intersecting the contours with the infinite lines. The used_flags of all intersection points are set to be "False".
- (4) After read in the intersecting points of intersecting zone #i, we define the intersecting points as $P_{i1}, P_{i2}, \dots, P_{in}$ by its value of y coordinate.
- (5) From the result of observation, we find $\overline{P_{i1}P_{i2}}, \overline{P_{i3}P_{i4}}, \dots$ are working segments and $\overline{P_{i2}P_{i3}}, \overline{P_{i4}P_{i5}}$ are not working segments. So we get the following result:
The working segments :

$$\overline{P_{i(2k+1)}P_{i(2k+2)}}, k=0,1,2, \dots$$

- (6) From the left boundary of working segments, we first connect $\overline{P_{i1}P_{i2}}$ in intersecting zone #1. If there is a point P_{i22} (in intersecting zone #2) on the same contour with point P_{i2} , connect $\overline{P_{i2}P_{i22}}$ and then $\overline{P_{i22}P_{i21}}$. Following this procedure, we can

connect the intersecting points in the same working area with Zig-Zag tool path. Until there is no adjacent point on the same contour, working area 1 is discovered. [see Figure 6(a)]

- (7) If not all the intersecting-zones are processed, point to the next intersecting-zone and find Zig-Zag tool path of the next working area as step 6. Otherwise, carry out the next step.
- (8) Set the used flag of the connected points as "True". If not even one single working area is found, terminate the procedure. Otherwise, read in the intersecting-zones from the very beginning and start a new working area.

The final results of working areas are shown in Figure 6(b).

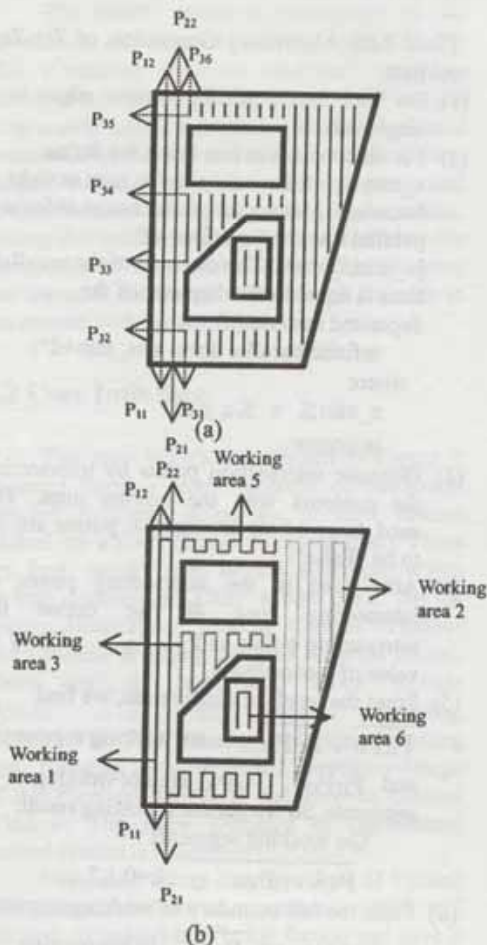


Figure 6. Tool Path Generation Process

6. Experimental Implementation:

To demonstrate the concept, we have created a 3D model with a CAD software-

PRO/ENGINEER, and exported it as a STL file. It is shown in Figure 7.

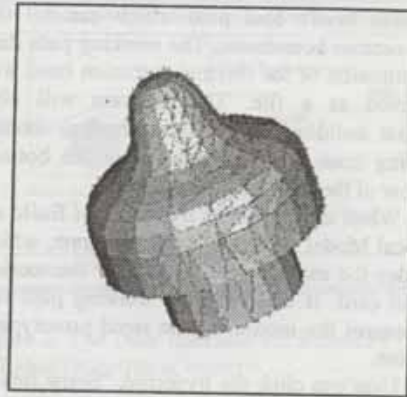


Figure 7. A Model of STL Format.

Then we upload the file to WWW server of remote control interface. It is shown in Figure 3. The model of STL file is shown in left window of the interface. Slicing Process can analyze the model part that defines the model to be fabricated and slices the model into layer by layer cross-sections. Since the model needs support to avoid model structural fail or collapse, support creating process can generate support during model building process. The cross sections are shown in left window of the interface as shown Figure 8.

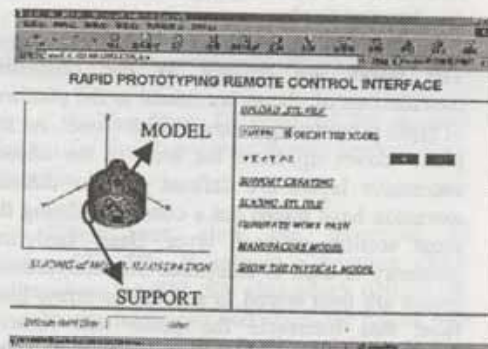


Figure 8. Illustration of Model Slicing.

Then the Generate Machine Tool Path Process generates the Tool path and extrusion of the thermal extrusion head. Those data will be saved as a file. When the re-process finished, the server sends command to control the rapid prototyping machine to build up physical model. We can get a live image of physical model in

rapid prototyping machine by CCD as shown in Figure 9.

When the model is completed, we can remove the support part and get the physical model as shown in Figure 10.

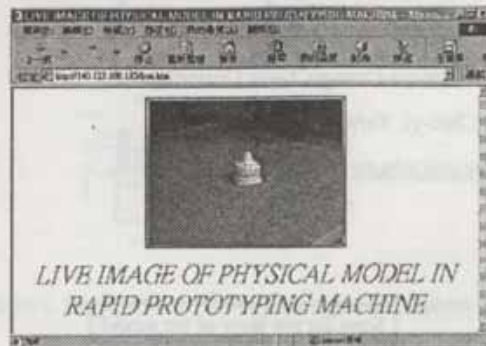


Figure 9. A Live Image of Physical Model in Rapid Prototyping Machine.



Figure 10. Completed Physical Model.

6. Conclusions

Rapid prototyping system has been used for a variety of applications extensively. The remote control system has proven itself as a feasible and useful tool to share our rapid prototyping machine with others via Internet. Through the World Wide Web browser one can directly build a physical model with rapid prototyping machine, and receives the live images of the physical model in the rapid prototyping machine.

The main features of the system can be described as follows:

1. A Rapid Prototyping machine can be shared and accessed through Internet to

reduce the capital investment on expensive RP machine.

2. No restrictions of computer platform on remote user site.
3. The client will need only 3D CAD software and WWW browser on the client site to create a 3D model as STL file, no special software is required.

Reference

- [1] Chua Chee Kai, "Three-dimensional rapid prototyping technologies and key development areas", IEE Computing & Control Engineering Journal, pp. 200 ~ 206, August 1994.
- [2] Hagen Schempf, "Neptune: Above-Ground Storage Tank Inspection Robot System", Proceedings 1994 IEEE International Conference on Robotics and Automation, vol.2, pp. 1403~1408.
- [3] Lynn Conway, Richard A. Volz, and Michael W. Walker, "Teleautonomous System: Projection and Coordinating Intelligent Action at a Distance", IEEE Transaction on Robotic and Automation, Vol. 6, No. 2, pp. 146~158, April 1990.
- [4] Michael J. Bailey, "Tele-Manufacturing: Rapid Prototyping on the Internet", IEEE Computer Graphics and Applications Journal, pp.20~26, November 1995.
- [5] Ya Wei Ma, "Representation and Slicing of Freeform 3-D Geometric Models for Desktop Prototyping and Manufacturing", A dissertation submitted to the Graduate Faculty of North California State University, 1995.
- [6] Jerome L. Johnson, *Principles of Computer Automated Fabrication*, Palatino Press Inc, 1994.
- [7] Y. Koren, C. C. Lo and M. Shpitalni, "CNC interpolators: Algorithms and Analysis", Manufacturing Science and Engineering, PED-VOL. 64, ASME, 1993

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Co-Chair: Jian Chen

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On the Approximation Capability of Neural Networks using Bell-Shaped and Sigmoidal Functions
Ion Ciuca, Research Institute for Informatics, Romania 1845

A Highly Linear Voltage Controlled Resistor for Neural Chip
Sung-Dae Lee, Ansan Technical College; Won-Hyo Lee and Kang-Min Chung, SungKyunKwan University, Korea 1851

CMOS Artificial Neuron on the Base of B-Driven Threshold Element
Victor Varshavski, The University of Aizu 1857

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Chair: Jian Chen

Co-Chair: N. Mani

Network of Dynamic Neurons in Fault Detection Systems
Jozef Korbicz, Andrzej Obuchowicz and Krzysztof Patan, Technical University of Zielona Gora, Poland 1862

Time Series Prediction using RNN in Multi-dimension Embedding Phase Space
Jun Zhang, City University of Hong Kong; K.F. Man, City University of Hong Kong, China 1868

Machine Learning Algorithms for Fault Diagnosis in Analog Circuits
Vivek Rajan, University of Connecticut; Jie Ying, Sumangal Chakrabarty and Krishna Pattipati, University of Connecticut, USA 1874

Fault Detection and Isolation for Robotic Systems Using a Multilayer Perceptron and a Radial Basis Function Network
Marco Henrique Terra and Renato Tinós, University of Sao Paulo, Brazil 1880

Neural Networks Realization of Searching Models for Nash Equilibrium Points and their Application to Associative Memories
Ryota Horie, Keio University; Eitaro Aiyoshi, Keio University, Japan 1886

- A Three-Stage Greedy and Neural-Network Approach for the Subgraph Isomorphism Problem
Nobuo Funabiki, and Junji Kitamichi, Osaka University, Japan 1892

MA08: Design of Fuzzy Logic Controllers

Chair: M. G. Singh
Co-Chair: Farooq Azam

- Hybrid Fuzzy Two-stage Controller for Induction Motor
K.L Shi, T.F. Chan and Y.K. Wong, Hong Kong Polytechnic University 1898

- An Hybrid Digital Neuro-Fuzzy Board for Control of Complex Systems
Marcello Chiaberge, Eduardo Miranda and Leonardo Reyneri, Politecnico di Torino, Italy 1904

- Derivation and Analysis of Three-input Inference for Fuzzy PID Controllers
G.K.I Mann, Memorial University of Newfoundland; BaoGang Hu, Institute of Automation, China; R.G. Gosine, Memorial University of Newfoundland, Canada 1910

- Nonlinear Variation Analysis of One-input Fuzzy PID Controllers
BaoGang Hu, Institute of Automation; G.K.I. Mann and R.G. Gosine, Memorial University of Newfoundland, Canada 1916

- A New Approach to Design of an Adaptive Fuzzy Logic Control System
Branko Novakovic, Bozo Vranjes and Dario Novakovic, FSB- University of Zagreb, Croatia 1922

MP08: Fuzzy Data, Models and Automata

Chair: M. Jamshidi
Co-Chair: C.-H. Wang

- Knowledge Acquisition from Input-Output Data by Fuzzy-Neural Systems
Chen-Sen Ouyang and Shie-Jue Lee, National Sun Yat-Sen University, Taiwan, R.O.C. 1928

- Generation of Fuzzy Models via Evolutionary Strategies
Thomas Sudkamp and Daniel Spiegel, Wright State University, USA 1934

- Fuzzy Data Recall using Polynominal Bidirectional Hetero-correlator
Chua-Chin Wang, National Sun Yat-Sen University; Cheng-Fa Tsai, National Sun Yat-Sen University, Taiwan 1940

- State Minimization of Fuzzy Automation
Maw-Sheng Horng, National Taipei Teachers College 1946

- On-Line Quantification of the Continuous-Discrete Structure of Reactive Real Time Systems using Hybrid Fuzzy-Boolean Automata
Janos L. Grantner and Hamed Shakouri, Western Michigan University, USA; George Fodor, ABB Industrial Systems AB, USA 1950

- On System Identification via Fuzzy Clustering for Fuzzy Modeling
Hsuan-Shih Lee, National Taiwan Ocean University 1956

MQ08: Semantic and Logic

Chair: Shigeki Sugiyama
Co-Chair: Burham Turksen

- Fuzzy System Identification Method for Cognitive and Decision Processes
P. Varlaki, L.T. Koczy and L. Nadai, Technical University of Budapest, Hungary 1962

- Stochastic Bi-directional Training
T.D. Gedeon, University of New South Wales, Australia 1968

- Skill-Based PID Control by using Neural Networks
Sigeru Omatu and Michifumi Yoshioka, Osaka Prefecture University, Japan; Takeshi Iwasa, Anan Technical College, Japan 1972

- Self Evolving Dynamic Knowledge Base
Shigeki Sugiyama, Softopia Japan, Japan 1978

- Intelligent Information Retrieval using Fuzzy Approach
Laszlo T. Koczy and Peter Baranyi, Technical University of Budapest, Hungary; Tamas D. Gedeon, The University of New South Wales, Australia 1984

TA08: Advances in Fuzzy Logic Control

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On SMC-based Indirect Adaptive Fuzzy Control
*Jen-Yang Chen, China Institute of Technology and
Commerce* 1990

Lateral Guidance of an Autonomous Vehicle by a Fuzzy
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*Zyed Zalila, University of Technology of Compiègne;
Frederic Bonnay, University of Technology of
Compiègne, France; Florent Coffin, Renault -
Research Division, France* 1996

Fuzzy Logic Control of Flexible Link Manipulators -
Controller Design and Experimental Demonstrations
*James X. Lee, Canadian Space Agency; George
Vukovich, Canadian Space Agency, Canada* ... 2002

Domain Decomposition for the Fuzzy Modeling of
Dynamic Systems with Periodic Forced Oscillations
Ellen Applebaum, University of Colorado 2008

Qualified Decision-making using the Fuzzy Relation
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*Hayao Miyagi, University of the Ryukyus; Ichico Kinjo
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TP08: New Developments in Fuzzy Logic Methods

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A New Resolution of Fuzzy Regression Analysis
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The Credibilistic Fuzzy C Means Clustering Algorithm
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Howard University, USA 4794

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Chair: Sheldon Chang

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Stony Brook, USA 4800

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Brook, USA 4805

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Caroline Childress, Department of Sociology,
University at Stony Brook, NY, USA *

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USA *

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Tsinghua University, China 4809

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Co-Chair: Keith W. Hipel

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USA 4815

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Chair: Liping Fang

Co-Chair: Keith W. Hipel

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WQ18: Software Engineering and Systems

Chair: A. M. Ferraro

Co-Chair: Nisse Husberg

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John W. Priest, University of Texas at Arlington; Gail Haddock, The University of Texas at Arlington, USA; Lisa Burnell, Texas Wesleyan University, USA; John Silva, Defence Science Office, USA 4866

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No-search Approach in Linguistic Geometry: Construction of Strategies

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MQ19: Linguistic Geometry Tools Implementations

Chair: Boris Stilman

A UML Based Notation for Specifying Abstract Board Games

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TP19: Panel Discussion: New Frontiers in Information/Intelligent Systems

Panel Discussion: New Frontiers in Information/Intelligent Systems

Lotfi A. Zadeh *

TQ19: Best Student Paper Competition

Chair: Julie Adams

* Paper unavailable at time of printing

Defect Detection in Indirect Layered Manufacturing

Izzat Bakhadyrov,
Mohsen A. Jafari¹, Tong Fang
Dept. of Industrial Engineering,
Rutgers University,
Piscataway, NJ 08854 USA

Ahmad Safari, Stephen Danforth
Dept. of Ceramic and Material
Engineering, Rutgers University
Piscataway, NJ 08854 USA

Noshir Langrana
Dept. of Mechanical Engineering,
Rutgers University
Piscataway, NJ 08854 USA

ABSTRACT

Direct Layered Manufacturing (LM) is an additive manufacturing process where part is built layer by layer based on its CAD file. Indirect LM is a process where mold for a part is built by direct LM process. In this work we demonstrate a machine vision setup for surface voids detection which can be used for surface quality inspection of parts built by indirect LM and certain direct LM techniques.

INTRODUCTION.

During last twenty year the use of Machine vision for Industrial inspection applications has progressed enormously. At the beginning its growth was constrained by considerably high computational requirements of image processing. But recently, due to the extreme advances in computer technology and also dramatic decrease of computer prices, machine vision systems has become more and more affordable and popular. Now they are intensively used in industry, significantly increasing the quality of manufacturing processes.

Basic advantages of machine vision for inspection applications are obvious: possibility of work in hazardous environment, non-destructive process, and high precision. There have been a number of successful applications of machine vision for inspection of surfaces of aircraft bodies [1] and engines [2], technical ceramics

[3], textile fabrics [4], lace [5], semiconductor wafermaps [6], etc.

Layered Manufacturing (LM), or Solid Free-Form Manufacturing (SFF), which is a new area in Rapid Prototyping, has been widely explored recently. LM process starts with a 3-D CAD model of a part. Currently industrial standard for the CAD data is .STL format, the collection of triangular facets, representing the surface of the object. Then, CAD model is sliced into a set of 2-D contours by intersecting it with set of horizontal planes. Next step is the toolpath generation – filling the interior of each slice by lines of different patterns: contours and rasters. At the fabrication stage, material is deposited from the liquefier, following the toolpath, layer by layer. The width of each deposited road depends on the width of liquefier nozzle, material type and parameters, etc. First, the boundary for each layer is fabricated following the contour curve to achieve a better smoothness. Then, the interior is filled by raster. Commonly, parts are fabricated with 90° alternating rasters between consecutive layers which results in a stronger part [7]. However, for some applications (e.g. piezoelectric actuators) quite different tool-path generation methods can be used. In indirect LM process the mold is built using direct LM technique and part itself is produced filling this mold.

It can be easily seen that errors in each layer in direct LM process can be and must be detected and fixed before going to consecutive layer. For some complicated

¹ All correspondence must be directed to this co-author

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parts LM process can take many hours, and for some materials, e.g. ceramics, even a small number of defects can be critical and can lead to a defective part. Hence, quick and precise quality inspection of each layer becomes very important step in the direct LM process. Machine Vision seems to be the best candidate tool for this inspection. Using optical sensing one will be able to monitor each layer after it is built and before the next layer is deposited, detecting defects and feeding back their location and size information to machine in order to correct them. The precision of optical equipment and affordability of CCD cameras make this application quite reasonable and promising. In indirect LM process surface inspection can also be very useful. In some applications, quality check of the mold and surface check of the part itself may be necessary. Also, for some materials used surface structure of part can reflect its bulk texture, which makes surface inspection extremely important step in the determination of part quality.

We studied square ceramic samples and experimental wrench sample. Green ceramic samples were fabricated of PZT (piezoelectric ceramic) powder with binder using direct LM technique with zero offset between raster roads, i.e. offset between any two tool-path raster roads was set equal to single road-width. Thus, each actual raster road was supposed to touch the adjacent roads, and any surface voids were not supposed to occur. Raster and contour roads were designed to overlap. Therefore, any voids on the surface can be characterized as defects, and voids detection, performed on each layer, would significantly increase the resulting quality.

Wrench sample was fabricated of metallic powder with binder by indirect LM technique. Assuming uniformity of its structure, we can say, that the distribution of voids on the wrench surface is similar to one in its volume. Hence, performing surface inspection on green sample of wrench would be helpful in determining its quality, which is rather important for hard tools.

MACHINE VISION SETUP.

Machine Vision setup used in our study is schematically shown on Fig.1. PULNIX TM-9701 CCD camera with NAVSTAR optical magnifying and polarizing equipment was set vertically. FOSTEC A20520.2 lighting setup was used to illuminate the sample surface. Two optical fiber goosenecks with polarizing caps were used as a beam light sources, directed at small angle to surface ($\sim 10^\circ$) to make surface voids appear distinctly on the image by double shading them. (Fig.2.) This lighting setup is similar to ones used in [1], [3]. Polarized light was used when inspecting ceramic samples to remove glares caused by direct reflection and obtain "smoother" image. We could not use polarized light for wrench inspection because of higher light absorption coefficient of its material, significant light intensity loss during polarizing and limited power of our light source.

Images were captured by μ Tech MV-2000 frame grabber board and saved as 640x480 uncompressed greyscale bitmap (.BMP) file, in which value of 0 corresponded to black color, 255 – to white color, and values between 0 and 255 – to intermediate levels of gray. Pixel size was set $10 \times 10 \mu\text{m}$ for ceramic samples, and to $15 \times 15 \mu\text{m}$ for wrench sample.

Single image captured by the camera contained only part of the sample surface, due to high precision requirements, constrained FOV (field-of-view) of camera and large sample size. Therefore, single images were to be mosaiced into one large image of the whole surface. In this work mosaicing was done manually by placing the samples onto positioning table and capturing images with certain horizontal and vertical shifts. In the on-line process mosaicing will be performed by positioning the camera, firmly attached to liquefier head, into certain points above the sample being built and capturing single images. Coordinates of these points can be calculated based on slice data and camera's magnification and FOV parameters. On-line mosaicing can be done with a rather high precision due to high precision of the LM machine positioning system. Also, no special sample-background segmentation was made, given that information about the slice contours would be provided in an on-line process.

IMAGE PROCESSING.

Image processing programs were written on MathWorks MatLab script using MatLab Image Processing Toolbox functions. Computations were performed on Gateway2000 E-3100 computer with Intel PentiumII 266 MHz processor and 64 Mb of RAM.

Before processing, image of wrench was enhanced. Due to "powder" structure of wrench material, direct reflection from some metallic particles appeared as small white spots, and absorption, presumably in interparticle microcavities, appeared as small black spots, forming "salt-and-peppa" noise on the input image. (Fig.3) Therefore, median filter with 7x7 mask was applied to remove this noise. (Fig.4) This filtering step was especially necessary since it removed a large number of small (1-3 pixel) black spots, which could be treated as defects and significantly slow down the following defect analysis.

As a result of double shading, voids appeared on the image as black spots, while the rest of surface appeared gray. Unlike other voids detection works [1], [3], where edge detection techniques were used to determine voids, we applied thresholding operation to form binary image containing voids (Fig.5) For wrench sample inspection light was calibrated to use fixed threshold value of 75, and for ceramic sample - of 55. All pixels of greyscale value of threshold and less, was assigned equal to 1 in binary image, and all others to 0. Automatic calculation of threshold by histogram [4] was not considered suitable in our application, since the number of pixels in black spots was significantly less than the number of gray pixels, and, hence, image histogram would not have two distinct peaks. Choosing threshold value by certain percentage of number of pixels having greyscale value less than threshold, was also not suitable, since the percentage of voids, and, therefore, black pixels, was not known.

For labeling, we defined an object as a set of pixels with values, equal to "1", where 4-connected (considering only two horizontal and 2 vertical closest neighbors) or 8-connected (considering also diagonal neighbors) neighborhood of each pixel contains pixels of

value "1". Labeling operation changes all "1" valued pixels of the specific object into specific number "n", where n starts with 1 for the first found object and increases by one for the next found object.

Since all objects are now different, we can now extract each object's features, such as size and location. First, we scan the image, storing the number of times each label value is found and the first and the last x- and y-coordinates it is found at, in an element of a vector $q[n]$, where q is the vector of certain characteristic. (size, etc.) It is seen at once that these vectors are very useful for the future analysis. Number of elements in the size vector is number of voids found, and we are now able to analyze the distribution of defect sizes. For example, the largest or the smallest void, or the number of voids of a certain size can be obtained easily and very quickly. Hence, for further operation with a certain voids, e.g., studying of a void shape, or generation of correcting tool-path, we narrow our work area from the whole image into a much smaller sub-image, which extremely decreases the processing time.

Fig.6 shows labeled voids with a size > 10 pixels. Centers of constraining rectangles are marked with circles. Figs.7-10 show the application of this detection technique to a sample made of ceramic material.

The structure of parts, fabricated by direct LM process with different parameters, may be significantly different than the ones studied in this work. For instance, parts built with positive offset parameter, have gaps between roads, which are made intentionally. These gaps would be wrongly detected as errors by our method. Also, setting negative offset parameter, i.e. overlap of adjacent roads, significantly decreases the risk of voids occurrence, but causes bumps along the raster roads due to double material deposition. These bumps can cause shadows, which would be detected as "false voids" by this technique. For these cases, different methods using texture approach and process signature analysis can be applied [8].

CONCLUSION.

Machine Vision setup has been designed for detection of surface defects (voids) in indirect and "zero-offset" direct LM process. Use of special lighting allowed exploring one-camera setup, which made inspection process much faster and more affordable. Computation efficient algorithms were designed and used for image processing.

REFERENCES.

- [1] P.Gunatilake, M.W.Siegel, A.J.Jordan, G.Podnar, "Image Understanding For Remote Inspection Of Aircraft Surfaces", ", *Machine Vision Applications in Industrial Inspection V*, SPIE, San Jose, California, SPIE Proceedings vol. 3029, pp. 2-13.
- [2] Y.Tang, A.Niu, W.G.We, and Ch.Y.Han, "An Automated Inspection System For Detecting Metal Surface Cracks From Fluorescent Penetrant Images," *Machine Vision Applications in Industrial Inspection III*, SPIE, San Jose, California, SPIE Proceedings vol. 2423, pp. 278-291.
- [3] D.R.Patek , K.W.Tobin, and L.Latcher, "Machine Vision Inspection Of Technical Ceramics," *Machine Vision Applications in Industrial Inspection IV*, SPIE, San Jose, California, SPIE Proceedings vol. 2665, pp. 253-257.
- [4] I.M.Dar, W.Mahmood, and G.Vachtsevanos, "Automated Pilling Detection and Fuzzy Classification of Textile Fabrics", *Machine Vision Applications in Industrial Inspection III*, SPIE, San Jose, California, SPIE Proceedings vol. 2665, pp. 108-119.
- [5] C.Sandby and L.Norton-Wayne, "Machine Vision Inspection Of Lace Using A Neural Network," *Machine Vision Applications in Industrial Inspection III*, SPIE, San Jose, California, SPIE Proceedings vol. 2423, pp. 314-322.
- [6] K.W.Tobin, S.S.Gleason, and T.P.Karnovski, "Automatic Classification of Spatial Signatures On Semiconductor Wafermaps," *SPIE's 22nd Annual International Symposium On Microlithography*, Santa Clara, California, March 9-14, 1997.
- [7] R.V.Weeren, M.Agrawala, V.R.Jamalabad, A.Bandyophaay, R.Vaidyanathan, N.Langarana, A.Safari, P.Whalen, S.C.Danforth, C.Ballard, "Quality of Parts Processed by Fused Position", *Proceedings of the Solid Freeform Fabrication Symposium*, August 1995.
- [8] T.Fang, Mohsen A.Jafari, and I.Bakhadyrov, "On-line Defect Detection in Layered Manufacturing Using Process Signature", *Proceedings of SMC'98 IEEE International Conference on Systems, Man and Cybernetics*, La Jolla, California, October 1998, to be published.

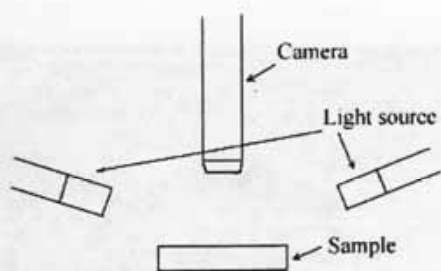


Fig.1. Schematic Machine Vision setup.

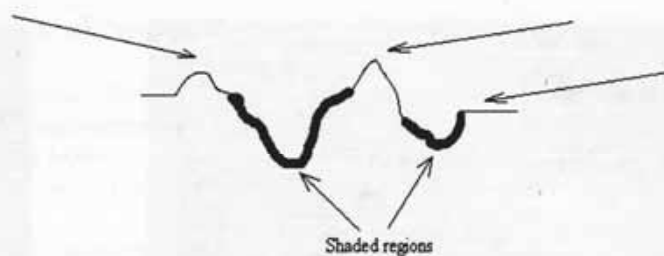


Fig.2. Double shading

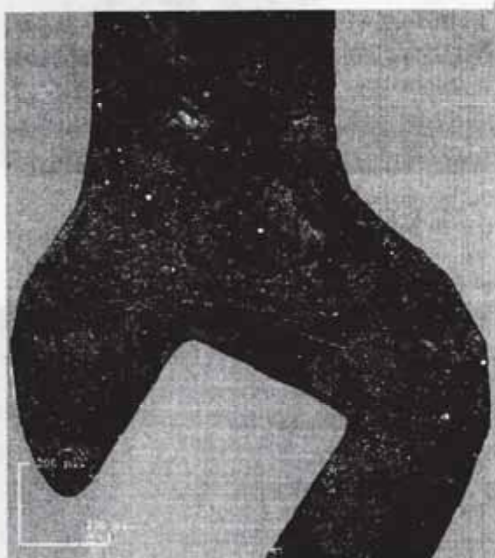


Fig.3. Initial image of the wrench sample



Fig.4. Filtered image of the wrench sample



Fig.5. Image of voids of the wrench sample



Fig.6. Voids location for wrench sample

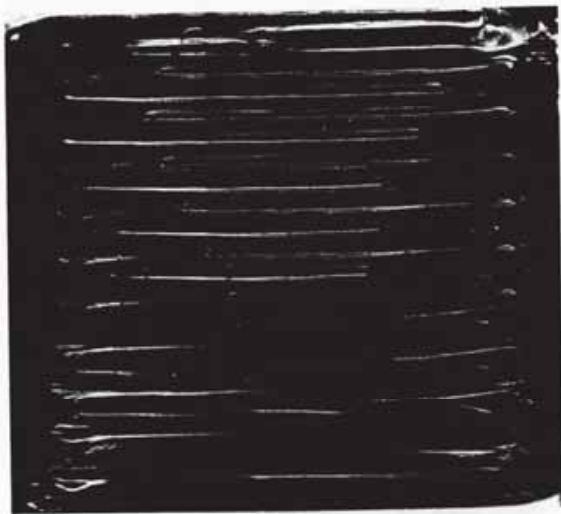


Fig.7. Initial image of ceramic sample

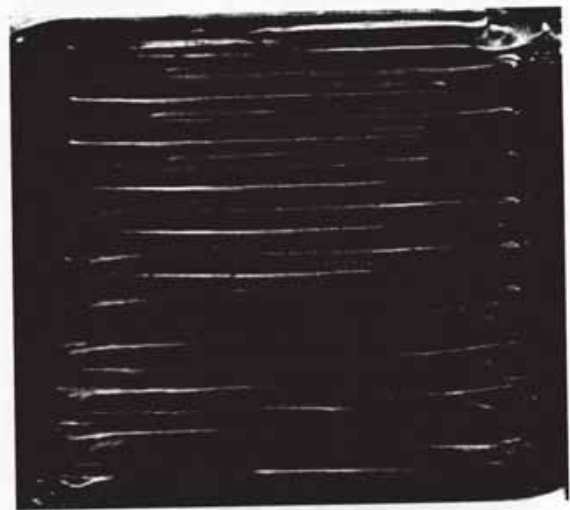


Fig.8. Filtered image of ceramic sample

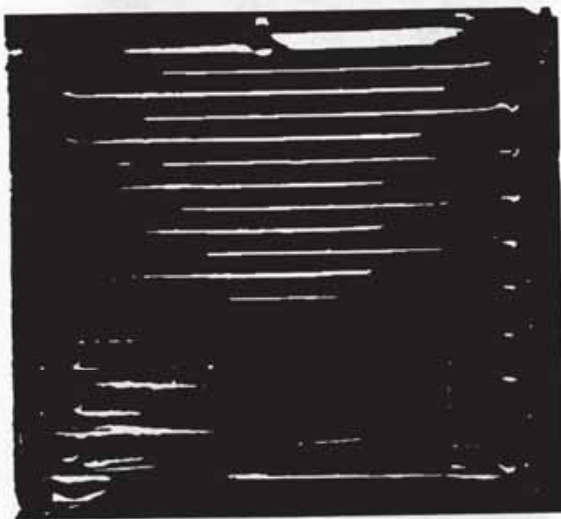


Fig.9. Image of voids of ceramic sample



Fig.10. Voids location for ceramic sample