

Computational Methods in Contact Mechanics VI

WITPRESS

WIT Press publishes leading books in Science and Technology.

Visit our website for new and current list of titles.

www.witpress.com

USA mirror site:

www.witpressUSA.com

SIXTH INTERNATIONAL CONFERENCE ON
COMPUTATIONAL METHODS IN CONTACT MECHANICS

CONTACT MECHANICS 2003

CONFERENCE CHAIRMAN

C.A. Brebbia

Wessex Institute of Technology, UK

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

J. Dominguez
L. Gaul
T.H. Hattori
L. Kukielka
Y.S. Morsi
I. Nitta
P. Prochazka

G. Rosenhouse
A.P.S. Selvadurai
R.A.M. Silveira
J. Stupnicki
K. Varadi
K. Willner
Z. Yao

Organised by

Wessex Institute of Technology, UK

Computational Methods in Contact Mechanics VI

Editor

C.A. Brebbia

Wessex Institute of Technology, UK

WITPRESS Southampton, Boston 

C.A. Brebbia

Wessex Institute of Technology, UK

Published by

WIT Press

Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK

Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853

E-Mail: witpress@witpress.com

<http://www.witpress.com>

For USA, Canada and Mexico

Computational Mechanics Inc

25 Bridge Street, Billerica, MA 01821, USA

Tel: 978 667 5841; Fax: 978 667 7582

E-Mail: info@compmech.com

US site: <http://www.witpressUSA.com>

British Library Cataloguing-in-Publication Data

A Catalogue record for this book is available
from the British Library

ISBN: 1-85312-963-1

ISSN: 1466-7266

*The texts of the papers in this volume were set
individually by the authors or under their supervision.
Only minor corrections to the text may have been carried
out by the publisher.*

No responsibility is assumed by the Publisher, the Editors and Authors for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

© WIT Press 2003.

Printed in Great Britain by The MFK Group, Stevenage

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Publisher.

Preface

Modern engineering design has led to the realisation of the importance of contact problems in many fields of technology. They are complex and inherently non-linear due to the presence of moving boundaries and the existence of friction along contact surfaces. Until a few years ago researchers were engaged solely on the fundamental concepts and mathematical aspects of contact problems. Nowadays, due to substantial improvements in computer technology and experimental measurements it is possible to solve many complex practical problems accurately and efficiently as demonstrated by the contents of the book.

The papers contained in this volume have been presented at the International Conference on Computational Methods in Contact Mechanics (CONTACT MECHANICS 2003) held in Crete in March 2003. The meeting was the sixth of a series started in Southampton, UK in 1993 and continued in Ferrara, Italy (1995); Madrid, Spain (1997); Stuttgart, Germany (1999) and Seville, Spain (2001). The conference provides a forum for the discussion of different aspects of contact mechanics. The papers presented are grouped in this book into three different sections, Computational Methods; Experimental Results and Computational Methods; and Fracture, Fatigue and Wear. The meeting was organised by the Wessex Institute of Technology of UK.

The Editor is grateful to all authors for their contributions and in particular to the members of the International Scientific Advisory Committee for their help in reviewing the papers published in this book.

The Editor
Crete 2003

CONTENTS

Section 1: Computational Methods

The effect of ground replacement on control of underground vibrations and differential settlement of structures <i>G. Rosenhouse, F. Kirzhner and Y. Zimmels</i>	3
A scheme of boundary element method for moving contact of 3D elastic solids <i>Z. Yao and Y. Liu</i>	15
Analysis of contact pressure between a thermal print head and ink of a thermal transfer printer <i>I. Nitta and H. Terao</i>	25
A boundary element-mathematical programming method for solving elastoplastic contact problems <i>A. Faraji, A. Cardou and A. Gakwaya</i>	35
Stationary damage concept for poroelastic contact mechanics <i>A.P.S. Selvadurai</i>	47
A reduced elastic friction model for complicated surfaces <i>J. Jäger</i>	53
Some problems of bridge contact analysis using MARC <i>Z. M. Bzymek and J. Dierberger</i>	63
On the formulation of thermo-mechanical contact for casting analysis <i>M. Chiumenti, M. Cervera and C. Agelet de Saracibar</i>	73
Computational method for interaction between rigid indenter and elastic inclusion <i>K. Fujimoto</i>	83
Numerical modelling: the contact problem of movable elasto/visco-plastic body <i>L. Kukielka</i>	93

Section 2: Experimental Results and Computational Methods

Finite element simulation of orthogonal metal cutting <i>L. Carrino, G. Giuliano, and G. Napolitano</i>	105
Effect of sheet thickness and friction on load characteristic of crushed center bevel cutter indentation to aluminum sheet <i>M. Murayama, S. Nagasawa, Y. Fukuzawa and I. Katayama</i>	115
Study of wear damage resistance of gears using laser surface treatment and microstructural simulation <i>H. Martikka and H. Eskelinen</i>	125
Investigation of thermal effects and the role of local abrasion in rubber friction processes <i>K. Hofstetter, J. Eberhardsteiner and H.A. Mang</i>	137
Analysis of superplastic forming process in a circular closed-die <i>L. Carrino, G. Giuliano and G. Napolitano</i>	147
Fixing the spatial photoelastic-photoplastic effect by ionising irradiation applied to contact problems <i>J. Kodvanj, R.J. Beer and S. Jecic</i>	157

Section 3: Fracture, Fatigue and Wear

Fretting wear and fretting fatigue process at the contact edge <i>T. Hattori and T. Watanabe</i>	169
Statistical characterization of the asperities of real surfaces <i>K. Váradi, Z. Néder and K. Friedrich</i>	179
Application of a hybrid approach for wear prediction of true tools for hot forging <i>M. Terčelj, I. Peruš, R. Turk and M. Knap</i>	189
The application of image processing techniques in the tool wear estimation <i>A. Zawada-Tomkiewicz and B. Storch</i>	201
Brittle rock behaviour within high-pressure condition <i>J. Vacek and V. Doležel</i>	211