

# (AI EDAM)

---

---

## ARTIFICIAL INTELLIGENCE FOR ENGINEERING DESIGN, ANALYSIS AND MANUFACTURING

---

---

Editor Clive L. Dym

VOLUME 1, 1987

**ACADEMIC PRESS**

*Harcourt Brace Javanovich, Publishers*  
London San Diego New York Boston  
Sydney Tokyo Toronto  
ISSN 0890-0604

Reprinted with permission of Cambridge University Press by



SWETS & ZEITLINGER BV  
LISSE - THE NETHERLANDS - 1994

# (AI EDAM)

---

---

## ARTIFICIAL INTELLIGENCE FOR ENGINEERING DESIGN, ANALYSIS AND MANUFACTURING

---

---

Editor Clive L. Dym

VOLUME 1

**ACADEMIC PRESS**

*Harcourt Brace Javanovich, Publishers*  
London San Diego New York Boston  
Sydney Tokyo Toronto  
ISSN 0890-0604

Reprinted with permission of Cambridge University Press by



SWETS & ZEITLINGER BV  
LISSE - THE NETHERLANDS - 1994

# (AI EDAM)

## Artificial Intelligence for Engineering Design, Analysis and Manufacturing

EDITOR

CLIVE L. DYM

*Department of Civil Engineering  
University of Massachusetts  
Amherst, MA 01003, USA*

RESEARCH BRIEFS EDITOR  
MANJULA WALDRON

*Ohio State University*

BOOK REVIEWS EDITOR  
DAVID C. BROWN

*Worcester Polytechnic Institute*

### EDITORIAL BOARD

Paul R. Cohen  
Lynn Conway  
Johan de Kleer  
John R. Dixon  
S. J. Fenves  
Patrick Fitzhorn  
John S. Gero  
John C. Kunz

Jean-Claude Latombe  
Victor R. Lesser  
Raymond E. Levitt  
John McDermott  
Sanjay Mittal  
Kiyoshi Niwa  
Panos Papalambros  
H. Van Dyke Parunak

Stephen Polit  
Robert H. Rae  
Daniel R. Rehak  
Warren Seering  
Melvin K. Simmons  
Arthur W. Westerberg  
F. Gordon Willis

(AI EDAM): ARTIFICIAL INTELLIGENCE FOR ENGINEERING DESIGN, ANALYSIS AND MANUFACTURING ISSN 0890-0604. Volume 1, 1987, published three times a year by Academic Press at 24-28 Oval Road, London NW1 7DX, U.K. Annual subscription price including postage: £60 U.K. and U.S. \$98 overseas. Subscription orders should be sent to Academic Press Limited, Foots Cray, Sidcup, Kent DA14 5HF, U.K. (Tel: 01-300-3322) Send notices of changes of address to the publisher at least 6-8 weeks in advance, including both old and new address

Application to mail at second class postage rate is pending at Jamaica, NY 11431, U.S.A.

Air freight and mailing in the U.S.A. by Publications Expediting Inc., 200 Meacham Avenue, Elmont, NY 11003, U.S.A.

U.S.A. POSTMASTERS: send change of addresses to (AI EDAM) ARTIFICIAL INTELLIGENCE FOR ENGINEERING DESIGN, ANALYSIS AND MANUFACTURING, c/o Publications Expediting, Inc., 200 Meacham Avenue, Elmont, NY 11003, U.S.A.

Printed in U.K.

© 1987 Academic Press Limited. The appearance of the code at the bottom of the first page of a paper in this journal indicates the copyright owner's consent that copies of the paper may be made for personal or internal use, or for the personal or internal use of specific clients in the U.S.A. This consent is given on the condition, within the U.S.A., that the copier pay the stated per-copy fee through the Copyright Clearance Center, Inc., 27 Congress Street, Salem, MA 01970, for copying beyond that permitted by sections 107 and 108 of the U.S. Copyright Law. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, for resale or for copying or distributing copies outside the U.S.A.

ISSN 0890-0604

## Volume 1, No. 1

<b>Statement from the Editor</b> . . . . .	1
<b>Note regarding book reviews</b> . . . . .	1
<b>Levitt, R. E. and Kunz, J. C.</b> Using artificial intelligence techniques to support project management . . . . .	3
<b>Popplestone, R. J.</b> The Edinburgh Designer System as a framework for robotics: the design of behaviour . . . . .	25
<b>Dym, C. L.</b> Issues in the design and implementation of expert systems . . . . .	37
<b>Cohen, P. R., Shafer, G. and Shenoy, P. P.</b> Modifiable combining functions . . . . .	47
<b>Chan, W. T. and Paulson, B. C. Jr.</b> Exploratory design using constraints . . . . .	59

## Volume 1, No. 2

<b>McLaughlin, S. and Gero, J. S.</b> Acquiring expert knowledge from characterized designs . . . . .	73
<b>Nguyen, G. T. and Rieu, D.</b> Expert database concepts for engineering design . . . . .	89
<b>Ronchi, J., Butera, G., Frascari, E. and Scaruffi, P.</b> A distributed blackboard-based architecture for tele-diagnosis . . . . .	103
<b>Lu, S. C.-Y and Chen, K.</b> A machine learning approach to the automatic synthesis of mechanistic knowledge for engineering decision-making . . . . .	109
<b>Hoeltzel, D. A., Chieng, W.-H. and Zissimides, J.</b> Knowledge representation and planning control in an expert system for the creative design of mechanisms . . . . .	119
<b>Research in Progress Briefs</b> . . . . .	139

---

## Volume 1, No. 3

<b>Editor's Preface</b> . . . . .	143
<b>Dixon, J. R.</b> On research methodology towards a scientific theory of engineering design . . . . .	145
<b>Hulthage, I., Przystupa, M. A., Farinacci, M. L. and Rychener, M. D.</b> The representation of metallurgical knowledge for alloy design . . . . .	159
<b>Cagan, J. and Agogino, A. M.</b> Innovative design of mechanical structures from first principles . . . . .	169
<b>Akagi, S. and Fujita, K.</b> Building an expert system for the preliminary design of ships . . . . .	191
<b>Mather, M. L.</b> Engineering design synthesis: a domain independent representation . . . . .	207
<b>Research in Progress Briefs</b> . . . . .	215

## Author Index

<b>Agogino, A. M.</b> see <b>Cagan, J.</b> . . . . .	169
<b>Akagi, S.</b> and <b>Fujita, K.</b> Building an expert system for the preliminary design of ships . . . . .	191
<b>Butera, G.</b> see <b>Ronchi, J.</b> . . . . .	103
<b>Cagan, J.</b> and <b>Agogino, A. M.</b> Innovative design of mechanical structures from first principles . . . . .	169
<b>Chan, W. T.</b> and <b>Paulson, B. C. Jr.</b> Exploratory design constraints . . . . .	59
<b>Chen, K.</b> see <b>Lu, S. C.-Y.</b> . . . . .	109
<b>Chieng, W-H.</b> see <b>Hoeltzel, D. A.</b> . . . . .	119
<b>Cohen, P. R., Shafer, G.</b> and <b>Shenoy, P. P.</b> Modifiable combining functions . . . . .	47
<b>Dixon, J. R.</b> On research methodology towards a scientific theory of engineering design . . . . .	145
<b>Dym, C. L.</b> Issues in the design and implementation of expert systems . . . . .	37
<b>Farinacci, M. L.</b> see <b>Hulthage, I.</b> . . . . .	159
<b>Fascari, E.</b> see <b>Ronchi, J.</b> . . . . .	103
<b>Fujita, K.</b> see <b>Akagi, S.</b> . . . . .	191
<b>Gero, J. S.</b> see <b>McLaughlin, S.</b> . . . . .	73
<b>Hoeltzel, D. A., Chieng, W-H.</b> and <b>Zissimides, J.</b> Knowledge representation and planning control in an expert system for the creative design of mechanisms . . . . .	119
<b>Hulthage, I., Przystupa, M. A., Farinacci, M. L.</b> and <b>Rychener, M. D.</b> The representation of metallurgical knowledge for alloy design . . . . .	159
<b>Kunz, J. C.</b> see <b>Levitt, R. E.</b> . . . . .	3
<b>Levitt, R. E.</b> and <b>Kunz, J. C.</b> Using artificial intelligence techniques to support project management . . . . .	3
<b>Lu, S. C.-Y.</b> and <b>Chen, K.</b> A machine learning approach to the automatic synthesis of mechanistic knowledge for engineering decision-making . . . . .	109
<b>Maher, M. L.</b> Engineering design synthesis: a domain independent representation . . . . .	207
<b>McLaughlin, S.</b> and <b>Gero, J. S.</b> Acquiring expert knowledge from characterized designs . . . . .	73
<b>Nguyen, G. T.</b> and <b>Rieu, D.</b> Expert database concepts for engineering design . . . . .	89
<b>Paulson, B. C. Jr.</b> see <b>Chan, W-T.</b> . . . . .	59
<b>Popplestone, R. J.</b> The Edinburgh Designer System as a framework for robotics: the design of behaviour . . . . .	25
<b>Przystupa, M. A.</b> see <b>Hulthage, I.</b> . . . . .	159
<b>Research in Progress Briefs.</b> . . . . .	139, 215
<b>Rieu, D.</b> see <b>Nguyen, G. T.</b> . . . . .	89
<b>Ronchi, J., Butera, G., Fascari, E.</b> and <b>Scaruffi, P.</b> A distributed blackboard-based architecture for tele-diagnosis . . . . .	103
<b>Rychener, M. D.</b> see <b>Hulthage, I.</b> . . . . .	159
<b>Scaruffi, P.</b> see <b>Ronchi, J.</b> . . . . .	103
<b>Shafer, G.</b> see <b>Cohen, P. R.</b> . . . . .	47
<b>Shenoy, P. P.</b> see <b>Cohen, P. R.</b> . . . . .	47
<b>Zissimides, J.</b> see <b>Hoeltzel, D. A.</b> . . . . .	119