

# **XXIV Italian Group of Fracture Conference 2017**

Procedia Structural Integrity Volume 3

Urbino, Italy  
1 – 3 March 2017

## **Editors:**

**Francesco Iacoviello  
Pedro M.G.P. Moreira  
J.S. Paulo**

ISBN: 978-1-5108-4089-8

**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© by Elsevier B.V.  
All rights reserved.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact Elsevier B.V.  
at the address below.

Elsevier B.V.  
Radarweg 29  
Amsterdam 1043 NX  
The Netherlands

Phone: +31 20 485 3911  
Fax: +31 20 485 2457

<http://www.elsevierpublishingsolutions.com/contact.asp>

**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](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

<b>EDITORIAL</b> .....	1
<i>Francesco Iacoviello, Luca Susmel, Donato Firrao, Giuseppe Ferro</i>	
<b>STRUCTURAL INTEGRITY OF PROGRESSIVELY COLD-DRAWN PEARLITIC STEELS: FROM RAFFAELLO SANZIO TO VINCENT VAN GOGH</b> .....	3
<i>Jesús Toribio</i>	
<b>IMPROVING THE MECHANICAL PERFORMANCE OF CEMENT COMPOSITES BY CARBON NANOTUBES ADDITION</b> .....	11
<i>Syed Shujat-Ul-Hussan Gillani, Anwar Khitab, Sajjad Ahmad, Rao Arsalan Khushnood, Giuseppe Andrea Ferro, Syed Minhaj Saleem Kazmi, Liaqat Ali Qureshi, Luciana Restuccia</i>	
<b>FRACTURE TOUGHNESS OF HIGHLY DEFORMABLE POLYMERIC MATERIALS</b> .....	18
<i>Roberto Brighenti, Andrea Carpinteri, Federico Artoni</i>	
<b>VALIDATION OF A LOW BLOW SPECIMEN TECHNIQUE FOR R-CURVE DETERMINATION USING A DROP TOWER</b> .....	25
<i>Wolfram Baer, Peter Wossidlo</i>	
<b>ANALYSIS OF THE MECHANICAL BEHAVIOR OF A DELAYED COKER DRUM WITH A CIRCUMFERENTIALLY CRACKED SKIRT</b> .....	33
<i>J. L. González, S. Gómez, G. Gómez</i>	
<b>FAILURE ANALYSIS OF A DIESEL ENGINE</b> .....	41
<i>J. L. González, D. Rivas, M. A. Beltrán</i>	
<b>INTEGRITY ASSESSMENT AND REHABILITATION RECOMMENDATION OF THE STRIPPER SECTION OF A FCC REACTOR IN THE CREEP REGIME</b> .....	48
<i>J. L. González, S. Gómez, D. Rivas</i>	
<b>ON THE ROLE OF MICROSTRUCTURAL PROPERTIES ON MECHANICAL BEHAVIOR OF API-X46 STEEL</b> .....	57
<i>M. A. Beltrán, J. L. González, D. Rivas, F. Hernández, H. Dorantes</i>	
<b>MULTIAXIAL FRACTURE OF GRAPHITE COMPONENTS: A REVIEW OF RECENT RESULTS</b> .....	68
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>MECHANICAL BEHAVIOUR OF HOT DIP GALVANIZED STEEL CONNECTION UNDER CYCLIC LOADING</b> .....	77
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi, F. Mutignani</i>	
<b>FATIGUE BEHAVIOUR OF NOTCHED SPECIMENS MADE OF 40CRMOV13.9 UNDER MULTIAXIAL LOADING</b> .....	85
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>FATIGUE ASSESSMENT OF STEEL ROLLERS USING AN ENERGY BASED CRITERION</b> .....	93
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>NON-LOCALIZED CREEP ASSESSMENT OF V-NOTCHED COMPONENTS: A REVIEW</b> .....	102
<i>P. Gallo, F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>SOME RECENT CRITERIA FOR BRITTLE FRACTURE PREDICTION UNDER IN-PLANE SHEAR LOADING</b> .....	110
<i>A. Campagnolo, F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>THE EFFECT OF RESIDUAL STRESS ON FATIGUE BEHAVIOR OF V-NOTCHED COMPONENTS: A REVIEW</b> .....	119
<i>P. Ferro, F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>SOME METHODS FOR RAPID EVALUATION OF THE MIXED MODE NSIFS</b> .....	126
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>MECHANICAL BEHAVIOR OF HOT-DIP GALVANIZED WELDED STEEL UNDER CYCLIC LOADING</b> .....	135
<i>F. Berto, S. M. J. Razavi, M. R. Ayatollahi, F. Mutignani</i>	
<b>ON THE FRACTURE BEHAVIOR OF POLYURETHANE NOTCHED COMPONENTS</b> .....	144
<i>F. Berto, L. Marsavina, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>EXPERIMENTAL AND NUMERICAL INVESTIGATIONS OF FRACTURE BEHAVIOR OF MAGNETOSTRICTIVE MATERIALS</b> .....	153
<i>M. Colussi, F. Berto, S. M. J. Razavi, M. R. Ayatollahi</i>	
<b>FATIGUE BEHAVIOR OF INNOVATIVE ALLOYS AT ELEVATED TEMPERATURE</b> .....	162
<i>F. Berto, P. Gallo, S. M. J. Razavi, M. R. Ayatollahi</i>	

<b>A COMBINED EXPERIMENTAL-NUMERICAL INVESTIGATION OF THE FAILURE MODE OF THIN METAL FOILS</b> .....	168
<i>Gabriella Bolzon, Mahdieh Shahmardani, Rui Liu, Emanuele Zappa</i>	
<b>AN INDENTATION BASED INVESTIGATION ON THE CHARACTERISTICS OF ARTIFICIALLY AGED PIPELINE STEELS</b> .....	172
<i>Gabriella Bolzon, Olha Zvirko</i>	
<b>ON FIELD DURABILITY TESTS OF MECHANICAL SYSTEMS. THE USE OF THE FATIGUE DAMAGE SPECTRUM</b> .....	176
<i>F. Cianetti, A. Alvino, A. Bolognini, M. Palmieri, C. Braccesi</i>	
<b>ON THE USE OF THE PEAK STRESS METHOD FOR THE CALCULATION OF RESIDUAL NOTCH STRESS INTENSITY FACTORS: A PRELIMINARY INVESTIGATION</b> .....	191
<i>P. Ferro, M. Colussi, G. Meneghetti, F. Berto, M. Lachin, S. A. Castiglione</i>	
<b>DAMAGING MICROMECHANISMS IN AN AS CAST FERRITIC AND A FERRITIZED DUCTILE CAST IRON</b> .....	201
<i>Laura D'Agostino, Vittorio Di Cocco, Diego O. Fernandez, Francesco Iacoviello</i>	
<b>CVD NANO-COATING OF CARBON COMPOSITES FOR SPACE MATERIALS ATOMIC OXYGEN SHIELDING</b> .....	208
<i>A. Delfini, A. Vricella, R. Bueno Morles, R. Pastore, D. Micheli, F. Gugliermetti, M. Marchetti</i>	
<b>CRACK PATH AND DAMAGE IN A CUZNAL SMA</b> .....	217
<i>V. Di Cocco, F. Iacoviello, L. D'Agostino, S. Natali, V. Volpe</i>	
<b>SN AND TI INFLUENCE ON DAMAGE OF BENT HOT-DIP GALVANIZING PHASES</b> .....	224
<i>Vittorio Di Cocco, Francesco Iacoviello, Laura D'Agostino, Stefano Natali</i>	
<b>DAMAGE MICROMECHANISMS IN A HOT DIP GALVANIZED STEEL</b> .....	231
<i>Vittorio Di Cocco, Francesco Iacoviello, Laura D'Agostino, Stefano Natali</i>	
<b>EXPERIMENTAL DETERMINATION OF THICKNESS INFLUENCE ON COMPRESSIVE RESIDUAL STRENGTH OF IMPACTED CARBON/EPOXY LAMINATE</b> .....	237
<i>M. P. Falaschetti, M. Scafe, A. Tati, E. Troiani</i>	
<b>STUDY OF DEFECT FORMATION IN AL 7050 ALLOYS</b> .....	246
<i>A. Brotzu, G. De Lellis, F. Felli, D. Pilone</i>	
<b>NEW SELF-HEALING TECHNIQUES FOR CEMENT-BASED MATERIALS</b> .....	253
<i>Luciana Restuccia, Anna Reggio, Giuseppe Andrea Ferro, Jean-Marc Tulliani</i>	
<b>SIZE EFFECT ON FRACTURE TOUGHNESS OF SNOW</b> .....	261
<i>Barbara Frigo, Alessandro P. Fantilli, Bernardino Chiaia</i>	
<b>ANALYSIS OF THE INTERGRANULAR CORROSION SUSCEPTIBILITY IN STAINLESS STEEL BY MEANS OF POTENTIOSTATIC REACTIVATION TESTS</b> .....	269
<i>Francesco Iacoviello, Vittorio Di Cocco, Laura D'Agostino</i>	
<b>INTEGRANULAR CORROSION SUSCEPTIBILITY ANALYSIS IN AUSTENO-FERRITIC (DUPLEX) STAINLESS STEELS</b> .....	276
<i>Francesco Iacoviello, Vittorio Di Cocco, Laura D'Agostino</i>	
<b>CLASSIFICATION OF DUCTILE CAST IRON SPECIMENS BASED ON IMAGE ANALYSIS AND SUPPORT VECTOR MACHINE</b> .....	283
<i>Francesco Iacoviello, Daniela Iacoviello, Vittorio Di Cocco, Alberto De Santis, Laura D'Agostino</i>	
<b>FATIGUE CRACK PROPAGATION IN DUCTILE CAST IRONS: AN ARTIFICIAL NEURAL NETWORKS BASED MODEL</b> .....	291
<i>Laura D'Agostino, Alberto De Santis, Vittorio Di Cocco, Daniela Iacoviello, Francesco Iacoviello</i>	
<b>DUPLEX STAINLESS STEELS "475° C EMBRITTLEMENT": INFLUENCE OF THE CHEMICAL COMPOSITION ON THE FATIGUE CRACK PROPAGATION</b> .....	299
<i>Vittorio Di Cocco, Francesco Iacoviello, Gloria Ischia</i>	
<b>HIGH TEMPERATURE EMBRITTLED DUPLEX STAINLESS STEELS: INFLUENCE OF THE CHEMICAL COMPOSITION ON THE FATIGUE CRACK PROPAGATION</b> .....	308
<i>Francesco Iacoviello, Vittorio Di Cocco, Ester Franzese, Stefano Natali</i>	
<b>MONITORING THE MECHANICAL RESPONSE OF ASYMMETRICALLY FRACTURED MARBLE EPISTYLES AFTER RESTORING THEIR STRUCTURAL INTEGRITY</b> .....	316
<i>Stavros K. Kourkoulis, Ioanna Dakanali</i>	
<b>RECORDING THE MECHANICAL RESPONSE AND FRACTURE OF MARBLE DENT SPECIMENS USING MODERN SENSING TECHNIQUES</b> .....	326
<i>S. K. Kourkoulis, D. Triantis, I. Stavrakas, E. D. Pasiou, I. Dakanali</i>	
<b>THE DISPLACEMENT FIELD IN AN ORTHOTROPIC DISC UNDER PARABOLIC PRESSURE. APPLICATION TO THE CASE OF TRANSVERSE ISOTROPY</b> .....	334
<i>Christos F. Markides, Stavros K. Kourkoulis</i>	

<b>CORRELATION OF PRESSURE STIMULATED CURRENTS AND ACOUSTIC EMISSIONS DURING 3PB OF CEMENT-MORTAR BEAMS AND THE ROLE OF LOADING RATE .....</b>	<b>346</b>
<i>D. Triantis, E. D. Pasiou, I. Stavrakas, I. Dakanali, S. K. Kourkoulis</i>	
<b>A VARIATIONAL MODEL FOR DETERMINING FRACTURE MODES IN FRCM SYSTEMS .....</b>	<b>354</b>
<i>Giovanni Lancioni, Jacopo Donnini, Valeria Corinaldesi</i>	
<b>A COUPLED ALE-COHESIVE FORMULATION FOR LAYERED STRUCTURAL SYSTEMS.....</b>	<b>362</b>
<i>Marco Francesco Funari, Fabrizio Greco, Paolo Lonetti</i>	
<b>MEGASTRUCTURES: USE OF CFD TURBULENCE MODELS FOR THE EVALUATION OF WIND-INDUCED FATIGUE LOADS .....</b>	<b>370</b>
<i>Alberto Lorenzon, Marco Antonello, Filippo Berto</i>	
<b>BURST BEHAVIOR OF CPVC COMPARED TO HDPE THERMOPLASTIC POLYMER UNDER A CONTROLLED INTERNAL PRESSURE .....</b>	<b>380</b>
<i>Majid Fatima, Safe Mohamed, Elghorba Mohamed</i>	
<b>MECHANICAL BEHAVIOR PREDICTION OF PPR AND HDPE POLYMERS THROUGH NEWLY DEVELOPED NONLINEAR DAMAGE-RELIABILITY MODELS.....</b>	<b>387</b>
<i>Majid Fatima, Ouardi Abderazzak, Barakat Mohamed, Elghorba Mohamed</i>	
<b>THE NUMERICAL MODELLING OF A MIDDLE STRENGTH ROCK MATERIAL UNDER FLEXURAL TEST BY FINITE ELEMENT METHOD-COUPLED TO-SPH.....</b>	<b>395</b>
<i>A. Mardalizad, A. Manes, M. Giglio</i>	
<b>CHANGE OF MISORIENTATION OF INDIVIDUAL GRAINS IN FATIGUE OF POLYCRYSTALLINE ALLOYS BY DIFFRACTION CONTRAST TOMOGRAPHY USING ULTRABRIGHT SYNCHROTRON RADIATION .....</b>	<b>402</b>
<i>Y. Nakai, D. Shiozawa, N. Asakawa, K. Nonaka, S. Kikuchi</i>	
<b>A GENERAL MODEL FOR CRACK GROWTH FROM INITIAL DEFECT IN VERY-HIGH-CYCLE FATIGUE .....</b>	<b>411</b>
<i>Davide S. Paolino, Andrea Tridello, Giorgio Chiandussi, Massimo Rossetto</i>	
<b>FATIGUE ASSESSMENT BY ENERGY APPROACH DURING TENSILE AND FATIGUE TESTS ON PPGF35.....</b>	<b>424</b>
<i>V. Crupi, E. Guglielmino, L. Scappaticci, G. Risitano</i>	
<b>DETERMINATION OF CRITICAL STRESS IN HIGH STRENGTH CONCRETE.....</b>	<b>432</b>
<i>A. D'Aveni, G. Fargione, E. Guglielmino, G. Risitano, A. Risitano</i>	
<b>ANALYSIS OF FAILURE IN QUASI-BRITTLE MATERIALS BY 3D MULTIPLANE COHESIVE ZONE MODELS COMBINING DAMAGE, FRICTION AND INTERLOCKING.....</b>	<b>441</b>
<i>Roberto Serpieri, Marco Albarella, Giulio Alfano, Elio Sacco</i>	
<b>AN INVESTIGATION ON THE "WIDTH AND SIZE EFFECT" IN THE EVALUATION OF THE FRACTURE ENERGY OF CONCRETE .....</b>	<b>450</b>
<i>Christian Carloni, Mattia Santandrea, Roman Wendner</i>	
<b>SOME COMMENTS ON MECHANICAL FATIGUE CHARACTERIZATION OF STEEL RAILS IN STANDARDS .....</b>	<b>459</b>
<i>Raffaella Sesana, Paolo Matteis</i>	
<b>ON THE FRACTURE PROCESSES OF CUTTING.....</b>	<b>468</b>
<i>P. Stähle, A. Spagnoli, M. Terzano</i>	
<b>PHASE FIELD MODELLING OF FORMATION AND FRACTURE OF EXPANDING PRECIPITATES.....</b>	<b>477</b>
<i>W. Rehehman, P. Stähle, E. Durgé, R. N. Singh</i>	
<b>CREEP BEHAVIOUR OF 15-15Ti(SI) AUSTENITIC STEEL IN AIR AND IN LIQUID LEAD AT 550°C .....</b>	<b>484</b>
<i>A. Strafella, A. Coglitore, E. Salernitano</i>	
<b>ADDITIVELY MANUFACTURED PLA UNDER STATIC LOADING: STRENGTH/CRACKING BEHAVIOUR VS. DEPOSITION ANGLE.....</b>	<b>498</b>
<i>A. A. Ahmed, L. Susmel</i>	
<b>DUCTILE FRACTURE ASSESSMENT OF X65 STEEL USING DAMAGE MECHANICS.....</b>	<b>508</b>
<i>Gabriel Testa, Nicola Bonora, Domenico Gentile, Antonio Carlucci, Yazid Madi</i>	
<b>TENSILE BEHAVIOR AND IMPACT TOUGHNESS OF AN ALSI3MGCR ALLOY .....</b>	<b>517</b>
<i>Marialaura Tocci, Annalisa Pola, Lorenzo Montesano, Mattia Merlin, Gian Luca Garagnani, G. Marina La Vecchia</i>	
<b>TORSION PROBLEMS OF FINITE CYLINDERS WEAKENED BY RING-SHAPED CRACKS.....</b>	<b>526</b>
<i>Nataly Vaysfeld, Yuriy Protcerov</i>	
<b>A NEW ADVANCED RAILGUN SYSTEM FOR DEBRIS IMPACT STUDY.....</b>	<b>545</b>
<i>A. Vricella, A. Delfini, A. Pacciani, R. Pastore, D. Micheli, G. Rubini, M. Marchetti, F. Santoni</i>	

<b>FAILURE INVESTIGATION: IN FLIGHT LOSS OF A MAIN LANDING GEAR DOOR OF A TRANSPORT AIRCRAFT</b> .....	553
<i>G. Zucca, V. Di Francesco, M. Bernabei, F. De Paolis</i>	
<b>ULTRASONIC FATIGUE TESTING ON THE POLYMERIC MATERIAL PMMA, USED IN ODONTOLOGY APPLICATIONS</b> .....	562
<i>G. M. Domínguez Almaraz, A. Gutiérrez Martínez, R. Hernández Sánchez, E. Correa Gómez, M. Guzmán Tapia, J. C. Verduzco Juárez</i>	
<b>ULTRASONIC FATIGUE TESTS ON THE NAFION PROTON EXCHANGE MEMBRANE, UNDER THE MODALITY OF THREE POINTS BENDING</b> .....	571
<i>G. M. Domínguez Almaraz, R. Hernández Sánchez, A. Gutiérrez Martínez, E. Correa Gómez, J. C. Verduzco Juárez, V. López Garza</i>	
<b>ESTIMATION OF THE DAMAGE IN DOUBLY NOTCHED A36 STEEL SPECIMENS, AS A FUNCTION OF THE REDUCTION RATE OF <math>N_F</math> UNDER A LOADING LEVEL <math>\Delta\sigma</math></b> .....	579
<i>Jilali Nattaj, Fatima Majid, Hassan Chaffoui, Mohamed El Ghorba</i>	
<b>Author Index</b>	