

10th South African Conference on Computational and Applied Mechanics (SACAM 2016)

Potchefstroom, South Africa
3 – 5 October 2016

Editor:

Jan-Hendrik Kruger

ISBN: 978-1-5108-3669-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2016) by South African Association for Theoretical and Applied Mechanics (SAAM)
All rights reserved.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact
South African Association for Theoretical and Applied Mechanics (SAAM)
at the address below.

South African Association for Theoretical and Applied Mechanics (SAAM)
c/o Schalk Kok
9-21 Engineering I
Department of Mechanical Engineering
University of Pretoria
South Africa

Phone: 27 21 808 3554
Fax: 27 86 615 5206

Schalk.Kok@uj.ac.za

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

| | |
|---|-----|
| SURFACE ACCURACY AND POINTING ERROR PREDICTION OF A 32 M CLASS RADIO ASTRONOMY TELESCOPE | 1 |
| <i>S. Azankpo, G. Venter</i> | |
| A DESIGN AND ANALYSIS OF A MULTIFUNCTIONAL COMPOSITE STRUCTURE FOR NANO-SATELLITES | 10 |
| <i>J. Ball, G. Oliver, M. Petersen</i> | |
| MODELLING THE STRUCTURAL BEHAVIOUR OF A ROUND NOZZLE TO FLAT PLATE INTERFACE IN PRESSURE VESSELS | 20 |
| <i>W. Beyers, A. Zapke, G. Venter</i> | |
| INTERFACE INFORMATION TRANSFER BETWEEN NON-MATCHING, NONCONFORMING INTERFACES USING RADIAL BASIS FUNCTION INTERPOLATION | 30 |
| <i>A. Bogaers, S. Kok, B. Reddy, T. Franz</i> | |
| ENERGY USAGE OPTIMISATION OF HEAVY HAUL FREIGHT TRAINS | 40 |
| <i>A. Bogaers, N. Botha</i> | |
| BULK AIR COOLER ENERGY OPTIMISATION THROUGH SIMULATION COUPLED WITH AN OPTIMISATION PLATFORM | 50 |
| <i>W. Bornman, J. Dirker, D. Arndt, J. Meyer</i> | |
| THE USE OF DIGITAL IMAGE CORRELATION IN TYRE RESEARCH | 60 |
| <i>B. Richard, G. Glenn, S. Joachim, E. Schalk</i> | |
| FATIGUE CRACK LIFE ESTIMATION OF A NOTCHED BLADE-LIKE COMPONENT USING FINITE ELEMENT MODELLING | 70 |
| <i>J. Brits, S. Heyns, H. Inglis</i> | |
| CALIBRATION OF THE DISCRETE ELEMENT METHOD AND THE EFFECT OF PARTICLE SHAPE | 79 |
| <i>C. Coetzee</i> | |
| AN ALTERNATIVE APPROACH TO SYSTEM IDENTIFICATION | 91 |
| <i>J. Crous, S. Kok, P. Heyns</i> | |
| FINITE ELEMENT ANALYSIS OF THE TREAD QUENCHING OF RAILWAY WHEELS | 101 |
| <i>J. Cuperus, G. Venter, D. Blaine</i> | |
| EXPERIMENTAL INVESTIGATION OF THE EFFECTIVE THERMAL CONDUCTIVITY IN THE NEAR-WALL REGION OF A PACKED PEBBLE BED | 115 |
| <i>M. Beer, C. Toit, H. Dreyer</i> | |
| A SYSTEM CFD SIMULATION OF THE EFFECT OF A PRESSURE PULSE ON THE PERFORMANCE OF A REACTOR CAVITY COOLING SYSTEM OF A VERY HIGH TEMPERATURE REACTOR | 126 |
| <i>C. Toit, P. Rousseau, J. Jun, M. Kim</i> | |
| METHODOLOGY FOR THE MECHANICAL CHARACTERISATION OF UNCOATED WOVEN POLYMER TEXTILES | 136 |
| <i>D. Ellis, M. Venter, G. Venter</i> | |
| COMPUTATIONAL MULTIPHASE FLOW MODELLING AND DIMENSIONAL ANALYSIS STUDY OF OXYGEN LANCING OF PYROMETALLURGICAL FURNACES | 146 |
| <i>M. Erwee, Q. Reynolds, J. Zietsman</i> | |
| NUMERICAL AND EXPERIMENTAL STUDIES OF A PULVERISED FUEL VERTICAL SPINDLE MILL | 154 |
| <i>A. Govender, W. Schmitz, R. Naidoo</i> | |
| RIDE COMFORT SENSITIVITY TO SPEED OVER DIFFERENT ROADS FOR AN OFF-ROAD VEHICLE | 164 |
| <i>R. Grabe, C. Kat, P. Els</i> | |
| MODELING AND DEVELOPMENT OF A MAGNETO-RHEOLOGICAL EQUIPPED HYDRO-PNEUMATIC SEMI-ACTIVE SUSPENSION SYSTEM | 172 |
| <i>G. Heymans, P. Els</i> | |
| DEVELOPING A METHODOLOGY TO FIT A CONSTITUTIVE CREEP MODEL TO 1CR-1MO-0.25V CAST ALLOY STEEL | 183 |
| <i>G. Howard, H. Inglis, F. Pietra, S. Kok</i> | |
| CYCLIC EFFECTS AND RECRYSTALLISATION IN TEMPERATURE AND RATE DEPENDENT STATE VARIABLE BASED PLASTICITY | 192 |
| <i>G. Rensburg, S. Kok, D. Wilke</i> | |

| | |
|--|-----|
| DESIGN AND EVALUATION OF A FLUTTER-SUPPRESSION CONTROL SYSTEM FOR AN AIRCRAFT WING | 202 |
| <i>S. Jivan, G. Venter, S. Spuy</i> | |
| FORMULATION OF A UNIT CELL FOR A THERMAL-HYDRAULIC SYSTEMS MODEL OF A PRISMATIC FUEL BLOCK OF A HIGH TEMPERATURE GAS-COOLED REACTOR | 212 |
| <i>S. Khoza, C. Toit, P. Rousseau</i> | |
| HEAT TRANSFER IN TWO AND THREE-DIMENSIONAL SINGLE SPAN GREENHOUSES | 221 |
| <i>S. Kruger, L. Pretorius</i> | |
| AERODYNAMIC ANALYSIS OF A SAILPLANE SELF-LAUNCH SYSTEM: PROPELLER SUB-MODEL | 231 |
| <i>J. Roux, J. Kruger, J. Bosman</i> | |
| EXPERIMENTAL OBSERVATION OF COMPUTED ULTRASONIC GUIDED WAVE DISPERSION PHENOMENA | 242 |
| <i>P. Loveday, D. Ramatlo</i> | |
| MODELLING MOORING LINE BEHAVIOUR TO DETERMINE THE IMPACT FORCE ON SQUID EGG BEDS | 250 |
| <i>V. Maluleke, G. Oliver, M. Roberts</i> | |
| NUMERICAL MODELLING AND VALIDATION OF HEAT GENERATION IN HAUL TRUCK TYRES | 263 |
| <i>J. Marais, G. Venter</i> | |
| A SYSTEMATIC COMPARISON OF TWO DIRECT EXCHANGE AREA SMOOTHING TECHNIQUES FOR MODELLING RADIATION HEAT TRANSFER IN THREE-DIMENSIONAL ENCLOSURES USING THE ZONAL METHOD | 273 |
| <i>W. Monnaemang, P. Rousseau, L. Jestin</i> | |
| ANALYSIS OF VIBRATION INDUCING SOURCES OF A LARGE-SCALE COOLING SYSTEM FAN BLADE | 285 |
| <i>J. Muiyser, D. Els, J. Spuy, N. Basson</i> | |
| MULTI-SCALE SIMULATION OF DROPLET-DROPLET INTERACTIONS AND COALESCENCE | 297 |
| <i>N. Musehane, O. Oxtoby, B. Reddy</i> | |
| A COMPARATIVE STUDY OF THE THERMO-HYDRAULICS OF THE SNUF TEST FACILITY CORE USING FLOWNEX AND RELAP5 | 307 |
| <i>V. Naicker, C. Zikhali, J. Kruger</i> | |
| CFD SIMULATION OF A SINGLE BURNER PULVERISED COAL COMBUSTION TEST FACILITY | 318 |
| <i>R. Naidoo, P. Rajoo, W. Schmitz</i> | |
| PRELOAD AND AMPLITUDE DEPENDENCY ON DYNAMIC PROPERTIES OF A RUBBER MOUNT | 331 |
| <i>C. Nel, J. Bloem</i> | |
| FINITE ELEMENT MODAL ANALYSIS FOR A COOLER FAN SUPPORT STRUCTURE | 340 |
| <i>C. Nel</i> | |
| FATIGUE ANALYSIS OF CLASS 5M RAILWAY BOGIE | 351 |
| <i>B. Nickerson, G. Venter</i> | |
| SIMULATION OF NATURAL CONVECTIVE FLOW IN AN EXPERIMENTAL REACTOR CAVITY COOLING SYSTEM FACILITY | 361 |
| <i>P. Niemand, C. Toit, N. Tak, M. Kim</i> | |
| CFD SIMULATION OF A FLUIDIZED BED REACTOR FOR PETROLEUM WASTEWATER PHOTODEGRADATION | 372 |
| <i>N. Nyembe, A. Ochieng, L. Lerotholi</i> | |
| FINITE ELEMENT FORMULATION AND ANALYSIS OF THE COMPOSITE STRUCTURE OF OVERHEAD TRANSMISSION LINES CONDUCTORS | 382 |
| <i>E. Ojo</i> | |
| THE EVALUATION OF 3D CFD APPROACHES TO MODEL THE FLOW AND HEAT TRANSFER INSIDE AN UNSTRUCTURED BED OF UNIFORM SPHERES | 394 |
| <i>M. Potgieter, C. Toit, J. Kruger</i> | |
| A ROW-BY-ROW AXIAL TURBINE PROCESS MODEL BASED ON A ONE-DIMENSIONAL THERMOFLUID NETWORK APPROACH | 403 |
| <i>R. Pottas, P. Rousseau</i> | |
| OPTIMAL DESIGN OF A PIEZOELECTRIC TRANSDUCER TO EXCITE ULTRASONIC GUIDED WAVES | 412 |
| <i>D. Ramatio, D. Wilke, P. Loveday</i> | |

| | |
|--|------------|
| COMPUTATIONAL MODELLING OF SLAG FOAMING IN PYROMETALLURGICAL FURNACES | 423 |
| <i>Q. Reynolds, M. Erwee</i> | |
| UNCERTAINTIES IN MODELLING AN ELECTROMAGNETIC LEVITATION CELL (EMLC) | 434 |
| <i>S. Roberts, S. Kok, H. Inglis, J. Zietsman</i> | |
| THE EFFECTS OF GRAIN SIZE VARIANTS ON FRACTURE TOUGHNESS OF NANOCRYSTALLINE MATERIALS PRODUCED BY ACCUMULATIVE ROLL-BONDING | 443 |
| <i>P. Sob, A. Alugongo, T. Tengen</i> | |
| A STRUCTURAL-LOCKING BICYCLE DOCKING MECHANISM TO ENABLE SAFE AND CONVENIENT BICYCLE USAGE IN URBAN ENVIRONMENTS | 452 |
| <i>M. Swanepoel, M. Booysen, W. Smit</i> | |
| THERMAL LOSSES CONSIDERATIONS IN THERMO-ACOUSTIC ENGINE DESIGN | 462 |
| <i>L. Tartibu</i> | |
| MODELLING OF THERMO-ACOUSTIC REFRIGERATORS USING GENERAL ALGEBRAIC MODELLING SYSTEM..... | 472 |
| <i>L. Tartibu</i> | |
| MODELLING OF COUPLED VIBRATION RESPONSE OF A ROTOR-STATOR SYSTEM TO MULTIPLE PARAMETRIC EXCITATIONS BY WAVELET TRANSFORM..... | 482 |
| <i>B. Tchomeni, L. Masu, A. Alugongo, T. Tengen</i> | |
| ANALYSIS OF A CRACKED UNBALANCED ROTOR-STATOR SYSTEM WITH FLUID FILM BEARING FORCES BY WAVELET TRANSFORM | 492 |
| <i>B. Tchomeni, A. Alugongo, T. Tengen</i> | |
| PARAMETRIC STUDY OF SUITABLE ORTHOGONALITY CONDITIONS FOR PLANAR MULTILINK FLEXIBLE ROBOTS | 503 |
| <i>F. Tekweme, A. Nel</i> | |
| THE EFFECTS OF THE SIZE VARIANTS OF NANOCRYSTALLINE MATERIALS PRODUCED BY ACCUMULATIVE ROLL-BONDING ON THEIR ENERGY, THERMODYNAMICS AND MECHANICAL PROPERTIES | 513 |
| <i>P. Sob, A. Alugongo, T. Tengen</i> | |
| A METHODOLOGY FOR THE INTEGRATED SYSTEM SIMULATION OF THE HEAT TRANSFER AND COMBUSTION IN A COAL-FIRED BOILER FURNACE..... | 523 |
| <i>W. Meer, P. Rousseau, L. Jestin</i> | |
| THE CFD MODELLING OF THE AIR FLOW THROUGH A FINNED COIL HEAT EXCHANGER | 534 |
| <i>M. Heystek, M. Eldik, P. Venter</i> | |
| NUMERICAL REPLICA OF A DUNNAGE BAG CERTIFICATION TEST | 544 |
| <i>M. Venter, G. Venter</i> | |
| GRADIENT-ONLY OPTIMIZATION IN REVIEW FOR ENGINEERING OPTIMIZATION PROBLEMS..... | 553 |
| <i>D. Wilke</i> | |
| THE SENSITIVITY OF STATIC TYRE TESTS AND THE EFFECTS OF AGED TYRES | 564 |
| <i>K. Wright, S. Els</i> | |
| Author Index | |