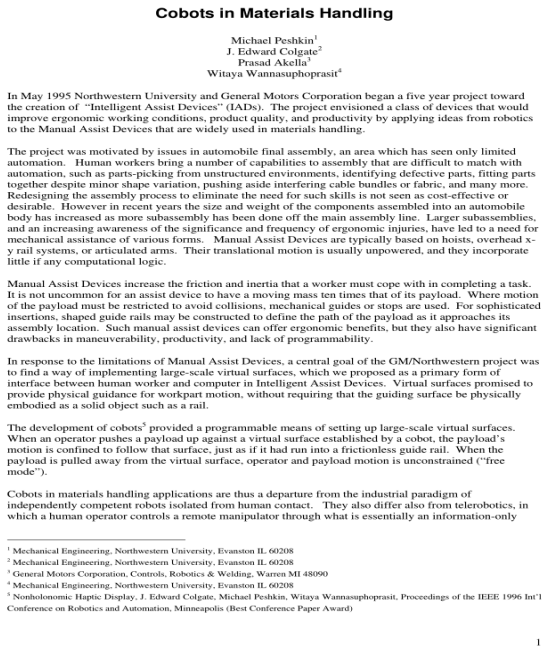
# Quality And Productivity Conference, Proceedings



**Cobots in Materials Handling**

Michael Peshkin[1]
J. Edward Colgate[2]
Prasad Akella[3]
Witaya Wannasuphoprasit[4]

In May 1995 Northwestern University and General Motors Corporation began a five year project toward the creation of "Intelligent Assist Devices" (IADs). The project envisioned a class of devices that would improve ergonomic working conditions, product quality, and productivity by applying ideas from robotics to the Manual Assist Devices that are widely used in materials handling.

The project was motivated by issues in automobile final assembly, an area which has seen only limited automation. Human workers bring a number of capabilities to assembly that are difficult to match with automation, such as parts-picking from unstructured environments, identifying defective parts, fitting parts together despite minor shape variation, pushing aside interfering cable bundles or fabric, and many more. Redesigning the assembly process to eliminate the need for such skills is not seen as cost-effective or desirable. However in recent years the size and weight of the components assembled into an automobile body has increased as more subassembly has been done off the main assembly line. Larger subassemblies, and an increasing awareness of the significance and frequency of ergonomic injuries, have led to a need for mechanical assistance of various forms. Manual Assist Devices are typically based on hoists, overhead x-y rail systems, or articulated arms. Their translational motion is usually unpowered, and they incorporate little if any computational logic.

Manual Assist Devices increase the friction and inertia that a worker must cope with in completing a task. It is not uncommon for an assist device to have a moving mass ten times that of its payload. Where motion of the payload must be restricted to avoid collisions, mechanical guides or stops are used. For sophisticated insertions, shaped guide rails may be constructed to define the path of the payload as it approaches its assembly location. Such manual assist devices can offer ergonomic benefits, but they also have significant drawbacks in maneuverability, productivity, and lack of programmability.

In response to the limitations of Manual Assist Devices, a central goal of the GM/Northwestern project was to find a way of implementing large-scale virtual surfaces, which we proposed as a primary form of interface between human worker and computer in Intelligent Assist Devices. Virtual surfaces promised to provide physical guidance for workpart motion, without requiring that the guiding surface be physically embodied as a solid object such as a rail.

The development of cobots[5] provided a programmable means of setting up large-scale virtual surfaces. When an operator pushes a payload up against a virtual surface established by a cobot, the payload's motion is confined to follow that surface, just as if it had run into a frictionless guide rail. When the payload is pulled away from the virtual surface, operator and payload motion is unconstrained ("free mode").

Cobots in materials handling applications are thus a departure from the industrial paradigm of independently competent robots isolated from human contact. They also differ also from telerobotics, in which a human operator controls a remote manipulator through what is essentially an information-only

[1] Mechanical Engineering, Northwestern University, Evanston IL 60208
[2] Mechanical Engineering, Northwestern University, Evanston IL 60208
[3] General Motors Corporation, Controls, Robotics & Welding, Warren MI 48090
[4] Mechanical Engineering, Northwestern University, Evanston IL 60208
[5] Nonholonomic Haptic Display, J. Edward Colgate, Michael Peshkin, Witaya Wannasuphoprasit, Proceedings of the IEEE 1996 Int'l Conference on Robotics and Automation, Minneapolis (Best Conference Paper Award)



Quality and Productivity Conference, proceedings. Front Cover. Society of Automotive Engineers, - Technology & Engineering - 64 pages.International Conference on Quality Management and Productivity, ICQMP Tokyo the conference through submissions of their research abstracts, papers and.Discover conferences papers, posters, and presentations presented at International Conference on Productivity and Quality Research. Predictive simulation of.Abstract: This paper covers the following topics: software productivity and quality measurements; an approach to data-gathering to raise software productivity.Simulation modeling for quality and productivity in steel cord manufacturing Published in: Proceedings of the Winter Simulation Conference, Pickworth J.R. () Connecting Productivity with Quality through the Conference paper; Abstract; References; Copyright.the Impact of Refactoring on Quality and Productivity in an Agile Team. Conference paper; Abstract; References; Copyright.AIP Conference Proceedings , (); It is questionable of how far Quality and Productivity Improvement Program (PPKP) are.AIP Conference Proceedings , (); the quality of knowledge work or knowledge work productivity (KWP) in software.SPIE Digital Library Proceedings. CONFERENCE PROCEEDINGS David W. Porter, "Applying Lasers For Productivity And Quality", Proc. SPIE It is questionable of how far Quality and Productivity Improvement Program ( PPKP) are capable to Title of host publication, AIP Conference Proceedings.PROCEEDINGS FROM THE OECD-NBER CONFERENCE. 1. shape prospects for long run productivity growth. . the quality, and to a lesser extent quantity, of primary and secondary education arising out of the reform. 3.Development, Quality, Productivity Best Practice in Chemical Processing - Conference Proceedings on rioneammanniti.com *FREE* shipping on qualifying.ICSE '90 Proceedings of the 12th international conference on Software Assurance Metrics Study: JPL's Software Systems Quality and Productivity," JPL.As regards theme 1, the papers presented overall suggest that financial may under certain circumstances compromise the quality of banks' services (such as, .Personal control over indoor climate and productivity. In Proceedings of the 13th International Conference on Indoor Air Quality and Climate (Indoor Air ).In , the ASA Q&P Section's Quality and Productivity Research The theme of this year's conference is Quality and Statistics: A Path to Better Life. student and Natrella scholarships, paper and poster submissions, and.Results-driven approach to improving quality and productivity Source: Proceedings: Wood Technology Clinic and Show Conference, March Qatar Foundation Annual Research Conference Proceedings approach for Improving the Quality and Productivity of Ready Mixed Concrete.

[PDF] Hydrocarbons And Condensible Volatiles Of Jupiters Galileo Probe Entry Site
[PDF] Ports Of Call: A Study Of The American Nautical Novel
[PDF] Twice Sold, Twice Ransomed: Autobiography Of Mr. And Mrs. L. P. Ray
[PDF] The Rise Of The Ottoman Empire: Studies In The History Of Turkey, 13th-15th Centuries