PROCEEDINGS OF THE
TWELFTH INTERNATIONAL
MACHINE TOOL DESIGN AND RESEARCH
CONFERENCE

PROCEEDINGS OF THE
TWELFTH INTERNATIONAL
MACHINE TOOL DESIGN AND RESEARCH
CONFERENCE

*held in Manchester
15–17 September 1971*

Edited by
F. KOENIGSBERGER
*Professor of Machine Tool Engineering
University of Manchester Institute of Science and Technology*

and

S. A. TOBIAS
*Chance Professor and Head of Department
Department of Mechanical Engineering
University of Birmingham*

MACMILLAN EDUCATION

All rights reserved. No part of this
publication may be reproduced or transmitted,
in any form or by any means, without permission.

*First published 1972 by
THE MACMILLAN PRESS LTD
London and Basingstoke
Associated companies in New York Toronto
Dublin Melbourne Johannesburg and Madras*

SBN 333 13318 8

ISBN 978-1-349-01399-9 ISBN 978-1-349-01397-5 (eBook)
DOI 10.1007/978-1-349-01397-5

© The Macmillan Press Limited 1972
Softcover reprint of the hardcover 1st edition 1972 978-0-333-13318-7

Typeset by H Charlesworth & Co Ltd Huddersfield

CONTENTS

Introduction. F. KOENIGSBERGER	1
Opening address. H. OPITZ	2
ADAPTIVE CONTROL	
Adaptive control for turning operations. A. LEDERGERBER	7
The on-line control of cutting conditions using direct feedback. N. F. SHILLAM	15
NUMERICALLY CONTROLLED MACHINE TOOL DESIGN	
Developments in automation for NC lathes. R. L. MACDONALD and M. THORNEY-CROFT	25
The modula range of NC machine tools. D. GRINDROD and G. FARNWORTH	31
Machine tools – the total concept. C. A. SPARKES	41
METAL FORMING	
On the isostatic compaction and hydrostatic extrusion of iron powder. J. M. ALEXANDER and D. R. QUAINTON	51
Development of a new precision shearing process opposed dies shearing process. K. KONDO and K. MAEDA	61
Hot forging of grey cast irons. R. FARNWORTH and B. W. ROOKS	69
MACHINE TOOL ELEMENT DESIGN	
Behaviour of the horizontal stiffness and the micro-sliding on the bolted joint under the normal pre-load. M. MASUKO, Y. ITO and C. FUJIMOTO	81
Calculating the elastic and plastic components of deflection of plane joints formed from machined surfaces. R. E. SCHOFIELD and R. H. THORNLEY	89
Experimental study on the optimum interface pressure on a bolted joint considering the damping capacity. Y. ITO and M. MASUKO	97
Some aspects of wear on disc clutches used in machine tools. H. LEVY, E. LENZ and K. LOEWY	107
Cutting forces in machining and their routine measurement with multi-component piezo-electric force transducers. G. H. GAUTSCHI	113
The effect of appearance considerations on the design of a small NC milling machine. E. J. HUNTLEY, R. ROSE and J. S. SHEEN	121
METAL FORMING	
Stress wave fracturing of a bar. S. T. S. AL-HASSANI and W. JOHNSON	129
Expanding sheet forming method for automobile bumpers. K. KOSHINO	141
The design of a press for use in the hydrostatic extrusion process. R. W. THATCHER and J. A. PENNELL	147
Die performance in high-energy rate forging. A. THOMAS and K. DENHAM	153
The production of tensile test specimens by an economical blanking process and its feasibility for practical application. T. NAKAGAWA, Y. FURUKAWA and K. YOSHIDA.	161
Bending of thin-walled tubes by combined external mechanical forces and internal fluid pressure. C. BOYD and F. W. TRAVIS.	169
MACHINE TOOL FEED DRIVES AND GUIDEWAYS	
Special design features of NC contouring machines. G. ENGEL.	179
A method of calculation for two-way flow-control valves depending on imposed dynamic performance. I. MAZILU	187
The choice of ballslideways for machine tools. J. de FRAINE	193
The improvement of the accuracy of electrohydraulic cylinder drives. A. DE PENNINGTON, D. W. MARSLAND and R. BELL.	199
An economic technique for the improvement of the stability of hydraulic cylinder drives. P. GALE and R. BELL	207
The specification and performance of electrohydraulic motor drives for numerically controlled machine tools. S. K. CESSFORD and R. BELL	217

GRINDING AND ELECTRO CHEMICAL MACHINING

Objective method for determining grinding wheel life. F. SZEKERES.	229
On the rounding-up process in high-production internal grinding machines by digital computer simulation. R. S. HAHN and R. P. LINDSAY	235
Geometrical configurations for stability in the centreless grinding process. D. L. RICHARDS, W. B. ROWE and F. KOENIGSBERGER	241
Electron beam, the multi-role tool for modern fabrication. K. H. von GROTE and A. H. MELEKA	247
Hydraulic approach to electrolyte flow in electrochemical machining. S. ITO and K. SEIMIYA	259
Vertical spindle electrochemical surface grinding. M. M. SFANTSIKOPOULOS and C. F. NOBLE	265
Effect of surface finish produced during ECM upon the fatigue life of Nimonic 80A. J. M. EVANS, P. J. BODEN and A. A. BAKER	271

MACHINE TOOL TESTING

A study of identification of dynamic characteristics of machine tools by means of micro tremor. H. SATO and T. AKUTSU.	281
Establishing standard cutting conditions for performance testing of universal metal cutting machine tools. M. BURDEKIN, A. COWLEY and J. TLUSTY	289
The development of a dynamic performance test for lathes. B. J. STONE	299
A new hydraulic vibrator. J. I. ROBERTS, R. LAWThER and G. PENDLEBURY	309
Inspection and acceptance tests for NC machine tools. K. JUSTEL	315
Positioning accuracy of NC machine tools. C. P. HEMINGRAY, A. COWLEY and M. BURDEKIN	319
Machine tool testing — a practical approach. J. W. ANDERSON	325
Techniques for testing accuracy of NC machine tools. J. TLUSTY	333

METAL PROCESSING

Metallurgical and residual stress investigations of explosively welded specimens. R. PRÜMMER	349
Forming force required for tube-forming. Y. TOZAWA and K. KAWADA	355
A study of the strain histories and drawing-in in a pressed steel shell. R. A. ETHERIDGE and F. J. MORBEY	359
The quantitative effect of tool geometry and strain-hardening on the critical punch force in cup drawing. J. A. G. KALS	367
Determination of tool-life equations by step turning test. T. S. KIANG and G. BARROW	379
The effect of component tolerance upon optimum machining conditions. J. R. CROOKALL and R. C. MALTBY	387
Thermoelectric characteristics of carbides. C. BUS, N. A. L. TOUWEN, P. C. VEENSTRA and A. C. H. van der WOLF	397
Carbide size and distribution and their effect on the performance of high-speed-steel tools. IVO KVASNICKA	401

DIGITAL COMPUTER-AIDED DESIGN AND CONTROL

The programmed approach in control systems. R. DOANE and D. HOLLAND	411
A system for direct numerical control of machine tools. G. SPUR and W. WENTZ.	421
Report on a special DNC system. G. STUTE and R. NANN	429
The design and development of a numerical control system using a small digital computer. C. J. CHARNLEY and S. SRINIVASAN	433
Computer approach to dynamically optimum design of machine tool structures. M. YOSHIMURA and T. HOSHI	439
Efficiency and accuracy of the flexibility and stiffness methods for the calculation of beam-like redundant structures. L. van der NOORTGATE	447
The finite-element method applied to the deformation analysis of thin-walled columns. S. HINDUJA and A. COWLEY.	455

METAL CUTTING

Tool-life equations and machining economics. G. BARROW	481
Selection of cutting speeds based on uncertain data. R. L. KEGG	495
Use of the scanning electron microscope to study the function of manganese sulphide inclusions in resulphurised free-machining steels. W. J. WILBER, A. W. J. CHISHOLM and E. J. PATTINSON	499

METAL CUTTING contd.

Assessing machinability from fundamental work material properties. W. F. HASTINGS, P. L. B. OXLEY and M. G. STEVENSON	507
The use of a cutting force spectrum for tool wear compensation during turning. N. AKGERMAN and J. FRISCH.	517

SYSTEM DESIGN AND IDENTIFICATION

Designing in digital space. W. B. HEGINBOTHAM	529
A computer-aided study of the texture of the working surfaces of grinding wheels. C. P. BHATEJA, A. W. J. CHISHOLM and E. J. PATTINSON	535
Digital computation of surface topography. H. KALISZER, D. J. GRIEVE and G. W. ROWE	543
Choosing manufacturing resources. G. A. E. SEWELL	551

METAL FORMING

The analysis of rotary forging investigations as an aid to design. E. APPLETON and R. A. C. SLATER	557
Tool-life test in clamp shearing of steel bar and wire. T. NAKAGAWA and K. MIYAMOTO	567
Elastic stresses at seals in plain and necked open-ended cylinders under internal and external pressures. B. LENGYEL and D. C. HARVEY	573

INDEXES

Authors and contributors	581
Technical	583