Preface

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This special issue titled “*Experimental Solid Mechanics*” is dedicated to Professor **Emmanuel E. Gdoutos** in celebration of his 65th birthday. It resulted from an invitation of the editor-in-chief Professor Alberto Carpinteri, which I wholeheartedly accepted.

The issue contains *twenty three papers* written by world renowned experts on experimental mechanics, which covers the wider area of solid mechanics including topics of experimental mechanics, structural analysis, composite materials, dynamic problems, microsystems and applications. More specifically topics covered include: response of ancient multi-spondyle columns to seismic loads, design of earthquake resistant reinforced concrete structural walls, failure mechanisms of reinforced concrete beam-column joints, seismic fluid dampers, bridge-pier Caisson foundations, finite deformations analysis of sine-wave St.-Venant beams, techniques that process experimental displacement data, applications of the electronic speckle- interferometry technique, development of an interior strain measurement technique using speckles, prediction of the compressive strength of concrete by non-destructive methods, measurements of mechanical properties of soft materials by

three-dimensional digital image correlation, constitutive behavior and failure criteria for composites under static and dynamic loading, damage evaluation of composite materials by a microwave thermographic technique, analysis of the reinforcement effect of carbon nanotubes in a matrix, response of graded corrugated steel sandwich panels to dynamic loads, study of the displacement field of a circular ring, study of the interaction between intergranular cracks and cracks that grow from material discontinuities at a fastener hole, use of optoelectronic laser interferometric microscope methodology for non-destructive evaluation of microsystems, evaluation of strains in a bioceramic material using embedded optical sensors, design of a microsystem for displacement-controlled testing of nanomaterials, an ultra-high-strain-rate sharing and deformation twinning in nanocrystalline aluminum, modification of the mechanical properties of carbon nanotube arrays using electron irradiation induced oxidation, and mechanical behavior and infrared imaging of ferromagnetic single crystals under cyclic fatigue.

The editor of this issue would like to thank the authors for their contribution and the referees who reviewed the quality of the submitted works. Finally, a special word of thanks goes to the Editor-in-Chief of the journal Meccanica Professor Alberto Carpinteri for his kind cooperation, encouragement and support.

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EMMANUEL E. GDOUTOS

Professor

Director of Laboratory of Applied Mechanics
Department of Civil Engineering
Democritus University of Thrace
GR-671 00 Xanthi, Greece

Born: June 2, 1948, Mitilini, Lesvos, Greece

Marital Status: Married (wife Maria, Professor, Democritus University of Thrace, Xanthi, Greece), two children (son Eleftherios, Doctor of Philosophy in Aeronautics, California Institute of Technology, Pasadena, California; daughter Alexandra, civil engineer, Northwestern University, Evanston, Illinois, USA)

1 Education

MS CE: National Technical University of Athens, Civil Engineering, June 1971

Ph. D.: National Technical University of Athens, Mechanical Engineering, July 1973

2 Academic career

1971–1973 Graduate Research and Teaching Assistant, Laboratory of Testing Materials, National Technical University of Athens, Athens, Greece

1973–1977 Instructor, Department of Theoretical and Applied Mechanics, National Technical University of Athens

1977–1980 Associate Professor, Chair of Applied Mechanics, Democritus University of Thrace

1980–now Professor and Director of Laboratory of Applied Mechanics, Department of Civil Engineering, Democritus University of Thrace

1981–1982 Visiting Professor, Institute of Fracture and Solid Mechanics, Lehigh University

1987–1989 Head of the Department of Civil Engineering, Democritus University of Thrace

2003–now Adjunct Professor, Northwestern University

2013–now Distinguished Clark Millikan Visiting Professor, California Institute of Technology, Pasadena, California, USA

3 Research interests

Professor E.E. Gdoutos performed outstanding research work in mechanics of solids including optical methods in stress analysis, fracture mechanics, composite materials, sandwich structures and nanotechnology. He developed innovative solutions to problems of photoelastic determination of stress field around cracks, representation of photoelastic problems based on the Jones and Muller calculus and Poincare sphere (he co-authored the book “Matrix Theory of Photoelasticity” on the subject), problems of crack growth under mixed-mode loading, stable and unstable crack growth in elastoplastic materials, growth of three-dimensional cracks, and cracks in anisotropic media. He studied repair of damaged metallic aircraft structures with composite patches. He developed and applied the optical method of caustics for the determination of stress intensity factors, plastic regions and for surface topography and distance measurement. He considered the three-dimensionality of the stress field around cracks for the determination of stress intensity factors in bodies with cracks by taking measurements at any distance away from the crack tip. He studied the thermomechanical behavior and failure mechanisms of metal or ceramic matrix composite materials with interfacial or matrix cracks and performed micromechanical analyses. His newest work includes nonlinear behavior and failure mechanisms of sandwich beams made of composite facings and foam cores. In nanotechnology he analyzed the mechanical and failure behavior of nanocomposites, and studied the mechanical and

failure behavior of cementitious nanocomposites reinforced with carbon nanotubes and carbon nanofibers.

4 Member of academies

Corresponding Member of the Academy of Athens, Greece, 2007
 Member of the European Academy of Sciences and Arts, 2001
 Fellow of New York Academy of Sciences, 2001
 Fellow of the American Academy of Mechanics, 2007
 Member of Academia Europaea, 2008
 Fellow of the European Academy of Sciences, 2008, Chair of the Scientific Committee of the Division of Engineering, 2010–now
 Foreign Member of the Russian Academy of Engineering, 2009
 Foreign Member of the Bulgarian Academy of Sciences, 2010
 Member of the International Academy of Engineering (former Academy of Engineering of USSR), 2010

5 Honorary diplomas

Doctorate Honoris Causa of the University of Nis, Republic of Serbia, 2013
 Doctorate Honoris Causa of the Russian Academy of Sciences, 2010
 Honorary member of the Serbian Society of Theoretical and Applied Mechanics, 2011
 Honorary member of the Polish Society for Theoretical and Applied Mechanics, 2009
 Honorary member of the Italian Group of Fracture, 2004

6 Presidentship of societies

Vice-President of the International Congress on Fracture—The World Academy of Structural Integrity (ICF-WASI), 2014–2017

President of the Society for Experimental Mechanics (SEM), 2013–2014

Vice-President of the Hellenic Society of Theoretical and Applied Mechanics, 2010–2013

President of the European Structural Integrity Society (ESIS), 2006–2010

Chairman of the European Association for Experimental Mechanics (EURASEM), 2004–2007

President of the “Greek Group of Fracture,” 2003–now

7 Fellowships

Fellow of the American Society of Mechanical Engineers (ASME), 1993

Fellow of the Society for Experimental Mechanics (SEM), 2004

Fellow of the European Structural Integrity Society (ESIS), 2008

Fellow of the International Congress on Fracture (ICF), 2009

Fellow of the American Association for the Advancement of Science (AAAS), 2012

8 Awards

“Award of Merit,” European Structural Integrity Society (ESIS), 2008

“Theocaris Award,” Society for Experimental Mechanics (SEM), 2009

“Lazan Award,” Society for Experimental Mechanics (SEM), 2009

Medal and Diploma of the International Academic Rating of Popularity “Golden Fortune,” 2009

Paton Medal of the Ukrainian Academy of Sciences, 2009

Jubilee Medal “XV Year to IAE” of the International Academy of Engineering, 2009

“Tatnall Award,” Society for Experimental Mechanics (SEM), 2010

“Award of Merit,” European Society for Experimental Mechanics (EURASEM), 2010

“Griffith Medal,” European Structural Integrity Society (ESIS), 2010

“Zandman Award,” Society for Experimental Mechanics (SEM), 2011

“Golden Sign,” Russian Academy of Engineering, 2011

“Theocarlis Award,” European Society for Experimental Mechanics (EURASEM), 2012

SAGE Best Paper Award at the First International Conference on Damage Mechanics, Belgrade, 25–27 July, 2012, for the paper: “Failure Modes of Composite Sandwich Beams,” *International Journal of Damage Mechanics*, Vol. 11, pp. 309–334, 2002, by Daniel, I.M., Gdoutos, E.E., Wang, K.-A. and Abot, J.L., 2012

“Panetti-Ferrari Prize,” Turin Academy of Sciences, 2012 (past recipients of the award include: G.I. Taylor (1958), J.M. Burgers (1960), W. Prager (1963), M.J. Lighthill (1965), C. Truesdell (1967), N.I. Muskhelishvili (1969), W.T. Koiter (1971), R.S. Rivlin (1975), P. Germain (1978), G. Grioli (1982), L. Crocco (1985), R. Hill (1988), G.I. Barenblatt (1995), D.C. Drucker (1999), H.K. Moffatt (2001), J.L. Ericksen (2003), K.R. Sreenivasan (2006), J.R. Rice (2008), U. Frisch (2010))

“Colonnetti Gold Medal 2012,” Italian Research Institute of Metrology (INRIM), 2012

9 Honors

Vice-President of SEM, 2011–2012

President-Elect of SEM, 2012–2013

President of SEM, 2013–2014

Member of the Executive Committee (Director) of the International Congress of Fracture (ICF), 2009–2013

Senior Vice-President of the International Congress of Fracture (ICF), 2013–2017

Member of the Honors Committee of International Conference on Fracture (ICF), 2005–2009

Member of the Honors Committee of SEM, 2005–2008

Member of the Fellows Committee of SEM, 2006–2008

Vice Chair of the National Meetings Council of SEM, 2006–2008

Chairman of the Fellows Committee of SEM, 2007–2008

Chairman of the Honors Committee of ESIS, 2004–2006

Chairman of the Honors Committee of EURASEM, 2004–2007

Member at Large of the Executive Board of SEM, 2006–2008

Honorary Citizen of the Prefecture of Lesvos, Greece, 2012

10 Distinctions

Member of the editorial board of the journals:

- MECCANICA, Associate Editor
- Mechanics of Solids (A Journal of the Russian Academy of Sciences)
- Theoretical and Applied Fracture Mechanics
- Applied Composite Materials
- Advanced Composites Letters
- Experimental Mechanics
- The Archive of Mechanical Engineering of the Polish Academy
- Facta Universitatis of the University of Nis
- The Open Mechanics Journal
- Scientific Technical Review, Belgrade, Republic of Serbia
- Physicochemical Mechanics of Materials, Ukraine Academy of Sciences

Chairman of the 14th international Congress on Fracture (ICF14), Rhodes, Greece, 18–25 June, 2017

Chairman of the 13th International Conference on Experimental Mechanics (ICEM13), Alexandroupolis, Greece, 1–6, July, 2007

Chairman of the 16th European Conference of Fracture (ECF16), Alexandroupolis, Greece, 3–7 July, 2006

Recipient of two Fulbright research awards to visit Lehigh University (June 30–September 21, 1985) and Northwestern University (July 5–August 31, 1995)

“Distinguished Visiting Professorship Award” of the Toledo University, 1992

Listed in “Who’s Who in the World-8th Edition”; “International Who’s Who of Intellectuals-Seventh

Edition”; “International Who’s Who in Education—Third Edition”; “Five Thousand Personalities of the World”; Who’s Who in Greece (1993, 1995); “Who is Who in the World” 8th–14th editions; “Longman Who’s Who”; “Who’s Who in Science and Engineering”

Member of the Editorial Board of the “International Series on Advances in Fracture Mechanics,” WIT Press

Member of the Structures and Materials Panel of AGARD, 1992–1997

Member of NATO Research and Technology Organization, 1997–1998

Member of the Research Board of Advisors and Fellow of the American Biographical Institute

Head of the Department of Civil Engineering of the Democritus University of Thrace, 1987–1989

Director of the Section of “Design and Construction of Structures,” 1983–1986 and 1993–1998

Director of the Section of “Mechanics,” 2002–now
Vice-Chairman of the Research Committee of the Democritus University of Thrace, 1994–1997

Member of the “P.S. Theocaris” Foundation, 2000–now

Member of the Bureau of Theoretical and Applied Mechanics of the Academy of Athens, 2007–now

External examiner of the Ph.D thesis of Mr. Johan Anton, Technical University of Tallinn, Estonia, 17/6/2008

External examiner of the Ph.D thesis of Mr. D. Jovanovic, University of Nis, Serbia, 10/11/2009

External examiner of the Ph.D thesis of Mr. Andrei Errapart, Technical University of Tallinn, Estonia, 25/5/2012

Director of “International Congress of Fracture—The World Academy of Structural Integrity,” 2009–2013.

Vice-President of “International Congress of Fracture—The World Academy of Structural Integrity,” 2013–2017.

11 Editorial activities

Editor-in Chief of “Strain—An International Journal for Experimental Mechanics,” 2007–2010

Guest editor of the special issues of the journals:

- International Journal of Fracture, Vol. 79, No. 2, pp. 97–208, 1996
- Applied Composite Materials, Vol. 3, No. 5, pp. 265–353, 1996
- International Journal of Fracture, Vol. 98, No. 3–4, pp. i–xiii & 195–406, 1999
- Facta Universitatis, Vol. 3, No. 13, pp. 491–764, 2003
- Applied Composite Materials, Vol. 12, No. 3–4, pp. 133–261, 2005

12 Teaching experience

He taught in many universities in Greece and USA (National Technical University of Athens, Democritus University of Thrace, University of California at Santa Barbara, University of California at Davis, Michigan Technological University, University of Toledo, Northwestern University, California Institute of Technology)

13 Publications

Author of 15 books, 135 papers in refereed journals, 146 papers in conference proceedings, and editor of 20 books. A list of publications of books follows:

1. Gdoutos, E.E., “Theory and Applications of Photoelasticity,” pp. 1–127, Athens National Technical University, 1976.
2. Theocaris, P.S. and Gdoutos, E.E., “Matrix Theory of Photoelasticity,” Springer Series in Optical Sciences, Vol. 11, pp. i–xi and 1–352, Springer Verlag, 1979.
3. Gdoutos, E.E. “Mechanics of Deformable Bodies—Theory of Elasticity and Strength of Materials,” pp. i–xv and 1–542, Kyriakids Bros Publishers, Thessaloniki, 1979.
4. Gdoutos, E.E., “Kinematics,” pp. i–x and 1–106, Kyriakids Bros Publishers, Thessaloniki, 1981.
5. Gdoutos, E.E. and Calfas, C., “Statics—Exercises, Vol. I,” pp. i–xiii and 1–558, Kyriakids Bros Publishers., Thessaloniki, 1981.
6. Gdoutos, E.E. and Calfas, C., “Statics—Exercises, Vol. II,” pp. i–viii and 1–769, Kyriakids Bros Publishers., Thessaloniki, 1983.

7. Gdoutos, E.E. and Zacharopoulos, D., “Problems of the Theory of Elasticity,” pp. i–xii and 1–318, Kyriakidis Bros Publishers, Thessaloniki, 1984.
8. Gdoutos, E.E., “Problems of Mixed-Mode Crack Propagation,” Martinus Nijhoff Publishers, pp. i–xiv and 1–204, 1984.
9. Gdoutos, E.E., “Statics,” pp. 1–359, Kyriakidis Bros Publishers, Thessaloniki, 1984.
10. Gdoutos, E.E. and Calfas, C., “Principles of Mechanics of Rigid Bodies—Statics,” Vol. I, pp. i–xii and 1–480, Kyriakidis Bros Publishers, Thessaloniki, 1985.
11. Gdoutos, E.E. and Calfas, C., “Principles of Mechanics of Rigid Bodies—Statics”, Vol. II, pp. i–xii and 1–492, Kyriakidis Bros Publishers, Thessaloniki, 1986.
12. Gdoutos, E.E., “Fracture Mechanics Criteria and Applications,” pp. i–xii and 1–314, Kluwer Academic Publishers, 1990.
13. Gdoutos, E.E. and Sih, G.C. (eds), “Mechanics and Physics of Energy Density,” pp. I–VIII and 1–209, Kluwer Academic Publishers, 1992.
14. Gdoutos, E.E., “Fracture Mechanics—An Introduction,” pp. i–xiii and 1–307, Kluwer Academic Publishers, 1993.
15. Theocaris P.S. and Gdoutos, E.E. (eds), “Proceedings of the Fourth Greek National Congress on Mechanics,” Vol. I and II, pp. i–xvi and 1–1068, Kyriakidis Bros Publishers, 1995.
16. Gdoutos, E.E., “Solutions Manual: Fracture Mechanics—An Introduction,” pp. i–viii and 1–196, Kyriakidis Bros Publishers, 1996.
17. Paipetis, S.A. and Gdoutos, E.E. (ed.), “Proceedings of the First Hellenic Conference on Composite Materials and Structures,” Vol. I, pp. i–xiv and 1–810 and Vol. II, pp. i–xvi and 1–238, Kyriakidis Bros Publishers, 1997.
18. Gdoutos, E.E. (ed.), “Honorary Volume for Professor D.D. Raftopoulos,” pp. i–xxvi and 1–562, Athanasopoulos and Papadakis Publishers, 1998.
19. Kounadis, A.N. and Gdoutos, E.E. (eds), “Recent Advances in Mechanics—Abstracts,” pp. i–viii and 1–102, Athanasopoulos and Papadakis Publishers, 1998.
20. Gdoutos, E.E., Pilakoutas, K. and Rodopoulos, C.A. (eds), “Failure Analysis of Industrial Composite Materials,” pp. i–xviii and 1–555, McGraw-Hill, 2000.
21. Katsikadellis, J.T. Beskos, D.E. and Gdoutos, E.E. (ed.), “Recent Advances in Applied Mechanics—Honorary Volume for Professor A.N. Kounadis,” pp. i–xix and 1–349, National Technical University of Athens, 2000.
22. Gdoutos, E.E. (ed.), “Recent Advances in Experimental Mechanics—In Honor of Isaac M. Daniel,” pp. i–xlvi and 1–798, Kluwer Academic Publishers, 2002.
23. Gdoutos, E.E. and Z. P. Marioli-Riga (eds), “Recent Advances in Composite Materials—In Honor of S. A. Paipetis,” pp. i–xxviii and 1–381, Kluwer Academic Publishers, 2003.
24. Gdoutos, E.E., Rodopoulos, C.A. and Yates, J.R. (eds), “Problems of Fracture Mechanics and Fatigue—A Solution Guide,” pp. i–xxvi and 1–618, Kluwer Academic Publishers, 2003.
25. Gdoutos, E.E., “Fracture Mechanics—An Introduction,” Second Edition, pp. i–xv and 1–369, Springer, 2005.
26. Gdoutos, E.E., (ed.), “Fracture of Nano and Engineering Materials and Structures,” Proceedings of the 16th European Conference of Fracture (ECF16), pp. i–I and 1–1418, Springer, 2006.
27. Gdoutos, E.E. and Andrianopoulos, N.P. (eds), “Collected Papers of Professor Pericles S. Theocaris,” Introductory Volume & Volumes 1–12, Pericles S. Theocaris Foundation, 2006.
28. Gdoutos, E.E., (ed.) “Experimental Analysis of Nano and Engineering Materials and Structures,” Proceedings of the 13th International Conference on Experimental Mechanics (ICEM13), pp. i–xlii, and 1–978, Springer, 2007.
29. Daniel, I.M., Gdoutos, E.E. and Rajapakse, Y.D.S. (eds), “Major Accomplishments in Composite Materials and Sandwich Structures—An Anthology of ONR Sponsored Research,” Springer, pp. i–xviii, and 1–818, Springer, 2009.
30. Kounadis, A.N. and Gdoutos, E.E. (eds), “Recent Advances in Mechanics—Dedicated to the Late Academician—Professor Pericles S. Theocaris,” Book of Abstracts, Pericles S. Theocaris Foundation, pp. i–xvi, and 1–75, 2009.
31. Gdoutos, E.E. (ed.), “Proceedings of the First National Greek Conference and First Greek-Ukrainian Symposium on Fracture Mechanics of Materials and Structures,” pp. i–x and 1–120, 2010.

32. Kounadis, A.N. and Gdoutos, E.E. (eds), “Recent Advances in Mechanics—Dedicated to the Late Academician—Professor Pericles S. Theocaris,” pp i–xxx, and 1–462, Springer, 2011.
33. Panasyuk, V.V., Gdoutos, E.E. and Bobalo, Yu.Ya. (eds), “Proceedings of the Second Ukrainian-Greek Symposium on Fracture Mechanics of Materials and Structures,” pp. 1–112, 2011.
34. Gdoutos, E.E. and Konsta-Gdoutos, M.S., (eds), “Proceedings of the First Greek-Russian Symposium on Advanced Solid and Fracture Mechanics,” pp. i–vii and 1–51, 2011.
35. Daniewicz, S.R., Belsick, C.A. and Gdoutos, E.E., (eds), “Fatigue and Fracture Mechanics: 38th Volume,” STP1546, American Society for Testing and Materials, pp. i–viii and 1–380, 2012.
9. “13th European Conference of Experimental Mechanics (ICEM13),” Democritus University of Thrace, Alexandroupolis, Greece, 1–6/7/2007
10. “Recent Advances in Mechanics, Dedicated to P.S. Theocaris,” Academy of Athens, Athens, Greece, 16–19/9/2009, Co-Chairman.
11. “First Greek and Greek-Ukrainian Conference on Fracture Mechanics,” Xanthi, Greece, 20–24/10/2010
12. “First Greek-Russian Symposium on Advanced Solid and Fracture Mechanics,” Xanthi, Greece, 10–13/10/2011
13. “Symposium on Modern Experimental Methods in Mechanics, Engineering, and the Sciences, in Honor of Fu-pen Chiang,” 12th International Conference on Computational & Experimental Engineering and Sciences” (ICCES’12), Chania, Crete, Greece, 30/4/2012–4/5/2012
14. “17th European Conference of Experimental Mechanics (ICEM17),” Rhodes Palace Hotel, Rhodes, Greece, 3–7 June 2016
15. “14th International Conference on Fracture,” (ICF14), Rhodes Palace Hotel, Rhodes, Greece, 18–23 June, 2017

14 Conference organizer

1. “International Symposium on Mechanics and Physics of Energy Density,” Xanthi, Greece, 17–20/7/1989
2. “Fourth Greek National Congress on Mechanics,” Xanthi, Greece, 26–29/6/1996
3. “First Hellenic Conference on Composite Materials and Structures,” Xanthi, Greece, 2–5/7/1997
4. “Greek-Polish-German Symposium on Recent Advances in Mechanics,” Xanthi, Greece, 4–6/7/1998
5. “International Symposium on Recent Advances in Mechanics—In Honor of Prof. A.N. Kounadis,” Athens, 25/11/2000, Co-Chairman.
6. “Symposium on Recent Advances in Mechanics—In Honor of I.M. Daniel,” 14th US National Congress of Applied Mechanics, Virginia Tech., 23–28/6/2002
7. “Symposium on Recent Advances in Composite Materials—In Honor of S.A. Paipetis,” Democritus University of Thrace, Xanthi, Greece, 12–14/6/2003
8. “16th European Conference of Fracture,” Democritus University of Thrace, Alexandroupolis, Greece, 3–7/7/2006

15 Invited lectures

He presented over 80 plenary and invited lectures in conferences and universities. A list of five lectures follows:

1. “Failure of Sandwich and Cellular Materials,” *Topics in Mechanical Engineering, The Frank W. Otto Distinguished Lecture Series*, The Department of Mechanical Engineering, College of Engineering and Applied Sciences, Stony Brook University, USA, 4/10/2011
2. “The Optical Method of Caustics Applied to Fracture Mechanics Problems” *15th International Conference on Experimental Mechanics, Porto, Portugal*, 22–27 July, 2012
3. “The Optical Method of Caustics for the Solution of Fracture Mechanics Problems,” *Gustavo Colonnetti Memorial Lecture*, Italian Research Institute of Metrology (INRIM), Torino, Italy, 13/11/2012

4. “Carbon Nanotubes Cementitious Nanocomposites,” *First International Conference on Mechanics of Composites*, Stony Brook University, Stony Brook, New York, 12/6/2014
5. “Mechanical Characterization of Cementitious Nanocomposites,” **XII International Conference of Nanostructured Materials, NANO2014, Moscow, 16/7/2014**

16 Participation in conferences

He participated in over 100 technical conferences around the world.