TABLE OF CONTENTS

The Impact of Technology on Sport VI ................................................................. 1

A Four Compartment Model on Human Exercise Bioenergetics .......................... 4

Analysis of Shaft Movement Using FEM Model Considering Inertia Effect of Club Head .................................................. 10


Numerical Simulation of the Ice Hockey Slap Shot ........................................ 22

Finite Element Analysis of Cricket Ball Impact on Polycarbonate-EVA Sandwich .............................................................. 28

Parametric Finite Element Analysis of Steel Bicycle Frames: The Influence of Tube Selection on Frame Stiffness .......................... 34

3-Dimensional Joint Torque Calculation of Compression Sportswear Using 3D-CG Human Model ........................................ 40

Finite Element Analysis of Soccer Heading ...................................................... 46

Analysis of Climbing Postures and Movements in Sport Climbing for Realistic 3D Climbing ......................................................... 52

Design Parameters and Performance Characteristics for Design of Polocrosse Faceguards .................................................. 58

Love at First Try? How Reliable is a First Impression for Selecting a Golf Putter? .............................................................. 65

Impact Attenuation of Customized User-centered Bicycle Helmet Design ......... 77

User Centred Design Customisation of Bicycle Helmets Liner for Improved Dynamic Stability and Fit ............................... 85

Skin Deformation Behavior during Hand Movements and their Impact on Functional Sports Glove Design ...................................... 92

3D Anthropometric Investigation of Head and Face Characteristics of Australian Cyclists ...................................................... 98

Auxetic Foams for Sport Safety Applications ................................................. 104

Frictional Behaviour of Running Sock Textiles Against Plantar Skin ............. 110

The Design Strain and Dead Mass of Energy Absorbing Materials and Structures: Mathematical Principles and Experimental Determination ...................................................... 116

Energy Absorption and Performance Relevant to Thermal Wear Comfort Evaluation of Existing Impact Protective Pad and Materials Intended for Impact Protective Pad ........................................ 122

Thermo-formable Materials for Ski Boots for Improved Comfort and Performance ......................................................... 128

Effect of Compression on Thermal Comfort of Ski Boots ............................ 134

New Materials for Sports Equipment Made of Anisotropic Fiber-reinforced Plastics with Stiffness Related Coupling Effect ..... 140
Centre of Pressure Detection and Analysis with a High-resolution and Low-cost Smart Insole .................................................. 146
  Adin Ming Tan, Franz Konstantin Fuss, Yehuda Weizman, Michael F. Azari

Development of a Smart Insole for Medical and Sports Purposes ................................................................. 152
  Adin Ming Tan, Franz Konstantin Fuss, Yehuda Weizman, Olga Troynikov

Development of Instrumented Soccer Footwear for Kicking Analysis and Training Purposes ................ 157
  Yehuda Weizman, Franz Konstantin Fuss

Muscle Activity Analysis with a Smart Compression Garment ............................................................ 163
  Aaron Belbasis, Franz Konstantin Fuss, Jesper Sidhu

Estimation of Cruciate Ligament Forces Via Smart Compression Garments ...................................................... 169
  Aaron Belbasis, Franz Konstantin Fuss, Jesper Sidhu

Laboratory Evaluation of Wireless Head Impact Sensor ................................................................................. 175
  Derek Nevin, Lloyd Smith, Jeff Kerssud

Detection of Running Asymmetry Using a Wearable Sensor System .......................................................... 180
  Kieran Moran, Chris Richter, Evan Farrell, Edmond Mitchell, Amin Ahmadi, Noel O’Connor

Automatic Detection, Extraction, and Analysis of Landing During a Training Session, Using a Wearable Sensor System ............................................................................................................. 184
  Kieran Moran, Amin Ahmadi, Chris Richter, Edmond Mitchell, Jennifer Kavanagh, Noel O’Connor

Development of a Pressure Sensor Platform for Direct Measurement of Head Injury Criterion (HIC) .......... 190
  David E. Krzeminski, Franz Konstantin Fuss, Yehuda Weizman, Ardalan Kabeta, Scott G. Piland

Dynamics of Spin Bowling: The Normalized Precession of the Spin axis Analysed with a Smart Cricket Ball .................................................................................................................................................. 196
  Franz Konstantin Fuss, Batdelger Doljin, René E. D. Ferdinands, Aaron Beach

The Accuracy of a Real Time Sensor in an Instrumented Basketball .................................................................. 202
  Emad Abdelsrasoul, Islam Mahmoud, Pro Stergious, Larry Katz

Wheel Skid Correction is a Prerequisite to Reliably Measure Wheelchair Sports Kinematics Based on Inertial Sensors .................................................................................................................................................. 207
  R. M. A. Van Der Slkke, M. A. M. Berger, D. J. J. Bregman, H. E. J. Veeger

Determination of Spatiotemporal Parameters in Straight Drive Cricket Bat Swing Using Accelerometer Sensors ................................................................................................................................................ 213
  Ajay K. Sarkar, David V. Thiel

Dynamic Calibration of a Strain Gauge Based Handlebar Force Sensor for Cycling Purposes ....................... 219
  Joachim Vanwalleghem, Ives De Baere, Mia Loccafier, Wim Van Paepegem

Dynamic Calibration of an Instrumented Bike Brake Hood in Measuring Power Absorbed by the Hands ........................................................................................................................................................................ 225
  Yvan Champoux, Joachim Vanwalleghem, Jean-Marc Drohet

Development of a Smart Kendo Sword and Assessment of Grip Pressure of Kamai Stance and Kote Cut ......................................................................................................................................................... 231
  Kwangyul Jeong, Franz Konstantin Fuss, Bernd Fuernschn, Yehuda Weizman

Estimating the Relationship between Heart Rate and Power Output for Short Term Cycling Exercises ........ 237
  Daniel Meyer, Carolin Dungs, Velt Senner

Long-distance, Short-distance: Triathlon. One Name: Two Ways ....................................................................... 244
  Jorge Santana-Cabrera, Francisco-Jorge Santana-Martín

Musculoskeletal Simulation of Isokinetic Exercises: A Biomechanical and Electromyographical Pilot Study .................................................................................................................................................. 250
  Nicola Petrone, Daniele Tregnaghi, Mattia Nardon, Giuseppe Marcolin

Attitudes Towards Physical Activity and Perceived Exertion in Three Different Multitask Cybercycle Navigational Environments ........................................................................................................... 256
  A. M. Campelo, G. Donaldson, D. P. Sheehan, L. Katz

On the Use of Inertial Sensors in Educational Engagement Activities .................................................................. 262
  Hugo G. Espinosa, Jim Lee, Justin Keogh, Josie Grigg, Daniel A. James

Comparison of Shoe-surface Traction on Various Playing Surfaces in Futsal ...................................................... 267
  Bahador Keshvari, Velt Senner

Investigating Shear Stability of Rugby Union Natural Turf Pitches .................................................................. 273
  F. D. Anderson, P. Fleming, P. Sherratt, K. Severn

Mechanical Characterization of Handball Shoes Using Biomechanical Load Spectrums ................................ 279
  Dominik Krumm, Anne Gläser, Gert Schlegel, Stephan Odendal

Shock Attenuation Properties and Deformation Behavior of Sports Surfaces by Two-dimensional Impact Test ................................................................................................................................................... 284
  Harudeshi Yukawa, Takeshi Ueda, Shozo Kawamura

Tennis Shoe Outsole Temperature Changes During Hard Court Sliding and Their Effects on Friction Behaviour .................................................................................................................................................. 290
  Daniel Ura, Jacob Conway, Jamie Booth, Matt. J. Curre
The Development of a Translational Traction Rig to Investigate the Mechanisms of Traction in 3G Turf.............................................................. 296
Carolyn Webb, Steph Forrester, Paul Fleming

Pressure Distribution Under the Feet on the Treadmill Walking with Unstable Shoes and Regular Running Shoes in Different Conditions ........................................................................... 302
Jan O. Søna, Per Vølf, Ladislav Nagy

The Player Surface Interaction of Rugby Players with 3G Artificial Turf During Rugby Specific Movements .......................................................................................... 308
Michael Ferrandino, Steph Forrester, Paul Fleming

Application of Topological Optimization Technique to Running Shoe Designing ......................................................................................... 314
Tatsuya Nishiwaki, Mai Nonogawa

Insights to Skin-turf Friction as Investigated Using the Securisport ......................................................................................................................... 320
Sow Peng Tay, Paul Fleming, Steph Forrester, Xiao Hu

An Attempt for Developing the Measurement System of Reaction Force from Snow Surface for Private Ski Boots by Compact Force Sensors ..................................................................................................................... 326
Ayuko Saito, Hitoshi Doki, Akiko Kondo, Kiyoshi Hirose

An Estimation Method of Ski Friction Coefficients in Ski Running on Actual Snow Fields by Sensor System .................................................................................................................. 332
Ayuko Kondo, Kiyoshi Hirose, Ayuko Saito, Hitoshi Doki

Comparison of Carving and Skidding Turns by Joint Torque of Skier and Gliding Velocities in Ski Running on Alpine Ski Slope ..................................................................................... 338
Kiyoshi Hirose, Akiko Kondo, Hitoshi Doki

Literature Review of Race Driver Fatigue Measurement in Endurance Motorsport ........................................................................................... 344
Nick Owen, Horace King, Matthew Lamb

Experimental Measurement of Rifle Dynamics During the Range Shooting of Biathlon Weapons ............................................................................................................. 349
Andrey Koptyug, Mats Ainegren

Influence of Different Seating and Crank Positions on Muscular Activity in Elite Handcycling - A Case Study ................................................................................................................. 355
Stefan Litzinger, Franziska Malty, Anton Sabo

Using an Alternative Forced-choice Method to Study Shock Perception at Cyclists’ Hands: The Effect of Tyre Pressure ............................................................................................................. 361
Simon Richard, Yvan Champoux, Julien Lépine, Jean-Marc Dronet

The Effect of Elastic Compensation Arms on the Field and Laboratory Behavior of Alpine Skis .......................................................................................... 367
Nicola Petrone, Vittorio Quaggiotti, Giuseppe Marcolin

The Features of the Landing Slope of a Ski Jumping Hill That Need to be Considered ................................................................................................. 373
Kazuya Seo, Yuji Nihet, Ryutaro Watanabe, Toshiyuki Shimano, Takayuki Sakaguchi

Development of New Simulator Generating High Frequency Component of Ski Board Vibrations in Actual Skiing .................................................................................................................. 379
Akiro Shiomiya, Yuta Shimizu, Yusuke Kenmotsu, Akira Imamura, Hisashi Uchiyama, Rika Kinoto, Yoshitaka Kawada

A New Approach for the Grinding of Nordic Skis ................................................................................................................................. 385
Felix Breitschädel

Flow Visualization Around Panel Shapes of Soccer Ball ......................................................................................................................... 391
Sungchan Hong, Takeshi Asai, Kazuya Seo

A Comparative Study of Vent Designs for Effective Ventilation in Cricket Helmets ................................................................................................. 395
Toh Yen Pang, Ahamed Nazly Shammas, Aleksandar Subic, Monir Takla

Validation of the Aerodynamic Loading on Basic Flying Disc Geometries Derived from CFD Simulations .......................................................................................... 400
Jonathan R. Potts, Dominic Masters

Relating Baseball Seam Height to Carry Distance ................................................................................................................................. 406
Jeffrey K. Kensrud, Lloyd V. Smith, Alan Nathan, Derek Nevin

A Quantitative Flow Visualization Technique for On-site Sport Aerosodynamics Optimization ........................................................................ 412
Andrea Sciachitano, Giuseppe Carlo Alp Caridi, Fulvio Sciarano

Comparison of the Aerodynamic Performance of Four Racing Bicycle Wheels by Means of CFD Calculations .................................................................................................................. 418
Matteo Poggi, Nicola Petrone, Marco Antonello, Paolo Gobbato

Aerodynamic Body Position of the Brakeman of a 2-man Bobsleigh ......................................................................................................................... 424
Harun Chowdhury, Bavin Loganathan, Firoz Alam, Hazim Moria

Effect of Porosity of Badminton Shuttlecock on Aerodynamic Drag ......................................................................................................................... 430
Firoz Alam, Chanuch Natsakom, Harun Chowdhury

Bobsleigh Performance Characteristics for Winning Design ............................................................................................................................. 436
Peter Dabnichki
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematics of Arm Joint Motions in Basketball Shooting</td>
<td>443</td>
</tr>
<tr>
<td>Hiroki Okubo, Mont Hubbard</td>
<td></td>
</tr>
<tr>
<td>Kinematics of Elite Unilateral Below-elbow Amputee Treadmill-running - A Case Study</td>
<td>449</td>
</tr>
<tr>
<td>Franziska Malaf, Stefan Litzenberger, Anton Sabo</td>
<td></td>
</tr>
<tr>
<td>Measurement of Three-dimensional Orientation of Golf Club Head with One Camera</td>
<td>455</td>
</tr>
<tr>
<td>Wataru Kimizuka, Masahide Onuki</td>
<td></td>
</tr>
<tr>
<td>Rowing on a Boat Versus Rowing on an Ergo-meter: A Biomechanical and Electromyographycal Preliminary Study</td>
<td>461</td>
</tr>
<tr>
<td>Giuseppe Marcolin, Alberto Lentola, Antonio Paoli, Nicola Petrone</td>
<td></td>
</tr>
<tr>
<td>The Reliability of a Real Time Wearable Sensing Device to Measure Vertical Jump</td>
<td>467</td>
</tr>
<tr>
<td>Islam Mahmoud, Ayman Ali Ahmed Othman, Eman Abdelrazour, Pro Stergiou, Larry Katz</td>
<td></td>
</tr>
<tr>
<td>Novel Lunge Biomechanics in Modern Sabre Fencing</td>
<td>473</td>
</tr>
<tr>
<td>Kevin C. Moore, Frances M. E. Chow, John Y. H. Chow</td>
<td></td>
</tr>
<tr>
<td>Shoulder Joint Angle Errors Caused by Marker Offset</td>
<td>479</td>
</tr>
<tr>
<td>Zhiqing Zhang, Ben Halkon, Saw Meng Chou, Xingda Qu</td>
<td></td>
</tr>
<tr>
<td>Effects of Helmet Surface Geometry on Head Acceleration in High Velocity Water Sports</td>
<td>485</td>
</tr>
<tr>
<td>Dustin Scheer, Ghodrat Karami, Mariusz Ziejewski</td>
<td></td>
</tr>
<tr>
<td>Front Crawl Swimming Analysis Using Accelerometers: A Preliminary Comparison between Pool and Flume</td>
<td>497</td>
</tr>
<tr>
<td>Hugo G. Espinosa, Nikolai Nordsborg, David V. Thiel</td>
<td></td>
</tr>
<tr>
<td>Hand Speed Measurements in Boxing</td>
<td>502</td>
</tr>
<tr>
<td>Dennis Kimm, David V. Thiel</td>
<td></td>
</tr>
<tr>
<td>High Reliability Body Sensor Network Using Gesture Triggered Burst Transmission</td>
<td>507</td>
</tr>
<tr>
<td>Haider A. Sabti, David V. Thiel</td>
<td></td>
</tr>
<tr>
<td>Coach-Swimmer Communications Based on Wrist Mounted 2.4GHz Accelerometer Sensor</td>
<td>512</td>
</tr>
<tr>
<td>Rabee M. Hagem, Haider A. Sabti, David V. Thiel</td>
<td></td>
</tr>
<tr>
<td>Improvement of Crawl Stroke for the Swimming Humanoid Robot to Establish an Experimental Platform for Swimming Research</td>
<td>517</td>
</tr>
<tr>
<td>Motomu Nakashima, Yuto Tsunoda</td>
<td></td>
</tr>
<tr>
<td>Investigating Forward Velocity and Symmetry in Freestyle Swimming Using Inertial Sensors</td>
<td>522</td>
</tr>
<tr>
<td>Andy Stamm, David V. Thiel</td>
<td></td>
</tr>
<tr>
<td>Non-invasive, Spatio-temporal Gait Analysis for Sprint Running Using a Single Camera</td>
<td>528</td>
</tr>
<tr>
<td>Marcus Dunn, John Kelley</td>
<td></td>
</tr>
<tr>
<td>Information Visualisation of Optimised Underhand Throw for Cybernetic Training</td>
<td>534</td>
</tr>
<tr>
<td>Hiroki Yokota, Shigemich Ohshima, Naoki Mizuno</td>
<td></td>
</tr>
<tr>
<td>Movement Variability of Professional Pool Billiards Players on Selected Tasks</td>
<td>540</td>
</tr>
<tr>
<td>Philipp Kornfeind, Arnold Baca, Thomas Boindl, Andreas Kettlgruber, Gerald Goldhuber</td>
<td></td>
</tr>
<tr>
<td>MobiXeyes: Real-time Stereo Vision Technology for Racket Sports</td>
<td>546</td>
</tr>
<tr>
<td>Odysseas Sekkas, Vasileios Tsitos, Aggelos Biboudis, Evangelos Zervas, Nikolaos Silvestros, Stathis Hadjiyianniades, Angelos Batistakis</td>
<td></td>
</tr>
<tr>
<td>Estimation and Visualization of Paddling Effort for Stand Up Paddle Boarding with a Geographical Information System</td>
<td>552</td>
</tr>
<tr>
<td>Harutoshi Yukawa, Mei Ilno, Takuma Fujiiwara</td>
<td></td>
</tr>
<tr>
<td>An Evaluation of the Riddell IQ HITS System in Prediction of an Athlete's Head Acceleration</td>
<td>556</td>
</tr>
<tr>
<td>Dustin Scheer, Ghodrat Karami, Mariusz Ziejewski</td>
<td></td>
</tr>
<tr>
<td>Industry Sustainability Under Technological Evolution: A Case Study of the Overshooting Hypothesis in Sports</td>
<td>562</td>
</tr>
<tr>
<td>Stuart Thomas, Jason Potts</td>
<td></td>
</tr>
<tr>
<td>New Teaching Methods in Sports Engineering: How to Speed-up Learning While Having Fun!</td>
<td>568</td>
</tr>
<tr>
<td>Arjen J. Jansen</td>
<td></td>
</tr>
<tr>
<td>Author Index</td>
<td></td>
</tr>
</tbody>
</table>