

2nd Aircraft Structural Design Conference 2010

**London, United Kingdom
26-28 October 2010**

Volume 1 of 2

ISBN: 978-1-61782-290-2

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© (2010) by the Royal Aeronautical Society
All rights reserved.

Printed by Curran Associates, Inc. (2011)

For permission requests, please contact the Royal Aeronautical Society
at the address below.

Royal Aeronautical Society
No. 4 Hamilton Place
London
W1J 7BQ
United Kingdom

Phone: +44 (0) 20 7670 4300
Fax: +44 (0) 20 7670 4309

www.raes.org.uk

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Volume 1

The Royal Aeronautical Society from 1866 - 1903	1
<i>Malcolm Nash</i>	
Keynote Address: High-Fidelity Multidisciplinary Design Optimization for the Next Generation of Aircraft	14
<i>Joaquim Martins</i>	

SESSION 1: COMPONENT DESIGN & OPTIMISATION

(1) Comparison of Beam and Shell Theory for Mass Estimation in Preliminary Wing Design	123
<i>Felix Dorbath, Björn Nagel, Volker Gollnick</i>	
(2) Design Optimisation Methodology for Ultra Thick Laminate Composites	153
<i>Jacinto Carrasco</i>	
(3) Design of a Morphing Wing Using a Composite Chiral Structure	168
<i>Giuseppe Quaranta, Alessandro Airoidi, M. Crespi, M. Castiglioni, G. Sala</i>	
(4) Design, Analysis and Experimental Validation of a Morphing UAV Wing	218
<i>Marc Bolinches, Andy Keane, Alexander I. J. Forrester, Jim P. Scanlan, Kenji Takeda</i>	
(5) Shape Optimisation in the Design of Thin-Walled Shells as Components of Aerospace Structures	249
<i>Pablo Andrés Suárez Espinoza, K. U. Bletzinger, Herbert R. E. M. Hörmlein, Fernass Daoud, Gerd Schuhmacher, Markus Klug</i>	
(6) Nonlinear Structural Optimisation and Simulation Based on Object-Oriented and Parallel Programming	293
<i>Matthias Firl, Kai-Uwe Bletzinger</i>	
(7) The Application of Composite Optimisation and Stochastic Analysis to Aerospace Structures	327
<i>Alan Prior, Kyle Indermuehle</i>	
(8) Optimisation of Composite Laminate Stack-Up Sequence Using a Differential Evolution Algorithm	355
<i>Venkataramana Mantha, B. M. V. A. Raju</i>	
(9) A Neuro-Fuzzy Approach to Weight Estimation of Aircraft Structures	431
<i>Vassili Toropov, C. Hannon, O. M. Querin</i>	

SESSION 2: AEROELASTICITY & AIRCRAFT LOADING

(10) Aeroelastic Design and Testing of a Variable Stiffness Composite	469
<i>Jaap Dekker, G. A. A. Thuwis, M. M. Abdalla, Z. Gürdal</i>	
(11) Aeroelastic Response of Aircraft with Freeplay Structural Nonlinearity	511
<i>Demian Tang, Earl H. Dowell</i>	
(12) Nonlinear Aeroelastic Design of Morphing Outboard Wing Sections	569
<i>R. De Breuker, M. M. Abdalla, Z. Gürdal</i>	
(13) Aeroelastic Wing Design Including Geometric Nonlinearities	602
<i>Jonathan Cooper, M. Y. Harmin</i>	
(14) Structural Analysis of Composite Aerofoils Using Aero- and Inertial-Elastic Tailoring	651
<i>Sara Nichols, Liam Skeritt, Thomas Bee, Richard Brown</i>	
(15) Influence of Atmospheric Variability on Transonic Aeroelasticity	683
<i>Simão Pinheiro Marques, K. J. Badcock</i>	
Keynote Address: The Next Generation 3D Textile Reinforced Composites	759
<i>Peter Linde</i>	
(16) Improving Aircraft Stress-Loads Evaluation and Optimisation Procedures	788
<i>Shaun McGuinness, Cecil Armstrong, Adrian Murphy, James Barron, Mark Hockenhu</i>	
(17) Finite Element Analysis of an Aircraft Landing Accident	831
<i>Anne Evans, Andrew Walton, Roger Hardy</i>	

SESSION 3: DYNAMICS & VIBRATION

(18) Design, Fabrication and Testing of a Composite Helicopter Tail Rotor Blade: An Experience..... 867
Bosko Rasuo

(19) Coupled Simulation of Helicopter Rotor Dynamics and Systems 933
Yves Lemmens, A. Toso, T. Olbrechts

(20) Natural Frequencies and Mode Shapes of Fuselage Frames for Aircraft Designers 961
Ali Dastgir, J. R. Banerjee

(21) Modal Analysis of Wing-Fuselage Assembly of High Aspect Ratio Aircraft Designers Perspective..... 990
Ali Dastgir, J. R. Banerjee

(22) Dynamic Analysis of GLARE Structures: An Experimental-Numerical Approach..... 1025
Galal Mohamed

(23) Aviation and Climate Change: Implications of Passenger Growth 1026
Alice Bows, Ruth Wood, Lin Jiaqiao

SESSION 4: FATIGUE, DAMAGE TOLERANCE & HEALTH MONITORING

(24) Damage Arrest Design Approach Using Stitched Composites 1068
Alex Velicki, Patrick Thrash

(25) Parametric Damage Tolerant Design of Advanced Aeronautical Stiffened Panels by Means of LEAF Analytical Tool 1091
Gianluca Molinari, I. Meneghin, E. Troiani

(26) Enhancing Aircraft Structures Damage Tolerant Design through Structural Health Monitoring..... 1092
Bernd Frankenstein, C. Boller, T. Hayo

(27) Development of a Reliable Test to Support and Validate a Numerical Model of Progressive Damage for Composite Materials..... 1118
Francesca Garattoni, G. Molinari, E. Troiani

(28) Fatigue Life Evaluation of Lugs with Cold Expanded Bushes under Constant and Variable Spectrum Loading 1165
E. Mirón, J. García-Cosío, F. Costagliola, E. Oslé, R. Tejerina

(29) Damage Tolerant Cork Based Composites for Aerospace Applications..... 1177
José Silva, C. Z. Nunes, N. Franco, P. V. Gamboa

Keynote Address: Composite Materials, Composite Structures, Composite Systems 1217
Michel Van Tooren, Christos Kasapoglou, Harald Bersee

(30) Structural Aircraft Materials Weight Assessment Based on Fatigue Behaviour 1275
Sergio Tavares, A. Turon, P. Camanho, P. M. S. T. De Castro

SESSION 5: MANUFACTURE & MATERIALS IN DESIGN & ANALYSIS

(31) Meeting the Composite Optimisation Challenge 1310
Sam Patten, Paul Sharp

(32) Design of Variable Stiffness Composite Structures Subject to Manufacturing Constraints..... 1359
Julien Van Campen, Christos Kassapoglou, Zafer Gürdal

(33) CATIA V5 PowerCopy for Five Axis Machined Pockets Using Knowledge Based Engineering Techniques..... 1397
Ton Van Der Laan, Jan Baan

(34) The Application of Titanium Alloys in Aircraft Landing Gear..... 1426
David Bond

(35) Mechanical Properties of a Bi-stable Composite Manufactured Using Tow-Steering 1443
Ajit Panesar, K. Hazra, K. D. Potter, P. M. Weaver

SESSION 6: STATIC & STABILITY ANALYSIS

(36) A Simple Finite Element Cross-Sectional Modelling of Thin-Walled Beams..... 1480
Mathieu Willaert, M. M. Abdalla, Z. Gürdal

(36A) Evolution of the Fuselage Design Process; An Insight into the Potential of Structural Health Monitoring Technologies.....	1521
<i>Sunil Mistry, M. R. Mofakhami, J. Pinosonnault</i>	
(37) Improved Exact Strip Postbuckling Analysis for Anisotropic Plates	1558
<i>Bin Che, David Kennedy, Carol A. Featherston</i>	
(38) Investigation of Buckling and Damage Propagation for the Design of Composite Stiffened Composites	1587
<i>Duo Zou, Chiara Bisagni</i>	

SESSION 7: VEHICLE DESIGN & OPTIMISATION

(39) Development of a Wing Box Modelling Engine to Support the Conceptual Design Process.....	1609
<i>Ton Van Der Laan, Luc Hootsmans</i>	
(40) Simultaneous Optimisation of the Airframe, Powerplant and Operation of a Transport Aircraft.....	1644
<i>Mark Drela</i>	
(41) Multidisciplinary Optimisation of Aircraft Wings Including Gust Loads	1672
<i>Ögmundur Petersson, Felix Stroscher, Horst Baier</i>	
(42) Environmental Life Cycle Analysis of Emissions in the Aviation Industry.....	1700
<i>Alma Hodzic, M. Bonner, L. Scelsi, K. Ridgway, R. Scaife, C. Soutis, C. W. Wilson</i>	
(43) Gradient-Based Multifidelity Optimisation for Aircraft Design Using Bayesian Model Calibration	1720
<i>Andrew March, Karen Willcox, Qiqi Wang</i>	
(44) Structured Information Systems Technology to Support Next-Generation Aircraft Structure Development.....	1754
<i>Mark Norris</i>	
Author Index	