

# Table of Contents

## Preface, Committees, Sponsors

## Chapter 1: Keynote Lectures

|                                                                                                                         |    |
|-------------------------------------------------------------------------------------------------------------------------|----|
| <b>Will Aluminium Structures Last Forever?</b><br>M. Curioni                                                            | 3  |
| <b>Sustainability, Durability and Structural Advantages as Leverage in Promoting Aluminium Structures</b><br>D. Kosteas | 13 |
| <b>Use of Aluminium Structures in the Offshore Industry</b><br>S. Lundberg                                              | 22 |

## Chapter 2: New Trends in Design and Production of Aluminium Alloys Constructions

|                                                                                                                                                                                                                 |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Overview of the Correlations between Process Parameters, Microstructure and Mechanical Properties of Reference Castings and Industrial Demonstrators</b><br>E. Battaglia, F. Bonollo, E. Fiorese and G. Kral | 35 |
| <b>Localized Corrosion Resistance of Dissimilar Aluminum Alloys Joined by Friction Stir Welding (FSW)</b><br>A.F.S. Bugarin, F.M. Queiroz, M. Terada, H.G. De Melo and I. Costa                                 | 41 |
| <b>Aluminium, a Material with a Solution for any Structural Application</b><br>C. Clauwaert                                                                                                                     | 47 |
| <b>Characterization of Innovative Al-Si-Mg-Based Alloys for High Temperature Applications</b><br>E. Gariboldi and M. Colombo                                                                                    | 53 |
| <b>Incremental ECAP as a Method to Produce Ultrafine Grained Aluminium Plates</b><br>M. Lewandowska, W. Chrominski, M. Lipinska, L. Olejnik and A. Rosochowski                                                  | 59 |
| <b>Design of Functionally Graded Beam of Aluminium Foam for Civil Structural Application</b><br>G. Perrella, D. Faiella, G. Brandonisio, M. Fraldi and E. Mele                                                  | 65 |
| <b>Aluminium Machining Chips Formation, Treatment &amp; Recycling: A Review</b><br>J.B. Mandatsy Mounghomo, D. Nganga Kouya and V. Songmene                                                                     | 71 |
| <b>Turning and Drilling Machinability of Recycled Aluminum Alloys</b><br>J.B. Mandatsy Mounghomo, D. Nganga Kouya and V. Songmene                                                                               | 77 |
| <b>Properties of Aluminium Alloys Produced by Selective Laser Melting</b><br>P. Bassani, C.A. Biffi, R. Casati, A. Zanatta Alarcon, A. Tuissi and M. Vedani                                                     | 83 |

## Chapter 3: Advanced Connecting Systems

|                                                                                                                                                                        |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Performance of Friction Stir Welded Tailor Welded Blanks in AA5059 and AA6082 Alloys for Marine Applications</b><br>E.E. Feistauer, L. Bergmann and J.F. Dos Santos | 91  |
| <b>Practical Design of Aluminium Silos According to EC9-1-5</b><br>P. Knoedel and T. Ummenhofer                                                                        | 97  |
| <b>Bearing Capacity of Aluminum Bars with Built-Up Cross Section and Glued or Welded Connections</b><br>M. Krajewski and P. Iwicki                                     | 103 |
| <b>Interfacial Morphology and Mechanical Properties of Aluminium to Copper Sheet Joints by Electromagnetic Pulse Welding</b><br>I. Kwee and K. Faes                    | 109 |
| <b>Pull-Out Strength of Screws in Screw Chases: Part 1</b><br>J.C. LaBelle, J.R. Kissell and T.A. Dolby                                                                | 115 |

|                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Pull-Out Strength of Screws in Screw Chases: Part 2</b><br>J.C. LaBelle, J.R. Kissell and T.A. Dolby                                                         | 121 |
| <b>Structural Response of Aluminium T-Stub Connections at Elevated Temperatures and Fire</b><br>J. Maljaars and G. De Matteis                                   | 127 |
| <b>Advances and Potentials in Friction Stir Welding of Aluminum Alloys</b><br>J.P. Bergmann, M. Grätzel, R. Schürer, A. Regensburg and M. Weigl                 | 137 |
| <b>Macroscopic Modelling of Flow-Drill Screw Connections</b><br>J.K. Sønstabø, D. Morin and M. Langseth                                                         | 143 |
| <b>Joining Mechanism of Dissimilar Materials such as Metal and Plastic Sheets by Friction Lap Joining</b><br>T. Okada, K. Nakata and M. Enomoto                 | 149 |
| <b>The Effects of Friction Stir Welding Parameters on the Characteristics of Banded Structure for Aluminum Alloys</b><br>M. Zoghلامي, M. Jahazi and V. Songmene | 155 |

## Chapter 4: Aluminium Surface Treatments

|                                                                                                                                                                                                              |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Loss of Adhesion at Al 8006/LDPE Interface in Containers for Food Packaging: A Case Study</b><br>T. Monetta, A. Acquesta, C. Sinagra, D.B. Mitton and F. Bellucci                                         | 163 |
| <b>On the Effects of Hydrothermal Treatments on the Corrosion Resistance of the TSA Anodized AA7475-T761 Alloy</b><br>T.L. Almeida, F.M. Queiroz, M. Terada, I. Costa and V.R. Capelossi                     | 169 |
| <b>On the Investigation of the Portevin-Le Chatelier Effect in the Rolling of AA 5083</b><br>A. Astarita, M. Liberini, C. Velotti, C. Sinagra and A. Squillace                                               | 175 |
| <b>Coil Coating: The Advanced Finishing Technology</b><br>S. Bianchi and F. Broggi                                                                                                                           | 181 |
| <b>Green Technology for Surface Treatments of Aluminium Foil for Flexible Packaging</b><br>C. Sinagra, F. Bravaccino, C. Bitondo, A. Bossio, T. Monetta, D.B. Mitton and F. Bellucci                         | 186 |
| <b>The Use of Cold Spray to Repair Corroded AA6005A-T6 Used for Bolt-Channel Joints</b><br>A. Bossio, C. Bitondo, A. Carangelo, A. Formisano, T. Monetta, R. Landolfo, F.M. Mazzolani and F. Bellucci        | 192 |
| <b>Products and Process for Guala Closures: An Overview of Aluminum Closures Production and the Drive for Innovation</b><br>F. Bove, C. Tagliabue and M. Mittino                                             | 198 |
| <b>Effect of Experimental Parameters on Passivation Phenomena of Ti6Al4V Alloy in Acid Solution</b><br>E. Nouicer, F.Z. Benlahreche and A. Nouicer                                                           | 204 |
| <b>Corrosion Protection of AA2524-T3 Anodized in Tartaric-Sulfuric Acid Bath and Protected with Hybrid Sol-Gel Coating</b><br>H. Costenaro, F.M. Queiroz, M. Terada, M.G. Olivier, I. Costa and H.G. De Melo | 210 |
| <b>Hydrothermal Surface Treatments with Cerium and Glycol Molecules on the AA 2024-T3 Clad Alloy</b><br>W.I.A. Dos Santos, I. Costa and C.R. Tomachuk                                                        | 216 |
| <b>Production Routes for Impact Extruded Aluminum Parts for the Automotive Industry</b><br>A. Wimmer and B. Schwarz                                                                                          | 222 |

## Chapter 5: Numerical and Experimental Analysis Methods

|                                                                                                                                                                                                                                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Proposal for an Empirical Evaluation of Rotation Capacity of RHS Aluminium Alloy Beams Based on FEM Simulations</b><br>P. Castaldo, E. Natri and V. Piluso                                                                                         | 231 |
| <b>Numerical Analysis of Aluminium Perforated Shear Panels</b><br>G. Brando and G. De Matteis                                                                                                                                                         | 238 |
| <b>Microstructure and Mechanical Properties of a New Secondary AlSi10MnMg(Fe) Alloy for Ductile High Pressure Die Casting Parts for the Automotive Industry</b><br>A. Niklas, A. Baquedano, S. Orden, E. Noguès, M. Da Silva and A.I. Fernández-Calvo | 244 |

|                                                                                                                                 |     |
|---------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Numerical Non-Linear Behaviour of Aluminium Perforated Shear Walls: A Parametric Study</b>                                   |     |
| A. Formisano and F.M. Mazzolani                                                                                                 | 250 |
| <b>Experimental and Numerical Researches on Aluminium Alloy Systems for Structural Applications in Civil Engineering Fields</b> |     |
| A. Formisano, G. De Matteis and F.M. Mazzolani                                                                                  | 256 |
| <b>Design and Performance Testing of a Skylight in Qatar</b>                                                                    |     |
| M.T. Naqash, A. Formisano and G. De Matteis                                                                                     | 262 |
| <b>FE Simulation of Residual Welding Stresses: Aluminium and Steel Structural Components</b>                                    |     |
| P. Knoedel, S. Gkatzogiannis and T. Ummenhofer                                                                                  | 268 |
| <b>End-Plate Connections in Bi-Axial Bending - Measurements</b>                                                                 |     |
| J. Mäkinen, K. Fränti, M. Korhonen, J. Fillion and M. Heinisuo                                                                  | 275 |
| <b>Evaluation of Rotation Capacity of RHS Aluminium Alloy Beams by FEM Simulation: Temper T6</b>                                |     |
| P. Castaldo, E. Nistri and V. Piluso                                                                                            | 281 |
| <b>Evaluation of Rotation Capacity of RHS Aluminium Alloy Beams by FEM Simulation: Temper T4</b>                                |     |
| P. Castaldo, E. Nistri and V. Piluso                                                                                            | 288 |
| <b>Numerical/Experimental Research on Welded Joints in Aluminium Truss Girders</b>                                              |     |
| D. van Hove and F. Soetens                                                                                                      | 295 |

## Chapter 6: Structural Capacity of Aluminium Elements

|                                                                                                                      |     |
|----------------------------------------------------------------------------------------------------------------------|-----|
| <b>Torsional-Flexural Critical Force for Various Boundary Conditions</b>                                             |     |
| I. Balaz, M. Kovac, T. Živner and Y. Kolekova                                                                        | 303 |
| <b>Resistances of I-Section to Internal Forces Interactions</b>                                                      |     |
| I. Balaz, M. Kovac, T. Živner and Y. Kolekova                                                                        | 309 |
| <b>Materials Performance and Design Analysis of Suspension Lower-Arm Fabricated from Al-Si-Mg Castings</b>           |     |
| K.A. Ragab, M. Bouazara, A. Bouaicha and H. Mrad                                                                     | 315 |
| <b>Novel Morphologies of Aluminium Cross-Sections through Structural Topology Optimization Techniques</b>            |     |
| L. Grekavicius, J.A. Hughes, K.D. Tsavdaridis and E. Efthymiou                                                       | 321 |
| <b>Aluminium Framing Members in Facades</b>                                                                          |     |
| M.T. Naqash, A. Formisano and G. De Matteis                                                                          | 327 |
| <b>Theoretical Analysis of the Possibilities for Aluminium Alloy Beam to Be Strengthened Using Elements of Steel</b> |     |
| B. Gligic, D. Budjevac and Z. Markovic                                                                               | 333 |
| <b>A Simple Method for the Design of Aluminium Structures</b>                                                        |     |
| T. Höglund                                                                                                           | 339 |
| <b>Low-Cycle Fatigue Testing of a Novel Aluminum Alloy Buckling-Restrained Brace</b>                                 |     |
| Y. Liu, L. Zhou and C.L. Wang                                                                                        | 345 |
| <b>Ultimate Load Bearing Capacity of Web Members of Lattice Aluminium Structures Made of CHS Profiles</b>            |     |
| D. Djuricic, B. Scepanovic, M. Misovic and D. Lucic                                                                  | 351 |
| <b>Deformation of Perforated Aluminium Plates under In-Plane Compressive Loading</b>                                 |     |
| I. Scheperboer, E. Efthymiou and J. Maljaars                                                                         | 357 |
| <b>Plate Stability Verifications of Aluminium Plate Girders</b>                                                      |     |
| L.G. Vigh and D. Abdelkarim                                                                                          | 363 |

## Chapter 7: Large Span Structures

|                                                                                                                |     |
|----------------------------------------------------------------------------------------------------------------|-----|
| <b>The Use of Structural Aluminum for the Design of Large Span Roofs: The Case of the “Cubierta De Oviedo”</b> |     |
| B. Faggiano, G. Iovane, A. Ricci, A. Squillace, A. Astarita, F. Passeggio, A.F. Canteli and F.M. Mazzolani     | 371 |

|                                                                                                     |     |
|-----------------------------------------------------------------------------------------------------|-----|
| <b>Aluminium Bridges</b>                                                                            |     |
| S. Joux                                                                                             | 378 |
| <b>Conceptual Design of an Aluminium Bridge in Alma, QC</b>                                         |     |
| L.G. Vigh, G. Schnierer, J. Buchmüller, Á. Pohl, B. Turányi, L. Kiss, L. St-Georges and L. Dussault | 383 |
| <b>Analysis of Lowering Effects in Aluminum Single-Layer Latticed Dome with Temcor Joints</b>       |     |
| S. Xu, Z.H. Chen and F.M. Mazzolani                                                                 | 390 |
| <b>Structural Design and Analysis of Aluminum Dome for Caoheidian Coal Storage</b>                  |     |
| Z.C. Zhang, H.B. Liu, X.D. Wang, X.Y. Yan, J.H. Yu and Z.H. Chen                                    | 396 |
| <b>Aluminium in Modular Structures for Offshore Lifts</b>                                           |     |
| V. Ntaskagianni                                                                                     | 402 |

## Chapter 8: Codification

|                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------|-----|
| <b>Analysis of Aluminium Beam-to-Column Joints by the Component Method: Existing Studies and Research Needs</b> |     |
| G. De Matteis and G. Brando                                                                                     | 409 |
| <b>Direct Methods of Plasticity in Aluminium Frames Accounting for Eurocode 9 Failure Criteria</b>              |     |
| A.T. Ampatzis, V.G. Psomiadis and E. Efthymiou                                                                  | 415 |
| <b>Bearing Length on Cold-Formed Sections</b>                                                                   |     |
| B. Norlin and T. Höglund                                                                                        | 421 |
| <b>Recent Developments in North American Aluminum Structural Design Codes</b>                                   |     |
| J.R. Kissell                                                                                                    | 427 |
| <b>EC9 Second Generation: Proposal for New Imperfection Factors for Unstiffened Aluminium Shells</b>            |     |
| F.M. Mazzolani, T. Höglund and A. Mandara                                                                       | 433 |
| <b>(Low-Cycle-) Fatigue Design According to DIN EN 1999-1-3 State of the Art and Current Research</b>           |     |
| C. Radlbeck, M. Rengstl, S. Pessel and M. Mensinger                                                             | 439 |
| <b>Lateral Torsional Buckling of Split Aluminium Mullion</b>                                                    |     |
| D. Skejić, M. Lukić, N. Buljan and H. Vido                                                                      | 445 |
| <b>Recent Development of Codes for Design of Aluminum Structures in Canada</b>                                  |     |
| S. Walbridge, D. Beaulieu and F.M. Mazzolani                                                                    | 451 |