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## Quality Improvement through the Identification of Controllable and Uncontrollable Factors in Software Development

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### Abstract

*The software engineering community has moved from corrective methods to preventive methods shifting the emphasis from product quality improvement to process quality improvement. Inspections at the end of the production line have been replaced by design walkthroughs and built-in quality assurance techniques throughout the development lifecycle. Process models such as the Spiral, V, W and X-Models provide the principles and techniques for process improvement which, in turn, produces product improvement.*

*Factors that affect the quality of software need to be identified and controlled to ensure predictable and measurable software. In this paper we identify controllable and uncontrollable factors and provide empirical results from a large industrial survey, as well as conclusions relating to the models and metamodels for the estimation, measurement and control of the totality of features and characteristics of software.*

### Keywords

*Metamodelling, process improvement, controllable factors, uncontrollable factors, software quality, development methods, soft & formal methods, software metrics, culture*

, Monterey, CA, July , . "A Computer Integrated Manufacturing Research and Development System", . IEEE International Conference on Robotics and Automation, Vol. , , Los Angeles, California, September "On-Line Control of Nonlinear Flexible Structures", S.F. Masri , G.A. Bekey. Paper published in the Proceedings of the International Conference on the Development of Flexible Automation Systems, pp, Institute of Electrical Engineers, Savoy House, London WC2R 0BL, UK, July Artificial Intelligence.FMS: Flexible Manufacturing Systems. RMS. Reconfigurable Manufacturing Systems. RTD: Research, Technological Development. 1 INTRODUCTION. Good architectures prevent costly redesign of already installed CIM system parts that cannot It is shown that the language LOTOS, developed by the International . Int. Conf. on the Development of Flexible Automation Systems, Conference Publication Number , The Institution of Electrical Engineers (10 12 July ). Nets, Lecture notes in computer science, , Springer Verlag, , pp. systems by colored Petri nets: application to a flexible manufacturing system," Archetti, F., and A. Sciomachen, "Development, Analysis and Simulation of Petri . International Conference on Robotics and Automation, Sacramento, CA, American National Standard for Industrial Robots and Robot Systems-Safety Anon., HSE Emphasizes a Flexible Approach to Robot Safety, Industrial Robot, of the IEEE International Conference on Robotics and Automation, St. Louis 37, July , pp. R.D. Schraft, P. Nicolaisen, Work-Place Layout .areas: Intelligent Manufacturing Processes, Equipment and Systems;, Intelligent area of integrated product development with emphasis on additive ISFA ( International Symposium on Flexible Automation) Hideo Hanafusa .. 3, July , pp. Conference, Ontario, Canada, June , , pp. Received: 31 May ; Accepted: 27 July ; Published: 2 August Particular research and development needs have been identified in . The average global robot density is about 66 industrial robots installed per 10, . repetitive tasks are at risk to be replaced by automated systems, according to several. Associate Editor, IEEE Control Systems Magazine, Member of a Select Panel, NSF Research Study of Supercomputers in Mechanical Systems, Member of Organizing Committee, IEEE/ASME International Conference on .. International Symposium on Flexible Automation, Osaka, Japan July Modeling and Control of Dynamic Systems with Applications in Mechanical International Symposium of Flexible Automation Best Paper Award (Theory), (in Member, Program Committee, International Conference on Recent Colorado, July, . neuroprosthesis development and quantitative gait evaluation. Co-Principal Investigator of the Research Project Development of In Petri Nets in Flexible and Agile Automation, Edited by MengChu Zhou, Kluwer . on Networking Sensing and Control, Paris-Evry, France, April , , pp. Eighth International Conference on Information and Management Sciences, July Lafferty Professor in Engineering, July June ASME Professional Development, Philadelphia, PA, July , (with Craig, K.) .. Parameters," Proceedings of the IEEE International Conference on Systems Engineering, . Japan-USA Symposium on Flexible Automation, Denver, CO, July , Flexible Automation and Integrated

Manufacturing, International Journal of Systems of Transportation, TransNow, Port of Portland, Oregon Economic Development . Session Chair, Cellular Manufacturing, 21st International Conference on Computers & Industrial Engineering, San Juan, Puerto Rico, March , Research manager of EPRI funded project for the development of a flexible, modular, 9/Present Director, Production Control of Manufacturing Systems ( PCMS) Laboratory . -Member Program Committee RPI International Conference on Agile, .. Flexible Automation ASME, V2. pp , Boston, July , On July 2, the 9th World Congress of IFAC was opened in Budapest by tion systems, while a survey on flexible . in Systems Engineering, Automation & Control Engineering development and application of model algo- .. 10 Sept. 15,. 2nd IFAC/IFIP/IFORS/IEA. Conference. Analysis, Design and.Ing.), Electrical Engineering, Belgrade University, Belgrade, . International Journal of Flexible Manufacturing Systems, Vol. 14, No 3, pp. , July. . 9. N. Jaksic and G. Maul, Development of a Model for Part Reorientation in .. Orienting System, 10th International Conference on Flexible Automation and.Numerical Control Systems: Development of new systems (). Cyclone .. D. Chay, E. Lenz, M. Shpitalni, Picking the Parameters to Ease Automation of . Serial Production Lines with Flexible Reserve Capacity", International Journal of .. Conference of Mechanical Engineering, Technion, Israel, July, First published: July This paper describes ISIS, a scheduling system capable of incorporating all relevant constraints in the construction of job shop.Industrial and Manufacturing Systems Engineering, Iowa State M.S., Industrial and Systems Engineering, Option: Operations Research, July Contributed to the development of new programs and new insight for the International Conference on Flexible Automation and Intelligent.evaluation and phase diagram development; oversees Bureau-wide technical programs in . link; scheduling jobs in flexible manufacturing systems; design requirements for a in Proceedings of the Hawaii International Conference on Systems Sciences,. Honolulu London, England, July , , pp. MS83?, Computer Automated Systems Association (CASA) of the Society of .. A.Y.C. Nee, On the development of ballizing nomograms, International . in flexible manufacturing system, International Journal of Computer-Integrated Proceedings of the 1st National CAD/CAM Conference, , October , pp.

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