

ROBOTICA

INTERNATIONAL JOURNAL OF INFORMATION, EDUCATION & RESEARCH
IN ROBOTICS & ARTIFICIAL INTELLIGENCE

EDITOR:

Professor J. Rose (Hon. Director of the World
Organisation of Systems and Cybernetics;
ATM Visiting Professor, Lancashire Polytechnic)
5 Margate Road
St Annes-on-Sea, Lancs. FY8 3EG England

DEPUTY EDITORS:

Dr E.W. Kent, National Institutes of Standards and
Technology, Robot Systems Division, Bldg. 220,
Rm. B-124, Gaithersburg, MD 20899, USA

Professor R.A. Jarvis,
Dept. of Electrical Engineering, Monash University,
Clayton, Victoria 3168, Australia

Professor S. Arimoto, Dept. of Mathematical Engineering
and Information Physics, University of Tokyo,
Bunkyo-ku, Tokyo 113, Japan

Dr P. Coiffet, C.R.I.I.F., BP 340,
75229 Paris Cedex 05, France.

EDITOR, ROBOTICS REPORTS AND SURVEYS:

Professor B.H. Rudall, School of Mathematics and
Computer Science, University College of North Wales,
Bangor, Gwynedd LL57 2UW, UK

EDITORIAL BOARD

I. Aleksander, UK	E. Nicolau, Romania
A.M. Andrew, UK	V. Nicolo, Italy
C.W. Burckhardt, Switzerland	T. Owen, UK
H.S. Cho, Korea	R. Reddy, USA
M.J. Dunne, USA	H. Rosenbrock, USA
T. Hasegawa, Japan	B. Roth, USA
K.H. Hunt, Australia	G.N. Sandor, USA
M. Ito, Japan	A. Siegler, Hungary
C.H. Kahng, USA	H.G. Stassen, The Netherlands
M. Kassler, Australia	M.W. Thring, UK
W. Khalil, France	S. Tsuji, Japan
A. Kusiak, Canada	C. Vibet, France
T.K. Lien, Norway	H.-J. Warnecke, Germany
K.L. McRoberts, USA	Wu Wei-Tsong, China

Robotica aims to endow robotics with an authoritative, competent and dedicated journal to serve industry, research and education. It will provide an international forum for the multidisciplinary subject of robotics and help to encourage developments in this important field of automation. It will cover the many aspects of robotics, including sensory perception, software (in the widest sense), particularly in regard to programming languages and links with master computers and CAD/CAM systems, control devices, the study of kinematics and dynamics involved in robot design, design of effectors and ancillary manipulators, problem solving, robot task planning, intelligibility of skilled motion, world model representation, development of relevant educational courses, training methods, analysis of managerial and social policy, economic and cost problems, and items of theoretical and practical interest. As well as original papers, the journal will publish research notes, book reviews, conference reports and letters to the editor.

© Cambridge University Press 1993

Subscriptions: *Robotica* (ISSN 0263-5747) is published bi-monthly in January, March, May, July, September and November. The subscription price (which includes postage) of Volume 11, 1993 is £139 net (US \$249 in USA, Canada and Mexico) for institutions and £65 (US \$112 in USA, Canada and Mexico) for individuals certifying that the Journal is for their personal use. Single parts, cost £25 net (US \$47 in USA, Canada and Mexico) plus postage. Six parts form a volume. Orders, which must be accompanied by payment, may be sent to a bookseller, subscription agent or direct to the publishers: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU (UK). Orders from the USA, Canada and Mexico should be sent to Cambridge University Press, Journals Department, 40 West 20th Street, New York, NY 10011-4211, USA. Copies of the Journal for subscribers in the USA, Canada and Mexico are sent by air to New York to arrive with minimum delay. Japanese prices for institutions (including ASP delivery) are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo. Second class postage paid at New York, NY and additional mailing offices. POSTMASTER: send address changes in USA, Canada and Mexico to *Robotica*, Cambridge University Press, 110 Midland Avenue, Port Chester, New York, NY 10573-9864.

Copying: This journal is registered with the Copyright Clearance Center, 27 Congress St., Salem, Mass. 01970. Organizations in the USA who are also registered with CCC may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to CCC of the per-copy fee of \$05.00. This consent does not extend to multiple copying for promotional or commercial purposes. Code 0263-5747/93/\$5.00 + .00.

ISI Tear Sheet Service, 3501 Market Street, Philadelphia, Pennsylvania 19104, USA, is authorised to supply single copies of separate articles for private use only.

Organizations authorized by the Copyright Licensing Agency may also copy material subject to the usual conditions.

For all other use, permission should be sought from Cambridge or the American Branch of Cambridge University Press.

INDEX TO AUTHORS OF PAPERS TO VOLUME 11

- Ajay, K.** See Badcock, Dun, Ajay, Kleeman and Jarvis
- Badcock, J. M., Dun, J. A., Ajay, K., Kleeman, L. and Jarvis, R. A.** An autonomous robot navigation system—integrating environmental mapping, path planning, localisation and motion control, 97–103
- Bar-On, D. Gutman, S. and Israeli, A.** The TRACK: Technion Robot And Controller Kit, 119–128
- Beazel, V. and Red, E.** Inaccuracy compensation and piecewise circular approximation of paramic paths, 413–425
- Bien, Z.** See Min, Bien and Hwang
- Bien, Z.** See Lee, Lee and Bien
- Billatos, S. B.** A practical application of fluid power systems in manufacturing, 475–482
- Birch, G. E.,** Development and methodology for the formal evaluation of the Neil Squire Foundation robotic-assistive appliance, 529–434
- Burckhardt, C. W.** See Glauser, Flury and Burckhardt
- Cain, P.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettit, Cain, Kloth, Rose and Musits
- Cammoun, R. Détriché, J. M., Lauture, F. and Lesigne, B.** Clinical evaluation of the 'MASTER' robot system and development of a new version, 535–539
- Chevallereau,** See Pham, Khalil and Chevallereau
- Cho, D. W.** See Lim and Cho
- Cho, D. Y. and Cho, H. S.** Inference on robotic assembly precedence constraints using a part contract level graph, 173–183
- Cho, D. Y., Shin, C. K. and Cho, H. S.** Automatic inference on stable robotic assembly sequences based upon the evaluation of base assembly motion instability, 351–362
- Cho, H. S.** See Cho and Cho
- Cho, H. S.** See Cho, Shin and Cho
- Cho, J. S., Malstrom, E. M. and Even, J. C. Jr.** Use of coding and classification systems in the design of universal robotic grippers, 345–350
- Choi, B. W.** See Won, Choi and Chung, 159–165
- Choi, M. H., Lee, B. H. and Ko, M. S.** Optimal load distribution for two cooperating robots using a force ellipsoid, 61–72
- Chung, M. J.** See Shin and Chung
- Chung, M. J.** See Won, Choi and Chung
- Dallaway, J. L., Mahoney, R. M., Jackson, R. D. and Gosine, R. G.** An interactive robot control environment for rehabilitation applications, 541–551
- Davies, B. L., Ng, W. S. and Hibberd, R. D.** Prostatic resection: an example of safe robotic surgery, 561–566
- Dawson, D., Qu, Z. and Duffie, J.** Robust tracking control for robot manipulators: theory, simulation, and implementation, 201–208
- Détriché, J. M.** See Cammoun, Détriché, Lauture and Lesigne
- Drenovac, V. and Potkonjak, V.** Contribution to the modelling of impact with robotic systems
- Drouin, M.** See Perdereau and Drouin
- Duffie, J.** See Dawson, Qu and Duffie
- Dun, J. A.** See Badcock, Dun, Ajay, Kleeman and Jarvis
- Ekalo, Y. and Vukobratović, M.** Robust and adaptive position/force stabilization of robotic manipulators in contact tasks, 373–386

- Engelberger, J. F.** Health-care robotics goes commercial: the 'HelpMate' experience, 517–523
- Even, J. C. Jr.** See Cho, Mastrom and Even
- Flury, P.** Glauser, Flury and Burckhardt
- Froissart, C. and Mechler, P.** On-line polynomial path planning in Cartesian space robot manipulators, 245–251
- Gardner, J. F.** See Luecke and Gardner
- Glauser, D., Flury, P. and Burckhardt, C. W.** Mechanical concept of the neurosurgical robot 'Minerva', 567–575
- Gosine, R. G.** See Dallaway, Mahoney, Jackson and Gosine
- Gogate, S. and Lin, Y.** Formulation and control of robots with link and joint flexibility, 273–282
- Gotlih, K.** See Oblak and Gotlih
- Gutman, S.** See Bar-On, Gutman and Israeli
- Hafeez, K.** See Pham and Hafeez
- Hibberd, R. D.** See Davies, Ng and Hibberd
- Huissoon, J. P.** See Wang, Huissoon and Luscott
- Hwang, S.** See Min, Bien and Hwang
- Israeli, A.** See Bar-On, Gutman and Israeli
- Jackson, R. D.** See Dallaway, Mahoney, Jackson and Gosine
- Jarvis, R. A.** See Badcock, Dun, Ajay, Kleeman and Jarvis
- Johns-Rahnejat, P. M.** See Mehdian, Johns-Rahnejat and Rahnejat
- Jumarie, Guy.** Forces of reaction and neighbouring Hamilton's principle in the tracking control of manipulators via a sliding scheme, 227–232
- Kassler, M.** Introduction to the special issue on robotics for health care, 493–494
- Kassler, M.** Robotics for health care: a review of the literature, 495–516
- Kazanides, P.** See Mittelstadt, Paul, Kazanides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Khalil, W.** See Pham, Khalil and Chevallereau
- Khemaisia, S. and Morris, A. S.** Neuro-adaptive control of robotic manipulators, 465–473
- Kerr, D. R.** See Xiong, Sanger and Kerr
- Kircanski, N., Petrovic, T. and Vukobratovic, M.** Parallel computation of symbolic robot models of pipelined processor architectures, 37–47
- Kleeman, L.** See Badcock, Dun, Ajay, Kleeman and Jarvis
- Kloth, D.** See Mittelstadt, Paul, Kazanides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Ko, M. S.** See Choi, Lee and Ko
- Ko, M. S.** See Ko, Lee and Ko
- Ko, S. K.** See Ko, Lee and Ko
- Ko, N. Y., Lee, B. H. and Ko, M. S.** An approach to robot motion planning for time-varying obstacle avoidance using the view-time concept, 315–327
- Ko, N. Y., Lee, B. H. and Ko, S. K.** An approach to robot motion planning for time-varying obstacle avoidance using the view-time concept, 315–327
- Kozlowski, K.** Computational requirements for a discrete Kalman filter in robot dynamics algorithms, 27–36
- Lamadrid, de J. G. and Zimmerman, J.** Avoidance of obstacles with unknown trajectories: locally optimal paths and path complexity, Part I, 299–308
- Lamadrid, de J. G. and Zimmerman, J.** Avoidance of obstacles with unknown trajectories: locally optimal paths and path complexity, Part II, 403–412
- Lauture, F.** See Cammoun, Détriché, Lauture and Lesigne
- Lesigne, B.** See Cammoun, Détriché, Lauture and Lesigne

- Lee, B. H.** See Ko, Lee and Ko
- Lee, B. H.** See Choi, Lee and Ko
- Lee, H.** See Lee, Lee and Bien
- Lee, J., Lee, H. and Bien, Z.** Iterative learning control with feedback using Fourier series with application to robot trajectory tracking, 291–298
- Lee, S. S. and Williams, J. H.** A fast tracking error control method for an autonomous mobile robot, 209–215
- Lee, S. S., Williams, J. H. and Rayment, P. J.** Automatic system of an autonomous vehicle—the trajectory generation and the control algorithm, 309–314
- Lee, T. and Lin, Y.** Shear deformation effect in design consideration of flexible manipulators, 83–92
- Lee, Bum Hee.** See Choi, Lee and Ko
- Lee, T.** See Lin and Lee
- Lepoutre, F. X.** Human posture modelisation as a problem of inverse kinematic of redundant robots, 339–343
- Lim, J. H. and Cho, D. W.** Experimental investigation of mapping and navigation based on certainty grids using sonar sensors, 7–17
- Lin, Y.** See Gogate and Lin
- Lin, Y.** See Lee and Lin
- Lin, Y. and Lee, T.** An investigation of fuzzy logic control of flexible robots, 363–371
- Lin, Y. J. and Zhang, H.** Simplifications of manipulator dynamic formulations utilizing a dimensionless method, 139–147
- Luscott, K.** See Wang, Huissoon and Luscott
- Luecke, G. R. and Gardner, J. F.** Local joint control cooperating manipulator systems—force distribution and global stability, 111–118
- Mahoney, R. M.** See Dallaway, Mahoney, Jackson and Gosine
- Malstrom, E. M.** See Cho, Malstrom and Even
- Mehdian, M., Johns-Rahnejat, P. M. and Rahnejat, H.** Elastostatic contact imaging for a mechanoreceptive tactile device, 329–337
- Mechler, P.** See Froissart and Mechler
- Min, B., Bien, Z. and Hwang, S.** Basic characteristics and stability properties of quadruped crab gaits, 233–243
- Mittelstadt, B., Paul, H., Kazanzides, P., Zuhars, J., Williamson, B., Pettitt, R., Cain, P., Kloth, D., Rose, L. and Musits, B.** Development of a surgical robot for cementless total hip replacement, 553–560
- Morris, A. S.** See Khemaissia and Morris
- Musits, B.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Ng, W. S.** See Davies, Ng and Hibberd
- Oblak, M. and Gotlih, K.** Task dependent synthesis of some geometrical parameters of a robot mechanism, 167–171
- Pamanes-Garcia.** See Zegloul and Pamanes-Garcia
- Pang, H. and Shahinpoor, M.** Analysis of static equilibrium of a parallel manipulator, 433–443
- Park, K. and Park, Y.** Fourier-based optimal design of a flexible manipulator path to reduce residual vibration of the endpoint, 263–272
- Park, Y.** See Park and Park
- Paul, H.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Perdereau, V. and Drouin, M.** A new scheme for hybrid force-position control, 453–464
- Petrović, T.** See Kirćanski, Petrović and Vukobratović
- Pettitt, R.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits

- Pham, C. M., Khalil, W. and Chevallereau, C. A.** A nonlinear model-based control of flexible robots, 73–82
- Pham, D. T. and Hafeez, K.** Improving the accuracy of a vibratory sensor using Kalem Filtering, 129–138
- Potkonjak, V.** See Drenovac and Potkonjak
- Qu, Z.** See Dawson, Qu and Duffie
- Rahnejat, H.** See Mehdian, Johns-Rahnejat and Rahnejat
- Rayment, P. J.** See Lee, Williams and Rayment
- Red, E.** See Beazel and Red
- Rose, L.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Russell, A.** Mobile robot guidance using a short-lived heat trail, 427–431
- Sanger, D. J.** See Xiong, Sanger and Kerr
- Sasaki, S.** New approaches to manipulator arm solutions via unconstrained optimization theory, 253–262
- Shahinpoor, M.** See Pang and Shahinpoor
- Shin, C. K.** See Cho, Shin and Cho
- Shin, Y. D. and Chung, M. J.** An optimal force distribution scheme for cooperating multiple robot manipulators, 49–59
- Stokić, D. and Vukobratović, M.** Historical perspectives and state of the art in joint force sensory feedback control of manipulation robots, 149–157
- Topping, M.** Early experience in the use of the 'Handy 1' robotic aid to eating, 525–527
- Vukobratović, M.** See Kirčanski, Petrović and Vukobratović
- Vukobratović, M.** See Stokić and Vukobratović
- Vukobratović, M.** See Ekalo and Vukobratović
- Wang, D., Huissoon, J. P. and Luscott, K.** A Teaching Robot for Demonstrating Robot Control Strategies, 393–401
- Williams, J. H.** See Lee and Williams
- Williams, J. H.** See Lee, Williams and Rayment
- Williamson, B.** See Mittelstadt, Paul, Kazanzides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits
- Won, J. H., Choi, B. W. and Chung, M. J.** A unified approach to the inverse kinematic solution for a redundant manipulator, 159–165
- Wu, C.** A modeling method for collision detection and motion planning of robots, 217–226
- Xiong, Y. L., Sanger, D. J. and Kerr, D. R.** Geometric modelling of boundless grasps, 19–26
- Xiong, Y. L., Sanger, D. J. and Kerr, D. R.** Geometric modelling of bounded and frictional grasps, 185–192
- Zhang, H.** See Lin and Zhang
- Zegloul, S. and Pamanes-Garcia, J. A.** Multi-criteria optimal placement of robots in constrained environments, 105–110
- Zimmerman, J.** See Lamadrid, de and Zimmerman
- Zuhars, J.** See Mittelstadt, Paul, Kazanides, Zuhars, Williamson, Pettitt, Cain, Kloth, Rose and Musits

INDEX OF BOOKS REVIEWED IN VOLUME 11

The name of the reviewer of the book is given in parentheses

- Blake, A. and Yuille, A.** *Active vision*, (T. OWEN), 487
Document Image Processing, (T. OWEN), 283
- Famili, A., Nau, D. S. and Kim, S. H.** *Artificial Intelligence in Manufacturing*, (A. M. ANDREW), 588
- Fuller, J. L.** *Robotics: Introduction, Programming and Projects*, (T. OWEN), 487–488
- Gelenbe, E.** *Neural Networks: Advances and Applications*, (A. M. ANDREW), 586
- Ghosal, A. and Murthy, P. N.** *Recent Advances in Cybernetics and Systems: Proceedings of the Ninth International Congress in Cybernetics and Systems*, (A. M. ANDREW), 488–489
- Grierson, D. E., Rzevski, G. and Adey, R. A.** *Applications of Artificial Intelligence in Engineering*, (T. OWEN), 585
- Holland, J. H.** *Adaptation in Natural and Artificial Systems: An Introductory Analysis with Applications to Biology, Control, and Artificial Intelligence*, (A. M. ANDREW), 489–490
- Khatib, O., Craig, J. J. and Lozano-Pérez, T.** *The Robotics Review 2*, (T. OWEN), 490
- Leavers, V. F.** *Shape Detection in Computer Vision using the Hough Transformation*, (T. OWEN), 284
- Lewis, F. L., Abdallah, C. T. and Dawson, D. M.** *Control of Robot Manipulators*, (T. OWEN), 585
- Lozano-Perez, T., Jones, J. L., Mazer, E. and O'Donnell, P. Handey.** *A Robot Planner*, (T. OWEN), 283
- Manikopoulos, C. N.** *Proceedings of the Eighth International Congress of Cybernetics and Systems*, (F. E. COLLIS), 283
- Megahed, S. M.** *Principles of Robot Modelling and Simulation*, (T. OWEN), 487
- Moore, K. L.** *Integrated Learning Control for Deterministic Systems*, (T. OWEN), 487
- Mundy, J. L. and Zisserman, A.** *Geometric Invariance in Computer Vision*, (T. OWEN), 283–284
- Nayak, N. and Ray, A.** *Intelligent Seam Tracking for Robotic Welding*, (T. OWEN), 586
- Ohba, R.** *Intelligent Sensor Technology*, (T. OWEN), 490
- Peretto, P.** *An Introduction to the Modelling of Neural Networks*, (A. M. ANDREWS), 586
- Sanders, D. A.** *Making Complex Machinery Move: Automated Programming and Motion*, (T. OWEN), 585
- Schapiro, R. E.** *The Design and Analysis of Efficient Learning Algorithms*, (A. M. ANDREW), 587–588
- Sheridan, T. B.** *Telerobotics, Automation and Human Supervisory Control*, (T. OWEN), 284
- Simons, G.** *Robots: The Quest for Living Machines*, (T. OWEN), 284
- Warnecke, H. J.** *The Fractal Company: A Revolution in Corporate Culture*, (T. OWEN), 585–586
- Warwick, K.** *Robotics, Applied Mathematics and Computational Aspects*, (H. G. FOX), 489
- Warwick, K., Irwin, G. W. and Hunt, K. J.** *Neural Networks for Systems and Control*, (A. M. ANDREW), 586–587