COMPUTERS IN ENGINEERING 1988

Proceedings of the 1988 ASME International Computers in Engineering Conference and Exhibition July 31-August 4, 1988 San Francisco, California

sponsored by

Computers in Engineering Division, ASME

Editors

V. A. Tipnis E. M. Patton

Associate Editors

D. W. Bennett A. A. Busnaina G. L. Kinzel M. F. Kinoglu D. R. Riley K. K. Tamma

VOLUME ONE

- Expert Systems
- · Artificial Intelligence
- Knowledge-Based Systems



CONTENTS

KNOWLEDGED BASED SYSTEMS: DESIGN I	
Expert System Approach in Design of Mechanical Components	
N. Ramchandran, A. Shah, and N. A. Langrana	
Support Systems for Design-in-the-Large	
V. Ashok, J. Ramanathan, S. Sarkar, and V. Venugopal	1
Analysis of Knowledge Abstraction, Representation and Interaction Requirements for Computer Aided	
Engineering	
J. J. Shah and P. R. Wilson	17
KNOWLEDGE BASED SYSTEMS: DESIGN II	
Iterative Respecification: A Computational Model for Hierarchical Mechanical System Design	
K. L. Meunier and J. R. Dixon	25
SCIO: A Tool for Knowledge Management in the R&D Environment	
J. Sandell and S. Truve	33
A Proposed Taxonomy of Mechanical Design Problems	
J. R. Dixon, M. R. Duffey, R. K. Irani, K. L. Meunier, and M. F. Orelup	4
A Methodology for Capturing Mechanical Design Expertise	
A. Esterline, D. Rosen, K. Otto, L. Nelson, T. Hessburg, D. R. Riley, and A. G. Erdman	47
KNOWLEDGE BASED SYSTEMS: APPLICATIONS I	
Object Oriented System for Component Selection	
M. B. Waldron and C. W. Chan	57
Expert Inspector of Surface Defects	
H. A. ElMaraghy and D. J. Bullis	63
Building Expert Systems in Statistical Process Control	
M. A. Kamal	7
Automation of Particle Accelerator Control	
R. R. Silbar and D. E. Schultz	79
KNOWLEDGE BASED SYSTEMS: APPLICATIONS II	
TOPSCO: An Expert System for Training NASA Satellite Operators on Power Subsystem Contingency	
Operations	
J. Liebowitz and P. Lightfoot	8
Teaching a Computer to Fix Itself — When There's No Alternative	
T. R. Fennel and G. S. Grisbeck	9
KNOWLEDGED BASED SYSTEMS: APPLICATIONS III	
An Expert System for Mechanically Fastened Joint Design	
M. W. Long, S. G. Bailey, and W. R. Shawver	97
An Expert System for Electronics Design	
M. Pecht, D. Barker, A. M. Leone, and J. Lynch	103
ADIS: Assistive Device Interface Selector for the Disabled	
S. Hsi, A. M. Agogino, M. Barker, and B. Yazdani-Kachoee	109
An Expert System Package for High Resolution Diode Laser Spectroscopy	
P. L. Varghese, T. T. D. Ho, and V. S-S. Hwang	115
KNOWLEDGED BASED SYSTEMS: APPLICATIONS IV	
Computer Architecture Design Expert — Knowledge-Based Approach for Disk I/O Design	
K. Cho and H. G. Cragon	12

A Component-Oriented Tool for the Development of Knowledge Systems	
M. P. Case, J. M. Gratch, and L. H. Quek	129
Automatic Production-Distribution-Inventory Network Modelling Using Frames KC. Yu	135
MAVEN: A Knowledge-Based System for Determining COMMON LANGUAGE Equipment Codes M. Gersho and D. Ruddock	147
	147
Knowledge Based Systems Panel: Applications of AI to Real Time Processes	153
J. Lester, D. Chester, L. Lei, and S. Azzaro	193
KNOWLEDGED BASED SYSTEMS: APPLICATIONS V	
Real-Time Expert Control System Using Propositional Logic	4-0
E. P. Andert, Jr. and W. C. Frasher	159
A Symbolic Verification Approach for Digital MOS VLSI Circuits Using Prolog	405
T. S. Chen and P. D. Fisher	165
Expert Systems Applications for Today's Space Problems	
K. Morris and C. Giffin	171
An Expert System for Selection of Axial Fans	
M. A. Wright, T. Wright, and D. G. Jackson, Jr.	179
KNOWLEDGED BASED SYSTEMS: PRODUCTION CONTROL AND SCHEDULING I	
Assembly Sequence Recovery in Flexible Assembly	
J. L. Sanders	185
Development of Control Rules for State-Dependent Scheduling of Material Handling Robots	
L. Lei and A. Thesen	191
A Statistically Aided Expert System for Wastewater Treatment Plant Control	400
P. M. Berthouex and W. Lai	199
Expert Systems: A Misnomer	005
M. J. Kelly	205
KNOWLEDGED BASED SYSTEMS: PRODUCTION AND SCHEDULING II	
Inventory and Production Decisions in Multi-Item, Multi-Stage Manufacturing Systems	
Z. J. Czajkiewicz and G. Suer	209
Evolving Applications for Artificial Intelligence in Real-Time Production Scheduling	
W. J. Davis	215
Integrating Expert Systems With Conventional Applications	
J. S. Kaminski, P. A. Clitherow, and G. J. Stuk	225
A Knowledge Based System for the Selection of Production Scheduling Papers	
G. Suer and C. Dagli.	231
KNOWLEDGED BASED SYSTEMS: DESIGNS BY FEATURES	
Designing With Features: The Origin of Features	
J. J. Cunningham and J. R. Dixon	237
General Feature-Based Frame Representation for Describing Mechanical Engineering Design Developed	
From Empirical Data	
J. Tikerpuu and D. G. Ullman	245
Feature Based Modeling Shell: Design and Implementation	
J. J. Shah and M. T. Rogers	255
Synthesis of an Optimal Approach to Form Feature Modelling	
M. J. Pratt	263
Features for Tolerancing a Solid Model	
P. S. Ranyak and R. Fridshal	275
KNOWLEDGED BASED SYSTEMS: CAD/CAM	
Expert System Aid for Intelligent Molding Cooling System Design	
T. H. Kwon and P. A. Weeks	281

Integrating Expert Systems With a Turnkey CAD/CAM System	
S. R. Glovin, P. J. Morris, and T. J. Peters	287
A Modular Learning Structure for Knowledge-Based CAD Systems Q. Zhu	293
A Natural Data Organization for a CSG-Based CAD Database	200
YK. Yang	301
Constructing Three Dimensional Geometric Models From Planar Views Using Knowledge-Based Systems	301
	200
S. L. Wang	309
KNOWLEDGED BASED SYSTEMS: TECHNOLOGY ISSUES	
Calibration of Fuzzy Linguistic Variables for Expert Systems	
P. Jain and A. M. Agogino	313
Assignment of Roles Among Cooperative Distributed Problem Solving Systems	
B. C. Draa and P. Millot	319
KNOWLEDGED BASED SYSTEMS: DIAGNOSIS I	
Hypertext/Expert System for Machine Diagnostics and Mechanic Training	
T. P. Gall, C. R. Marling, D. A. Moyer, C. K. Wu, and K. J. Daniel	325
KLUE: A Diagnostic Expert System Tool for Manufacturing	OZ.
G. Karel and M. Kenner	331
Diagnosis for a Complex Machine: Integration of Evidential Reasoning With Causal Reasoning and	331
Quantitative Simulation	
E. Subrahmanian, M. D. Rychener, J. W. Wiss, and S. J. Lasky	337
A Hypertext System for Troubleschooting and Maintaining Complex Manufacturing Equipment	337
· · · · · · · · · · · · · · · · · · ·	245
C. R. Hill and H. E. Roehl	343
KNOWLEDGED BASED SYSTEMS: DIAGNOSIS II	
CVAID: An Expert System for Diagnosis and Repair of a Car Valve Actuator	
A. M. Agogino, R. K. Paasch, K. A. Swanson, R. E. Heiskell, J. M. Quinto, and R. G. Taylor	349
An Approach to Expert Systems Analysis of Sensor-Based Data	
S. H. Azzaro, B. C. Beutter, and D. P. Smith	355
An Expert System On-Line Rotor Crack Monitoring and Diagnostic System	
G. J. Carlson, I. Imam, S. H. Azzaro, and J. R. Scheibel	361
Development of an Expert System for Paper Machine Problem Diagnosis	•
N. G. Margolis	367
KNOWLEDGED BASED SYSTEMS: ANALYSIS I	
Four Years' Experience With Failure Analysis Expert Systems	
J. P. Morrill and D. Wright	371
Feasibility of Using a Knowledge-Based Expert System in Computational Fluid Dynamics	
G. D. Abbott, K. R. Blake, and M. Z. Sheikholeslami	377
Knowledge-Based Stress Analysis of Multilayer Structures Using Processing Information	
JH. Jou, SY. Lee, and S. Wang	383
KNOWLEDGED BASED SYSTEMS: ANALYSIS II	
Controlling Dynamic Analysis Using Meta-Level Inference	
D. R. Brown and L. J. Leifer	389
Automated Hierarchical Planning for Structural Design	-
G. E. Nevill, Jr., L. A. Jackson, and J. H. Clinton.	395
An Intelligent Specifications Extraction Interface for Structural Design	350
J. R. Umaretiya, S. P. Joshi, and S. B. Joshi	403
An Object-Oriented System Environment for Partial Differential Equation Solution	703
R. L. Peskin and M. F. Russo	409
11. L. I Gall II III IV. F. DUSSU	-+LIN

KNOW LEDGED BASED \$45 LEMS: MANOPACTORING I	
QTC — An Integrated Design/Manufacturing/Inspection System for Prismatic Parts	
T. C. Chang, D. C. Anderson, and O. R. Mitchell	417
An Implementation of Rule Based Selection of Milling Cutters, Feed Rates, and Spindle Speed	
R. Melkote and D. L. Taylor	427
Automated Generation of Uniform Group Technology Part Codes From Solid Model Data	
A. L. Ames	433
A. E. Allies,	
KNOWLEDGED BASED SYSTEMS: MANUFACTURING II	
Knowledge-Based Simulation System for a Wafer Fabrication Shop	400
S. Adiga and YF. Hung	439
A Coding Design Expert System for Automatic Assembly	
HY. Lai	443
Optimum Process Planning (OPIPP) and Expert System Process Planning (ESYPP): A Key to CAD/CAM	
Integration	
N. K. Jha	451
KNOWLEDGED BASED SYSTEMS: ENGINEERING OPTIMIZATION	
A Model for Intuitive Reasoning in Expert Systems	
W. Zhang and J. N. Siddall	459
	100
Reasoning About Mechanical Devices: A Top-Down Approach to Deriving Behavior From Structure	467
S. D. Bacon and D. C. Brown	407
An Expert System for Structural Optimization	470
W. Zhang and J. N. Siddall	473
An Expert System to Choose the Right Optimization Strategy	
S. I, Mehta and U. P. Korde	483
KNOWLEDGED BASED SYSTEMS: FEATURED BASED ANALYSIS-GEOMETRIC REASONING	
Feature Mapping and Application Shell	
J. Shah, A. Bhatnagar, and D. Hsiao	489
Feature-Based Geometry Construction for Geometric Reasoning	
J. C. H. Chung, R. L. Cook, D. Patel, and M. K. Simmons	497
Automating the Design of Extrusions: A Case Study in Geometric and Topological Reasoning for	
Mechanical Design	505
M. R. Duffey and J. R. Dixon	505
Parallel Grammars in Design	
G. Stiny	513
KNOWLEDGED BASED SYSTEMS: FEATURE RECOGNITION—SHAPE GRAMMARS	
Shape Feature Recognition From 3D Solid Models	
H. Sakurai and D. C. Gossard	515
A New CSG Tree Reconstruction Algorithm for Feature Representation	
YC. Lee and KF. J. Jea	521
FRAPP: Automated Feature Recognition and Process Planning From Solid Model Data	
M. R. Henderson and G. J. Chang	529
The Formal Definition and Automatic Extraction of Group Technology Codes	
A, H. Bond and R. Jain	537
Knowledge Representation Scheme for an Intelligent Feature Extractor	
B. Kumar, D. K. Anand, and J. A. Kirk	543
= , ,	
KNOWLEDGED BASED SYSTEMS: FEATURE BASED MANUFACTURING	
An Object-Oriented Approach to Interactive, Feature-Based Design for Quick Turnaround	
Manufacturing	
G. P. Turner and D. C. Anderson	551

Features in Process-Based Design	
M. R. Cutkosky, J. M. Tenenbaum, and D. Muller	557
Feature-Based Process Planning in the AMRF	
M. B. Unger and S. R. Ray	563
Feature-Based Process Planning for Machined Parts	
A. H. Bond and K. J. Chang	571