

**BIOMECHANICS RESEARCH:
Experimental and Computational**

TWENTY SIXTH INTERNATIONAL WORKSHOP

November 1, 1998
Tempe, Arizona

Editor

Faris A. Bandak, Ph.D.

**BIOMECHANICS RESEARCH:
Experimental and Computational**

TWENTY SIXTH INTERNATIONAL WORKSHOP

November 1, 1998
Tempe, Arizona

Editor

Faris A. Bandak, Ph.D.

*National Highway Traffic Safety Administration
U.S. Department of Transportation
Washington, DC*

National Transportation Biomechanics Research Center

Preface

AS WE END THE FIRST twenty five years of the International Workshop on Human Subjects and begin the next, we are witnessing the recent, rapid, technological changes that are revolutionizing the way we think about and conduct biomechanics research. In this light we have implemented some changes in the Twenty Sixth Workshop that will help further broaden the content related to human subjects research, namely, computational biomechanics, dummy instrumentation, and test device development. The response from the community was very favourable as evidenced by the breadth of the subject matter covered by this year's paper submissions.

It is clear that this Workshop has provided, as in previous years, a forum for presenting research topics critical to the development of injury criteria that support advancements in safety standards. The Workshop is centered around the biological experiment that supplies critical information into the overall injury criteria development process. The Workshop has in the past and will continue to focus on the interdisciplinary aspects of such an experiment.

This year's Workshop included fourteen presentations given under four sessions. Papers were submitted in areas covering mechanical response and properties of cadaveric tissue, cadaveric and animal brain injury research, protection for helmeted heads, as well as footwell intrusion injuries. Other topics included novel approaches in the estimation of chest velocities, sternum instrumentation, computer modelling of the shoulder and the lower leg, an H-point machine for the 5th percentile Hybrid III dummy, and a crash data system.

The proceedings of this workshop are documented here in fourteen submitted papers that have not been peer reviewed.

*Faris A. Bandak, Ph.D.
Washington, DC*

Acknowledgements

The Twenty-Sixth International Workshop could not have been successfully held without the support and help of several people. On behalf of the Workshop Meeting Planner, Thuvan T. Nguyen and myself, I would like to thank Anna Zhang, Rabih Tannous, Zaifei Zhou, and Shashi Kuppa for their assistance in the preparation and conduct of the Workshop.

I would also like to express my appreciation to Sharon Carreyn, Meeting Planner for the Society of Automotive Engineers, and Leda Ricci, the Executive Director of the Stapp Conference Advisory Committee, for their help in the Workshop coordination.

Thanks are also extended to the Authors and Presenters for their contributions to making this Workshop a very useful and beneficial experience for all the participants.

*Faris A. Bandak, Ph.D.
Chair*

Contents

Preface	iii
Acknowledgements	iv

MECHANICAL PROPERTIES

1.	Experiments on the Bending Behavior of Cervical Spine Motion Segments <i>R. Nightingale, B. A. Winkelstein, K. E. Knaub, and B. S. Myers</i>	1
2.	Determination of Bone Mineral Content in Cadaveric Test Specimens <i>S. M. Duma, L. P. Ryan, J. R. Crandall, and W. D. Pilkey</i>	7
3.	Mechanical Properties of Selected Biological Structures <i>J. Kovanda, H. Kovandova, J. Stingl</i>	17
4.	Tensile Neck Strength Characteristics <i>F. A. Pintar and N. Yoganandan</i>	23

HEAD INJURY

5.	Influence of Planar Head Motions on the Production of Prolonged Traumatic Coma in the Miniature Pig <i>D. F. Meany, R. T. Miller, M. Leoni, M. Namakura, and D. Smith</i>	33
6.	Brain Tissue Material Properties: A Comparison of Results <i>B. R. Donnelly</i>	47
7.	Investigations on Impact Testing of Head Injury Protection Helmets <i>G. I. Johnson</i>	59

INSTRUMENTATION, TEST PROCEDURES, and DATA

8.	Use of a Kalman Filter to Improve The Estimation of ATD Response During Impact <i>G. S. Nushotz, L. C. Cattani, and P. J. Eagle</i>	69
9.	Sled Tests with Footwell Intrusion – First Experiences <i>D. Kallieris</i>	81

10. A Multipurpose Sternum Instrumentation 95
P. Potier, A. Jaffredo, S. Robin, J-Y Le Coz, J-P. Lassau

CRASH TESTS AND MODELING

11. Computer Modeling of Trans-Shoulder Forces in Motor Vehicle Accidents 99
H. G. French, and H. P. Davis
12. A Finite Element-Based Study of Pylon Fracture 107
R. E. Tannous, A. X. Zhang, and F. A. Bandak
13. The National Crash Survival Data Bank 117
E. J. Kaminsky, and S. J. Guccione, Jr.
14. Fifth Percentile Female Hybrid III H-Point Machine 131
M. N. Hamilton, R. Scherer, and C. McCreddie