

Lorenzo Trainelli, PhD

Politecnico di Milano (PoliMI)¹

Dipartimento di Scienze e Tecnologie Aerospaziali (DSTA)²

Via La Masa, 34 – 20156 Milano

Tel. + 39 02 2399 8387, fax + 39 02 2399 8334, e-mail lorenzo.trainelli@polimi.it

Updated April 25, 2019

CURRENT TEACHING POSITIONS

- Professor of “Aircraft design”, MSc Aeronautical Engineering, PoliMI
- Professor of “Flight testing”, MSc Aeronautical Engineering, PoliMI

RESEARCH AND SCIENTIFIC INTERESTS

- Engineering applications
 - Innovative aircraft design and electric/hybrid propulsion in aviation
 - Fixed/rotary-wing flight mechanics and flight testing
 - Rotorcraft aeroelastic modelling and simulation
 - Rotorcraft sensor systems and flight instrumentation
- Methodologies
 - Flexible multibody dynamics
 - Theory of rotation and rigid motion
 - ODE & DAE numerical integration algorithms

APPLIED RESEARCH ACTIVITIES

- Selection of past and present research programs
 - EU-funded projects
 - Research unit leader and WP leader
Clean Sky JTI project "UNIFIER19 – Community Friendly Miniliner" (2019-2022):
Conceptual design of a 19-passenger commuter aircraft with near zero emissions.
 - Research unit leader and WP leader
H2020 RIA project "MAHEPA – Modular Approach to Hybrid Electric Propulsion Architecture" (2017-2021):
Development and testing of advanced power management concepts, design of regional aircraft, analysis of hybrid-electric aircraft operations and performance.
 - Project coordinator and WP leader
Clean Sky JTI GRC5 project "MANOEUVRES – Manoeuvring Noise Evaluation Using Validated Rotor State Estimation Systems" (2013-2016):
Development of innovative measurement and monitoring systems for on-board acoustic predictions in rotorcraft approaches and departures.
 - Company-funded and independent research – Rotorcraft
 - Helicopter fuselage and rotor disc angle of attack in-flight estimation
 - Kinematic and dynamic analysis of an innovative gimbal helicopter rotor
 - Performance and stability analysis of an innovative lightweight helicopter

¹ Polytechnic University of Milan.

² Department of Aerospace Science and Technology; formerly Department of Aerospace Engineering (Dipartimento di Ingegneria Aerospaziale, DIA).

- Company-funded and independent research – Fixed-wing
 - Optimal propeller design
 - Flight testing of ultralight airplanes for type certification
 - Flight testing of small UAVs
 - Aerial work mission profile optimization
 - Basic static stability and control formulations
- Diverse engineering systems
 - Analysis and diagnostics of a novel electromechanical flap actuator
 - Brake squeal optimization and robust design of automotive disc brake systems
 - 1.5 MW class wind turbine aeroelastic modelling and simulation
- Research sponsorships and collaborations
 - *European Union*
 - H2020 (project MAHEPA)
 - Clean Sky JU (projects MANOEUVRES and UNIFIER19)
 - *Military*
 - Marina Militare – Centro Sperimentale Aeromarittimo³
 - *Helicopter manufacturers*
 - Leonardo Helicopters (formerly AgustaWestland)
 - K4A
 - *Airplane manufacturers*
 - Pipistrel Vertical Solutions
 - Blackshape Aircraft
 - NG – Ing. Nando Groppo
 - Elytron Aeronautica
 - *Aerospace industrial consortia*
 - Italian Aerospace Network
 - *Wind turbine generator manufacturer*
 - Leitner/LeitWind
 - *Other companies*
 - Compact Dynamics (electrical drives and power electronics)
 - Logic (avionics)
 - Umbra Cuscinetti (mechanics for aerospace)
 - Brembo (brake systems)
 - ABB (industrial automation)
 - Vicoter (structural analysis and testing)

EDUCATION AND QUALIFICATIONS

- Academic national qualifications
 - *Associate professor (Professore di II fascia) qualification*
April 2011.
 - *Assistant professor (Ricercatore universitario) qualification*
September 2004.
- Professional national qualifications
 - *Professional engineer license*
November 1995.

³ Naval Aviation Test and Evaluation Center, Italian Navy.

- Academic degrees
 - *PhD in Aerospace Engineering*
Politecnico di Milano, Milano, Italy, January 1999.
 - *MSc in Aeronautical Engineering*
University of Roma "La Sapienza", Roma, Italy, May 1995.
- Main courses taken
 - *Rotorcraft Handling Qualities Engineering*
DSTA-PoliMI, Milano, Italy, June 2015 (3 days).
 - *1st ANSV Course on Aircraft Accident Investigation*
ANSV (Agenzia Nazionale per la Sicurezza del Volo),⁴ December 2008 (1 week).
 - *Modern Methods of Analytical Mechanics and their Applications*
CISM (International Centre for Mechanical Sciences), Udine, Italy, June 1997 (1 week).
 - *Contact Problems: Theory, Methods, Applications*
CISM (International Centre for Mechanical Sciences), Udine, Italy, July 1997 (1 week).
- Other academic experiences
 - *Visiting PhD student*
Department of Mathematics and Department of Aerospace Engineering, Georgia Institute of Technology, Atlanta (GA), USA (April 1998 – September 1998).

EMPLOYMENT

- Academic positions
 - From June 2015
Associate professor (Professore di II fascia), DSTA-PoliMI, Milano, Italy.
 - January 2005 – June 2015
Assistant professor (Ricercatore universitario), DIA/DSTA-PoliMI, Milano, Italy.
 - January 1999 – January 2005
Postdoctoral researcher (assegnista di ricerca), DIA-PoliMI, Milano, Italy.
- Company positions
 - January 1997 – December 1999
Research consultant on numerical modelling and analysis of rotorcraft systems, Agusta Spa, Cascina Costa di Samarate (VA), Italy.
 - September 1995 – April 1996
Consultant on the analysis of CNS/ATM systems (innovative air traffic management), ITAL-ATC Srl, Roma, Italy.
- Public service
 - Expert enrolled in the Reviewer Register of the Trento Provincial Government (Italy).
 - Expert enrolled in the Technical Advisor Register of the Brescia Appeal Court (Italy).

TEACHING EXPERIENCE

- Current main assignments
 - From year 2012-2013
Professor of "*Flight Testing*"
MSc Degree in Aeronautical Engineering, PoliMI, Milano, Italy.
 - From year 2011-2012
Professor of "*Aircraft Design*"
MSc Degree in Aeronautical Engineering, PoliMI, Milano, Italy.

⁴ Italian aircraft accident investigation agency.

- Past main assignments
 - Years 2009-2010 to 2010-2011
Professor of "*Fundamentals of Atmospheric and Space Flight Mechanics*"
BSc Degree in Aerospace Engineering, PoliMI, Milano, Italy.
 - Years 2000-2001 to 2007-2008
Professor of "*Flight Mechanics*"
BSc Degree in Aerospace Engineering, PoliMI, Milano, Italy.
 - Years 2004-2005 to 2011-2012
Assistant lecturer of "*Flight Testing*"
MSc Degree in Aeronautical Engineering, PoliMI, Milano, Italy.
 - Years 2003-2004 to 2005-2006
Assistant lecturer of "*Aerospace Mechanics*"
BSc Degree in Aerospace Engineering, PoliMI, Milano, Italy.
 - Years 2000-2001 to 2002-2003
Assistant lecturer of "*Advanced Flight Mechanics*"
MSc Degree in Aerospace Engineering, PoliMI, Milano, Italy.
- Other courses
 - From 2007
Yearly short courses on the theory of rotation and rigid motion
PhD course in Aerospace Engineering, PoliMI, Milano, Italy.
 - June 2004
Short course on "*Multibody System Dynamics with Applications to Rotary Wing Systems*"
CIRA (Centro Italiano Ricerche Aerospaziali), Capua (NA), Italy.
 - May – June 2002
Lecturer of "*Aerodynamics*"
Airplane maintenance specialist course, ASLAM, S. Macario di Samarate (VA), Italy.
 - 1999 – 2002
Seminars on CNS/ATM systems within the course on "*Management of Air Transportation*"
BSc Degree in Aerospace Engineering, PoliMI, Milano, Italy.
- Academic mentorship in award-winning international student competition projects
 - "Hybris" team (2016)
Ranked 1st in the "1st Annual General Aviation Design Competition: E-Conditions Fixed-Wing Aircraft Design Challenge" sponsored by the Royal Aeronautical Society for the promotion of innovative design in light aviation.
 - "Flynk" team (2015)
Ranked 1st in the "2014-2015 AIAA Foundation Graduate Team Aircraft Design Competition" sponsored by the American Institute of Aeronautics and Astronautics for the design of an innovative V/STOL air taxi system.
 - "Caurus" team (2014)
Ranked 2nd and Best New Entrant in the "31st Annual AHS International Student Design Competition" sponsored by the American Helicopter Society for the design of an innovative VTOL aircraft with exceptional performance in vertical and cruise flight.
 - "Flybrid" team (2013)
Ranked 3rd and sole European team among the 5 finalists in the "Fly Your Ideas 2013" world competition sponsored by Airbus for innovative projects in civil aviation.

ACADEMIC ASSIGNMENTS

- Service to the department
 - 2017 – ongoing
DSTA supervisor for external communications, PoliMI, Milano, Italy.
 - 2015 – ongoing
DSTA supervisor for outreach & educational guidance activities and Director of the DSTA Summer School, PoliMI, Milano, Italy.
- Scientific committees
 - 2006 – 2012
Member of the *Aerospace Engineering PhD Program Committee*, PoliMI, Milano, Italy.
 - 2005 – 2009
Member of the *Rotorcraft PhD Program Committee*, PoliMI, Milano, Italy.
- Management boards
 - 2019
Member of the board of the 1st level Master Course in “*Fundamentals of Air Transportation*”, PoliMI, Milano, Italy.

FURTHER ACCOMPLISHMENTS

- Patents
 2. Bernasconi A., Biondani F., Capoferri L., Favier A., Velarde Lopez de Ayala C., Gualdoni F., Riboldi C. E. D., Trainelli L., "Velivolo con Batterie Elettriche, in Particolare Velivolo Ibrido" ("Aircraft with Electric Battery, in Particular Hybrid Aircraft"), International PCT Patent Application No. PCT/EP2017/078728, filed on November 09, 2017 (priority date November 14, 2016).
 1. Trainelli L., Zappa E., Rolando A., Cordisco P., Vigoni E., Terraneo M., Grassetti R., Redaelli M., Riviello L., Colombo A., "Rotor for a Hover-Capable Aircraft and Method for Detecting the Attitude of a Blade with Respect to a Hub of such a Rotor", European Patent EP3228541A1 (published 11 October 2017; priority date April 8, 2016).
- Scientific publications and peer-reviewing
 - Author of 119 scientific publications (details in the following section):
 - 5 contributions to scientific books
 - 19 papers on peer-reviewed scientific journals
 - 95 memories/presentations in scientific conferences and 4 articles published on professional society periodicals.
 - Best paper awards:
 - AIDAA 2017 “G. Cavallini” award prize-winning paper
 - Reviewer for
 - Wiley engineering technology books series
 and for the following international scientific journals:
 - *Journal of Guidance, Control and Dynamics*
 - *Aerospace Science and Technology*
 - *Aircraft Engineering and Aerospace Technology*
 - *The Aeronautical Journal*
 - *Journal of Aerospace Engineering*
 - *CEAS Aeronautical Journal*
 - *Aerotecnica Missili e Spazio*
 - *Journal of Sound and Vibration*
 - *Computer Methods in Applied Mechanics and Engineering*

- *International Journal for Numerical Methods in Engineering*
- *ASME Journal of Computational and Nonlinear Dynamics*
- *Multibody System Dynamics*
- *Finite Elements in Analysis and Design*

■ Main collaborative projects

- Permanent research groups
 - 2014 – ongoing
Coordinator of the "FMSlab – Flight Mechanics & Flight Systems Laboratory", DSTA-PoliMI, Milano, Italy.
 - 2009 – ongoing
Coordinator of the "PoliMI-Xflight – Flight Operations, Instrumentation and Testing Research Group", DIA/DSTA-PoliMI, Milano, Italy.
- Funded research projects
 - 2019 – 2022
Research unit leader and WP leader in the EU-funded Clean Sky JTI "UNIFIER19 – Community Friendly Miniliner" project on the conceptual design of a 19 passenger commuter aircraft with near zero emissions (duration 30 months).
 - 2017 – 2021
Research unit leader and WP leader in the EU-funded H2020 RIA "MAHEPA (Modular Approach to Hybrid Electric propulsion Architecture)" project (duration 48 months).
 - 2013 – 2016
Project coordinator and WP leader in the EU-funded Clean Sky JTI GRC5 "MANOEUVRES (Manoeuvring Noise Evaluation Using Validated Rotor State Estimation Systems)" project (total project budget 1.5 M€, duration 32 months).
 - 2002 – 2003
Investigator in the EU funded FP5-GROWTH "ADYN (Advanced European Tiltrotor Dynamics and Noise)" project.

■ Organizing committees

- Chairman of the local organizing committee, 28th Society of Flight Test Engineers – European Chapter (SFTE-EC) Symposium, Milano, September 13-15, 2017.
- Member of the local organizing committee, 43rd European Rotorcraft Forum (ERF 2017), Milano, September 12-15, 2017.
- Member of the local organizing committee, ECCOMAS Thematic Conference on Multibody Dynamics, Milano, June 25-28, 2007.

PUBLICATIONS

■ Contributions to scientific books

5. Trainelli L., "Cinematica teorica: nota sintetica sulle parametrizzazioni", in: E. Pennestrì, F. Cheli (eds.), *Cinematica e dinamica dei sistemi multibody – Vol. 1: Teoria*, Casa Editrice Ambrosiana, Milano, 2006, ISBN: 8840813454, p. 51-55.
4. Trainelli L., Borri M., "Integrazione delle rotazioni", in: E. Pennestrì, F. Cheli (eds.), *Cinematica e dinamica dei sistemi multibody – Vol. 1: Teoria*, Casa Editrice Ambrosiana, Milano, 2006, ISBN: 8840813454, p. 860-863.
3. Trainelli L., Borri M., "Stabilità non lineare e metodi energetici", in: E. Pennestrì, F. Cheli (eds.), *Cinematica e dinamica dei sistemi multibody – Vol. 1: Teoria*, Casa Editrice Ambrosiana, Milano, 2006, ISBN: 8840813454, p. 877-884.

2. Borri M., Bottasso C. L., Trainelli L., "An Embedded Projection Method for Index-3 Constrained Mechanical Systems", in: J.A.C. Ambrósio, M. Kleiber (eds.), *Computational Aspects of Nonlinear Structural Systems with Large Rigid Body Motion*, NATO Science Series, Series III: Computer and System Sciences, vol. 179, IOS Press, Amsterdam, 2001, ISBN: 9781586031602, p. 237-252.
1. Morino L., Iemma U., Trainelli L., "Finite-State Acoustoelasticity", in: Atluri S. N., Yagawa G., Cruse T. A., *Computational Mechanics '95*, Springer Verlag, Berlin, 1996, ISBN: 3540591141, p. 3098-3103.

■ Peer-reviewed journal articles

19. Riboldi C. E. D., Gualdoni F., Trainelli L., "Preliminary Weight Sizing of Light Pure-Electric and Hybrid-Electric Aircraft", *Transportation Research Procedia*, **29**: 376–389 (2018). [doi:10.1016/j.trpro.2018.02.034](https://doi.org/10.1016/j.trpro.2018.02.034) [OA]
18. Zappa E., Liu R., Trainelli L., Ferrario A., Cordisco P., Terraneo M., Grassetti R., Redaelli M., "Laser and Vision-Based Measurements of Helicopter Blade Angles", *Measurement*, **118**: 29-42 (2018). [doi:10.1016/j.measurement.2017.12.037](https://doi.org/10.1016/j.measurement.2017.12.037)
17. Trainelli L., Gennaretti M., Bernardini G., Rolando A., Riboldi C. E. D., Redaelli M., Riviello L., Scandroglio A., "Innovative Helicopter In-Flight Noise Monitoring Enabled by Rotor State Measurements", *Noise Mapping*, **3** (1): 190-215 (2016). [doi: 10.1515/noise-2016-0014](https://doi.org/10.1515/noise-2016-0014) [OA]
16. Trainelli L., Anselmi M., Ballarin M., D'Andrea S., Zuliani G., "Design of the Series Hybrid Reconfiguration of a General Aviation Aircraft", *Aerotecnica Missili e Spazio*, **94** (1): 58-68 (2015). [doi: 10.19249/ams.v94i1.122](https://doi.org/10.19249/ams.v94i1.122)
15. Trainelli L., Rolando A., Bonaita G., Chimetto P., "Experiences in Academic Flight Testing Education", *Aircraft Engineering and Aerospace Technology*, **86** (1): 56-66 (2014). [doi:10.1108/AEAT-10-2012-0178](https://doi.org/10.1108/AEAT-10-2012-0178)
14. Trainelli L., Rolando A., "Reliable and Cost-effective Flight Testing of Ultralight Aircraft", *Journal of Aircraft*, **48** (4): 1342-1350 (2011). [doi:10.2514/1.C031277](https://doi.org/10.2514/1.C031277)
13. Bottasso C. L., Dopico D., Trainelli L., "On the Optimal Scaling of Index Three DAEs in Multibody Dynamics", *Multibody System Dynamics*, **19** (1/2): 3-20 (2008). [doi:10.1007/s11044-007-9051-9](https://doi.org/10.1007/s11044-007-9051-9)
12. Bottasso C. L., Croce A., Savini B., Sirchi W., Trainelli L., "Aeroelastic Modeling and Control of Wind Turbine Generators Using Finite Element Multibody Procedures", *Multibody System Dynamics*, **16** (3): 291-308 (2006). [doi:10.1007/s11044-006-9027-1](https://doi.org/10.1007/s11044-006-9027-1)
11. Borri M., Trainelli L., Croce A., "The Embedded Projection Method: A General Index Reduction Procedure for Constrained System Dynamics", *Computer Methods in Applied Mechanics and Engineering*, **195** (50/51): 6974-6992 (2006). [doi:10.1016/j.cma.2005.03.010](https://doi.org/10.1016/j.cma.2005.03.010)
10. Bottasso C. L., Trainelli L., "An Attempt at the Classification of Energy Decaying Schemes for Structural and Multibody Dynamics", *Multibody System Dynamics*, **12** (2): 173-185 (2004). [doi:10.1023/B:MUBO.0000044418.23751.fe](https://doi.org/10.1023/B:MUBO.0000044418.23751.fe)
9. Bauchau O. A., Trainelli L., "The Vectorial Parameterization of Rotation", *Nonlinear Dynamics*, **32** (1): 71–92 (2003). [doi:10.1023/A:1024265401576](https://doi.org/10.1023/A:1024265401576)
8. Borri M., Bottasso C. L., Trainelli L., "An Invariant-Preserving Approach to Robust Finite-Element Multibody Simulation", *Zeitschrift für Angewandte Mathematik und Mechanik*, **83** (10): 663-676 (2003). [doi:10.1002/zamm.200310065](https://doi.org/10.1002/zamm.200310065)
7. Bauchau O. A., Bottasso C. L., Trainelli L., "Robust Integration Schemes for Flexible Multibody Systems", *Computational Methods in Applied Mechanics and Engineering*, **192** (3/4): 395-420 (2003). [doi:10.1016/S0045-7825\(02\)00519-4](https://doi.org/10.1016/S0045-7825(02)00519-4)
6. Bottasso C. L., Borri M., Trainelli L., "Geometric Invariance", *Computational Mechanics*, **29** (2): 163-169 (2002). [doi:10.1007/S00466-002-0329-8](https://doi.org/10.1007/S00466-002-0329-8)

5. Borri M., Bottasso C. L., Trainelli L., "A Novel Momentum-Preserving/Energy-Decaying Algorithm for Finite-Element Multibody Procedures", *Computer Assisted Mechanics and Engineering Sciences*, **9** (3): 315-340 (2002).
4. Bottasso C. L., Trainelli L., "Implementation of Effective Procedures for Unilateral Contact Modeling in Multibody Dynamics", *Mechanics Research Communications*, **28** (3): 233-246 (2001). [doi:10.1016/S0093-6413\(01\)00168-9](https://doi.org/10.1016/S0093-6413(01)00168-9)
3. Borri M., Bottasso C. L., Trainelli L., "Integration of Elastic Multibody Systems by Invariant Conserving/Dissipating Algorithms - Part I: Formulation", *Computational Methods in Applied Mechanics and Engineering*, **190** (29/30): 3669-3699 (2001). [doi:10.1016/S0045-7825\(00\)00286-3](https://doi.org/10.1016/S0045-7825(00)00286-3)
2. Borri M., Bottasso C. L., Trainelli L., "Integration of Elastic Multibody Systems by Invariant Conserving/Dissipating Algorithms - Part II: Numerical Schemes and Applications", *Computational Methods in Applied Mechanics and Engineering*, **190** (29/30): 3701-3733 (2001). [doi:10.1016/S0045-7825\(00\)00285-1](https://doi.org/10.1016/S0045-7825(00)00285-1)
1. Borri M., Trainelli L., Bottasso C. L., "On Representations and Parameterizations of Motion", *Multibody System Dynamics*, **4** (2/3): 129-193 (2000). [doi:10.1023/A:1009830626597](https://doi.org/10.1023/A:1009830626597)

■ Conference articles and presentations

95. Salucci F., Longo M., Faranda R. S., Trainelli L., "An Optimization Model for Airport Infrastructures in Support to Electric Aircraft", 13th IEEE Power & Energy Society PowerTech Conference, Milano, Italy, June 23-27, 2019 (to be presented).
94. Comincini D., Trainelli L., "A Powertrain Sizing Method for Hydrogen-Driven Aircraft", 15th Pegasus-AIAA Student Conference, Glasgow, UK, April 10-12, 2019.
93. Trainelli L., Riboldi C. E. D., Rolando A., Salucci F., "Evaluating the Impact of Fleet Switching to Hybrid-Electric Aircraft on Airport Infrastructures", More Electric Aircraft Conference (MEA 2019), Toulouse, France, February 6-7, 2019.
92. Trainelli L., Riboldi C. E. D., Rolando A., "Recent Developments in Electric Aircraft Conceptual Design", More Electric Aircraft Conference (MEA 2019), Toulouse, France, February 6-7, 2019. [poster]
91. Trainelli L., Perkon I., "MAHEPA – A Milestone-Setting Project in Hybrid-Electric Aircraft Technology Development", More Electric Aircraft Conference (MEA 2019), Toulouse, France, February 6-7, 2019. [poster]
90. Rossi N., Salucci F., Riboldi C. E. D., Rolando A., Trainelli L., "A General Approach to the Conceptual Design of All-Electric and Hybrid-Electric Aircraft", Advanced Aircraft Efficiency in a Global Air Transport System Conference (AEGATS 2018), Toulouse, France, October 23-25, 2018. [slide presentation]
89. Riboldi C. E. D., Trainelli L., Biondani F., "A Sizing Procedure for Structural Batteries in Hybrid-Electric Aircraft", Advanced Aircraft Efficiency in a Global Air Transport System Conference (AEGATS 2018), Toulouse, France, October 23-25, 2018.
88. Arditi M., D'Ascenzo A., Montorfano G., Poiana G., Rossi N., Sesso M., Spada C., Riboldi C. E. D., Trainelli L., "An Investigation of the Micro-Feeder Aircraft Concept", Advanced Aircraft Efficiency in a Global Air Transport System Conference (AEGATS 2018), Toulouse, France, October 23-25, 2018. [slide presentation]
87. Arditi M., Bianco-Mengotti R., Trainelli L., "A Preliminary Sizing Tool for eVTOL Personal Air Vehicles", Advanced Aircraft Efficiency in a Global Air Transport System Conference (AEGATS 2018), Toulouse, France, October 23-25, 2018.
86. Bigoni F., Moreno-Perez A., Salucci F., Riboldi C. E. D., Rolando A., Trainelli L., "Design of Airport Infrastructures in Support of the Transition to a Hybrid-Electric Fleet", Advanced Aircraft Efficiency in a Global Air Transport System Conference (AEGATS 2018), Toulouse, France, October 23-25, 2018.

85. Trainelli L., "A New Framework for Rotorcraft In-flight Noise Monitoring", 6th CEAS Air & Space Conference (Aerospace Europe 2017), Bucharest, Romania, October 16-20, 2017.
84. Riboldi C. E. D., Gualdoni F., Trainelli L., "Preliminary Weight Sizing of Light Pure-Electric and Hybrid-Electric Aircraft", 6th CEAS Air & Space Conference (Aerospace Europe 2017), Bucharest, Romania, October 16-20, 2017. [slide presentation]
83. Trainelli L., Riboldi C. E. D., "Award-Winning Innovative Aircraft Design Projects at Politecnico di Milano", 6th CEAS Air & Space Conference (Aerospace Europe 2017), Bucharest, Romania, October 16-20, 2017.
82. Broglia A., Clozza L., Russo M., Spada C., Vendemini L., Zuanetti A. G., Riboldi C. E. D., Trainelli L., "Flynk – The Future All-Electric Commuter Concept for Metropolitan Areas", XXIV Congresso Nazionale AIDAA, Palermo-Enna, Italy, September 18-22, 2017.
81. Bernasconi A., Biondani F., Capoferri L., Favier A., Velarde Lopez de Ayala C., Riboldi C. E. D., Trainelli L., "Conceptual Design of a Structural-Battery Hybrid-Electric Aircraft", XXIV Congresso Nazionale AIDAA, Palermo-Enna, Italy, September 18-22, 2017.
80. Draghi S., Trainelli L., "Optimal Planning of Aerial Multi-Field Missions", XXIV Congresso Nazionale AIDAA, Palermo-Enna, Italy, September 18-22, 2017.
79. Riboldi C. E. D., Trainelli L., Capocchiano C., Cacciola S., "A Model-Based Design Framework for Rotorcraft Trim Control Laws", 43rd European Rotorcraft Forum (ERF 2017), Milano, Italy, September 12-15, 2017.
78. Trainelli L., Riboldi C. E. D., Salucci F., "Developing an Observation Methodology for Non-Measurable Rotorcraft States", 43rd European Rotorcraft Forum (ERF 2017), Milano, Italy, September 12-15, 2017.
77. Amoozgar M., Croce A., Riboldi C. E. D., Trainelli L., "Basic Aeroelastic Stability Studies of Hingeless Rotor Blades in Hover Using Geometrically Exact Beam and Finite-State Inflow", 43rd European Rotorcraft Forum (ERF 2017), Milano, Italy, September 12-15, 2017.
76. Redaelli M., Zappa E., Liu R., Trainelli L., Rolando A., Rossi F., Cordisco P., "In-Flight Demonstration of a Novel Contactless Sensor for Helicopter Blade Motion Measurement", 28th Annual Society of Flight Test Engineers European Chapter Symposium, Milano, Italy, September 13-15, 2017.
75. Lerro A., Battipede M., Brandl A., Gili P., Rolando A., Trainelli L., "Test in Operative Environment of an Artificial Neural Network for Aerodynamic Angles Estimation", 28th Annual Society of Flight Test Engineers European Chapter Symposium, Milano, Italy, September 13-15, 2017.
74. Bernasconi A., Capoferri L., Riboldi C. E. D., Trainelli L., "Hybris – An Innovative Concept for Future General Aviation", 13th Pegasus-AIAA Student Conference, Berlin, Germany, April 5-7, 2017.
73. Rolando A., Rossi F., Trainelli L., Leonello D., Maisano G., Redaelli M., "Demonstration and Testing of the Pilot Acoustic Indicator on a Helicopter Flight Simulator", 42nd European Rotorcraft Forum (ERF 2016), Lille, France, September 5-8, 2016.
72. Zappa E., Trainelli L., Cordisco P., Vigoni E., Rolando A., Redaelli M., Rossi F., Liu R., "A Novel Contactless Sensor for Helicopter Blade Motion In-flight Measurements", 42nd European Rotorcraft Forum (ERF 2016), Lille, France, September 5-8, 2016.
71. Trainelli L., Gennaretti M., Zappa E., Lovera M., Rolando A., Cordisco P., Grassetti R., Redaelli M., "Development and Testing of Innovative Solutions for Helicopter In-flight Noise Monitoring and Enhanced Control Based on Rotor State Measurements", 42nd European Rotorcraft Forum (ERF 2016), Lille, France, September 5-8, 2016.

70. Zappa E., Trainelli L., Liu R., Rolando A., Rossi F., Cordisco P., Vigoni E., Redaelli M., "Real Time Contactless Sensor for Helicopter Blade Angle Measurement", 3rd IEEE International Workshop on Metrology for Aerospace, Firenze, Italy, June 22-23, 2016. [doi:10.1109/MetroAeroSpace.2016.7573219](https://doi.org/10.1109/MetroAeroSpace.2016.7573219)
69. Cigada A., Colombo A., Cordisco P., Ferrario A., Grassetti R., Manzoni S., Redaelli M., Rolando A., Terraneo M., Trainelli L., Vigoni E., Zappa E., "Contactless Rotor Flapping Sensor Design, Implementation and Testing", American Helicopter Society International 72nd Annual Forum, West Palm Beach, FL, USA, May 17-19, 2016.
68. Trainelli L., Cordisco P., Gennaretti M., Grassetti R., Lovera M., Redaelli M., Rolando A., Zappa E., "Innovative Rotor-State Measurements Enabling Helicopter In-Flight Noise Monitoring and Enhanced Attitude Control", American Helicopter Society International 72nd Annual Forum, West Palm Beach, FL, USA, May 17-19, 2016.
67. Cordisco P., Liu R., Redaelli M., Riviello L., Rolando A., Rossi F., Trainelli L., Vigoni E., Zappa E., "Developing a Novel Contactless Sensor for Helicopter Rotor State Measurement", 36th European Telemetry and Test Conference ETC2016 - 3rd Symposium on Advanced In-flight Measurement Techniques AIM2016, ISBN: 978-3-9816876-2-0, Nuremberg, Germany, May 10-12, 2016. [doi:10.5162/etc2016/2.3](https://doi.org/10.5162/etc2016/2.3)
66. Trainelli L., Rolando A., Gadarco T., Terzaghi V., Riccobono M., "Flight Testing of a New Ultralight Airplane for LTF-UL Certification", 27th Annual Society of Flight Test Engineers European Chapter Symposium, Nuremberg, Germany, May 10-12, 2016.
65. Bus F., Trainelli L., "Fixed-Wing UAV Performance Flight Testing", 12th Pegasus-AIAA Student Conference, Valencia, Spain, April 20-22, 2016.
64. Sala L., Alitta G., Berbenni D., Capocchiano C., Fugazza A., Rojas S., Sangalli S., Scaringello A., Waffo P., Trainelli L., "The 'Nibbio' High-Speed Tilt Rotor Concept", XXIII Congresso Nazionale AIDAA, Torino, Italy, November 17-19, 2015.
63. Ramazzotti A., Trainelli L., "Project Firefly – An Innovative Solution for the Italian Aerial Firefighting System", XXIII Congresso Nazionale AIDAA, Torino, Italy, November 17-19, 2015.
62. Draghi S., Trainelli L., "Optimal Design of Agricultural and Environmental Aerial Mission Profiles", XXIII Congresso Nazionale AIDAA, Torino, Italy, November 17-19, 2015.
61. Trainelli L., Rolando A., "The 'Flight Testing' Graduate Course at Politecnico di Milano", 26th Annual Society of Flight Test Engineer European Chapter Symposium, Seville, Spain, October 6-8, 2015.
60. Trainelli L., Croce A., Riboldi C. E. D., Possamai R., "Trimming a High-Fidelity Multibody Helicopter Model for Performance and Control Analysis", 41st European Rotorcraft Forum (ERF 2015), Munich, Germany, September 1-4, 2015.
59. Gennaretti M., Bernardini G., Serafini J., Trainelli L., Rolando A., Scandroglio A., Riviello L., Paolone E., "Acoustic Prediction of Helicopter Unsteady Manoeuvres", 41st European Rotorcraft Forum (ERF 2015), Munich, Germany, September 1-4, 2015.
58. Trainelli L., Riboldi C. E. D., Bucari M., "Observing the Angle of Attack of the Tip Path Plane from Rotor Blade Measurements", 41st European Rotorcraft Forum (ERF 2015), Munich, Germany, September 1-4, 2015.
57. Rolando A., Rossi F., Riboldi C. E. D., Trainelli L., Grassetti R., Leonello D., Redaelli M., "The Pilot Acoustic Indicator: A Novel Cockpit Instrument for the Greener Helicopter Pilot", 41st European Rotorcraft Forum (ERF 2015), Munich, Germany, September 1-4, 2015.
56. Trainelli L., Lovera M., Rolando A., Zappa E., Gennaretti M., Cordisco P., Grassetti R., Redaelli M., "Project MANOEUVRES – Towards Real-Time Noise Monitoring and

- Enhanced Rotorcraft Handling Based on Rotor State Measurements", 41st European Rotorcraft Forum (ERF 2015), Munich, Germany, September 1-4, 2015.
55. Trainelli L., Croce A., Riboldi C. E. D., Possamai R., Castagnoli A., "Multibody Modelling of a Novel Two-Bladed Helicopter: Trim Studies", ECCOMAS Thematic Conference "Multibody Dynamics 2015", Barcelona, Spain, June 28-July 2, 2015. [slide presentation]
 54. Trainelli L., Croce A., Possamai R., "Dynamic Characterization of a Novel Gimbal Two-Blade Helicopter Rotor", American Helicopter Society International 71st Annual Forum, Virginia Beach, VA, USA, May 5-7, 2015. [slide presentation]
 53. Sala L., Alitta G., Berbenni D., Capocchiano C., Fugazza A., Rojas S., Sangalli S., Scaringello A., Waffo P., Trainelli L., "Project Caurus "Nibbio" – A Novel Tilt Rotor Concept for Very High Speed Applications", American Helicopter Society International 71st Annual Forum, Virginia Beach, VA, USA, May 5-7, 2015.
 52. Ramazzotti A., Trainelli L., "Concept Study of an Innovative Aerial Component for the Italian Firefighting System", 11th Pegasus-AIAA student conference, Salon-de-Provence, France, April 20-22, 2015.
 51. Croce A., Possamai R., Trainelli L., "Dynamic Properties of Some Gimbal and Teetering Two-Blade Helicopter Rotor Heads", 40th European Rotorcraft Forum (ERF 2014), Southampton, UK, September 2-5, 2014.
 50. Croce A., Possamai R., Savorani A., Trainelli L., "Modelling and Characterization of a Novel Gimbal Two-Blade Helicopter Rotor", 40th European Rotorcraft Forum (ERF 2014), Southampton, UK, September 2-5, 2014.
 49. Bona G. E., Bucari M., Castagnoli A., Trainelli L., "Flybrid: Envisaging the Future Hybrid-Powered Regional Aviation", AIAA paper no. 2014-2733, AIAA/3AF Aircraft Noise and Emissions Reduction Symposium, AIAA Aviation and Aeronautics Forum and Exposition 2014, Atlanta, GA, USA, June 16-20, 2014. [doi:10.2514/6.2014-2733](https://doi.org/10.2514/6.2014-2733)
 48. Trainelli L., Rolando A., Zappa E., Manzoni S., Lovera M., Gennaretti M., Bernardini G., Cordisco P., Terraneo M., Vigoni E., Grassetto R., "MANOEUVRES – An Effort Towards Quieter, Reliable Rotorcraft Terminal Procedures", Greener Aviation: Clean Sky breakthroughs and worldwide status, Brussels, Belgium, March 12-14, 2014.
 47. Trainelli L., Anselmi M., Ballarin M., D'Andrea S., Zuliani G., "Series Hybrid Reconfiguration of a General Aviation Aircraft", XXII Congresso Nazionale AIDAA, Napoli, Italy, September 2013.
 46. Trainelli L., Rolando A., Cardani C., "Academic Flight Testing Capabilities Enabling Ultralight Aircraft Certification", 3rd CEAS Air & Space Conference and XXI Congresso Nazionale AIDAA, Venezia, Italy, October 2011.
 45. Cardani C., Rolando A., Trainelli L., Chimetto P., Bonaita G., "A Cost-Effective Approach to Ultralight Machine Flight Testing - An Academic Perspective", 21st Annual Society of Flight Test Engineer European Chapter Symposium, Vergiate, Italy, October 2010.
 44. Trainelli L., Rolando A., Chimetto P., Bonaita G., "Education in Flight Testing at the Politecnico di Milano", XX Congresso Nazionale AIDAA, Milano, Italy, June 2009.
 43. Trainelli L., Rolando A., Cardani C., Folchini A., Chimetto P., Bonaita G., "Experiences in Flight Mechanics Education: Getting the Students Hands on the Real Thing", IX Congresso Nazionale SIMAI, Roma, Italy, September 2008. [slide presentation]
 42. Borri M., Trainelli L., "Geometrically Consistent Formulations for Constrained System Dynamics", 8th World Congress on Computational Mechanics (WCCM8) - 5th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008), Venezia, Italy, June 2008. [slide presentation]

41. Borri M., Trainelli L., "Basic Airplane Equilibrium and Stability Revisited", International Conference on Aeronautical Science and Air Transportation (ICASAT 2007), Tripoli, Libya, April 2007.
40. Borri M., Trainelli L., "On Formulations For Constrained Mechanical System Dynamics", International School of Mathematics "G. Stampacchia" 47th Workshop - "Variational Analysis and Aerospace Engineering", Erice, Italy, September 2007. [slide presentation]
39. Bottasso C. L., Dopico D., Trainelli L., "Optimal Preconditioners for the Solution of Constrained Mechanical Systems in Index-3 Form", III Asian Conference on Multibody Dynamics (ACMD 2006), Tokyo, Japan, August 2006.
38. Bottasso C. L., Dopico D., Trainelli L., "On the Optimal Scaling of Index Three DAEs in Multibody Dynamics", III European Conference on Computational Mechanics, Solids, Structures and Coupled Problems in Engineering (ECCM 2006), Lisbon, Portugal, June 2006.
37. Trainelli L., Bottasso C. L., "Optimal Scaling of High Index DAEs", 11th Seminar on Numerical Solution of Differential and Differential-Algebraic Equations (NumDiff 11), Halle, Germany, September 2006. [slide presentation]
36. Borri M., Trainelli L., "Evident Constraints and Hidden Constraints: The Quality of the Numerical Solution in Multibody Dynamics", Workshop on Multibody System Dynamics, Paestum, Italy, April 2006. [slide presentation]
35. Bottasso C. L., Croce A., Savini B., Sirchi W., Trainelli L., "Aeroelastic Modeling and Control of Wind Turbine Generators Using Finite Element Multibody Procedures", ECCOMAS Thematic Conference Multibody Dynamics 2005, Madrid, Spain, June 2005.
34. Borri M., Trainelli L., "A Simplified Approach to Basic Airplane Equilibrium and Stability", VII Congresso Nazionale SIMAI, Venezia, Italy, September 2004.
33. Trainelli L., "An Attempt at a Systematic Framework for the Parameterization of Rotation and Rigid Motion", WCCM VI – APCOM'04, Beijing, China, September 2004. [slide presentation]
32. Bottasso C. L., Trainelli L., Croce A., Sirchi W., Savini B., "Sviluppo di Strumenti per la Simulazione di Moderne Turbine Eoliche", Eolica Expo Mediterranean 2004, Roma, Italy, September 2004. [slide presentation]
31. Trainelli L., Croce A., "A Comprehensive View of Rotation Parameterization", 4th European Congress ECCOMAS 2004, Jyväskylä, Finland, July 2004.
30. Bottasso C. L., Bauchau O. A., Croce A., Leonello D., Riviello L., Trainelli L., "Finite Element Procedures for Non-Linear Aeroelastic Problems", 7th US National Congress on Computational Mechanics, Albuquerque, NM, USA, July 2003. [slide presentation]
29. Trainelli L., "On the Parameterization of Rotation and Rigid Motion: A Comprehensive Picture", XVII Congresso Nazionale AIDAA, Roma, Italy, September 2003.
28. Borri M., Trainelli L., "Airplane Equilibrium and Stability: A Simplified Teaching Approach", XVII Congresso Nazionale AIDAA, Roma, Italy, September 2003.
27. Bottasso C. L., Sirchi W., Trainelli L., "On the Non-Linear Effects of the Gimbal Design on the Aeroelastic Behavior of a Tilt Rotor", XVII Congresso Nazionale AIDAA, Roma, Italy, September 2003.
26. Borri M., Trainelli L., Bottasso C. L., "Recent Advances in Invariant Algorithms for Structural and Multibody Dynamics", XVII Congresso Nazionale AIDAA, Roma, Italy, September 2003.
25. Borri M., Trainelli L., "A Simple Framework for the Study of Airplane Trim and Stability", AIAA paper no. 2003-5620, AIAA Atmospheric Flight Mechanics Conference and Exhibit, Austin, TX, USA, August 2003. [doi:10.2514/6.2003-5620](https://doi.org/10.2514/6.2003-5620)

24. Bottasso C. L., Trainelli L., "An Attempt at the Classification of Energy Preserving/Decaying Schemes for Structural and Multibody Dynamics", ECCOMAS Thematic Conference "Multibody Dynamics 2003", Lisbona, Portugal, July 2003.
23. Borri M., Trainelli L., Croce A., "An Index Reduction Method in Holonomic Systems Dynamics", 2nd M.I.T. Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, Cambridge, MA, USA, June 2003.
[doi:10.1016/B978-008044046-0/50033-6](https://doi.org/10.1016/B978-008044046-0/50033-6)
22. Bottasso C. L., Trainelli L., Abdel-Nour P., Labò G., "Tilt Rotor Analysis and Design Using Finite-Element Multibody Procedures", 28th European Rotorcraft Forum (ERF 2002), Bristol, UK, September 2002.
21. Borri M., Bottasso C. L., Trainelli L., "Robust Finite Element Simulation of Complex Multibody Systems", ECMI Workshop on Numerical Methods in Multibody Dynamics, Bad-Herrenalb, Germany, October 2001. [slide presentation]
20. Bottasso C. L., Bauchau O. A., Trainelli L., "On the Modeling of Rotorcraft Systems with Finite Element Multibody Dynamics", XVI Congresso Nazionale AIDAA, Palermo, Italy, September 2001.
19. Borri M., Trainelli L., "Reducing the DAE Index in Constrained System Dynamics", XVI Congresso Nazionale AIDAA, Palermo, Italy, September 2001.
18. Borri M., Trainelli L., "Index Reduction in Constrained Dynamical Systems", Euromech Colloquium 427, Cachan, France, September 2001.
17. Borri M., Bottasso C. L., Trainelli L., "An index Reduction Method in Non-Holonomic System Dynamics", 1st M.I.T. Conference on Computational Fluid and Solid Mechanics, Cambridge, MA, USA, June 2001.
16. Borri M., Bottasso C. L., Trainelli L., "On the Importance of Some Algorithmic Aspects of Multibody Dynamics for Complex Applications", 1st M.I.T. Conference on Computational Fluid and Solid Mechanics, Cambridge, MA, USA, June 2001. [slide presentation]
15. Borri M., Bottasso C. L., Trainelli L., "A New Formulation of Constrained Dynamical Systems", 16th IMACS World Congress, Lausanne, Switzerland, August 2000.
14. Borri M., Trainelli L., "Solution of Constrained Dynamical Systems via an Embedded Projection Method", 20th International IUTAM Congress - ICTAM 2000, Chicago, IL, USA, August 2000. [slide presentation]
13. Borri M., Bottasso C. L., Trainelli L., "An Embedded Projection Method for Constrained Dynamics", North-Atlantic Treaty Organization (NATO) Advanced Research Workshop on Computational Aspects of Nonlinear Structural Systems with Large Rigid Body Motion, Pultusk, Poland, July 2000.
12. Borri M., Bottasso C. L., Trainelli L., "A Novel Momentum-Preserving/Energy-Decaying Algorithm for Finite-Element Multibody Procedures", North-Atlantic Treaty Organization (NATO) Advanced Research Workshop on Computational Aspects of Nonlinear Structural Systems with Large Rigid Body Motion, Pultusk, Poland, July 2000.
11. Bauchau O. A., Bottasso C. L., Trainelli L., "Robust Integration Schemes for Flexible Multibody Systems", North-Atlantic Treaty Organization (NATO) Advanced Research Workshop on Computational Aspects of Nonlinear Structural Systems with Large Rigid Body Motion, Pultusk, Poland, July 2000.
10. Bottasso C. L., Borri M., Trainelli L., "Progettare Integratori che 'Capiscono' le Equazioni: il Caso dei Sistemi Multicorpo Flessibili", Associazione Italiana di Meccanica Teorica e Applicata (AIMETA), GIMC '98 - XI Convegno Italiano di Meccanica Computazionale, Trento, Italy, July 1998.

9. Borri M., Bottasso C. L., Trainelli L., "Integrating Elastic Multibody Systems: Manifolds. Invariants, and Non-Linear Stability", 4th IACM World Congress on Computational Mechanics, Buenos Aires, Argentina, June 1998.
 8. Borri M., Bottasso C. L., Trainelli L., "Non-Linear Unconditional Stability in the Integration of Flexible Multibody Systems", IV Congresso Nazionale SIMAI, Giardini Naxos, Italy, June 1998.
 7. Borri M., Bottasso C. L., Trainelli L., "Energy Preserving/Decaying Algorithms for Non-Linear Flexible Multibody Systems", XIV Congresso Nazionale AIDAA, Napoli, Italy, October 1997.
 6. Borri M., Bottasso C. L., Trainelli L., "Energy Preserving/Decaying Schemes for Non-Linear Elastic Multibody Systems", 7th Workshop on Dynamics and Aeroelastic Stability Modeling of Rotorcraft Systems, St. Louis, MO, USA, October 1997.
 5. Borri M., Bottasso C. L., Trainelli L., "Energy Preserving /Decaying Schemes for Holonomic/Non-Holonomic Non-Linear Multibody Systems", IV U.S. National Congress on Computational Mechanics, San Francisco, CA, USA, July 1997. [slide presentation]
 4. Iemma U., Gennaretti M., Trainelli L., Giordani A., Morino L., "A Unified Boundary Integral Formulation for Acousto-aeroelastic Analysis of Shells", ICAS Paper no. 96-5.6.1, 20th ICAS Congress, Sorrento, Italy, September 1996.
 3. Iemma U., Trainelli L., Morino L., "A Finite State BEM Method for Acousto-aeroelasticity of Shells", AIAA paper no. 1996-1701, International Association of Aeronautics and Astronautics, 2nd AIAA/ CEAS Aeroacoustics Conference, State College, PA, USA, May 1996. [doi:10.2514/6.1996-1701](https://doi.org/10.2514/6.1996-1701)
 2. Morino L., Iemma U., Trainelli L., "Finite State Acousto-aeroelasticity", IABEM-95 Symposium on the Boundary Element Method, Mauna Lani, HI, USA, August 1995.
 1. Morino L., Iemma U., Trainelli L., "Internal Noise Generated by Sources External to an Elastic Shell", AIAA paper no. 1995-042, International Association of Aeronautics and Astronautics, CEAS - AIAA Conference '95, Munich, Germany, June 1995.
- Divulgative articles
4. Trainelli L., "Structural Batteries in Aviation: A Key for the Future of Electric Flight?", *Compositi Magazine*, Assocompositi, **51**, 2019.
 3. Trainelli L., "Politecnico di Milano Educational Flight Test Campaign", *Flight Test News*, Society of Flight Test Engineers, **49** (10), 2018.
 2. Trainelli L., "Politecnico di Milano Flight Test Exercise at Italian Naval Aviation Test and Evaluation Center", *Flight Test News*, Society of Flight Test Engineers, **49** (6), 2018.
 1. Grimaccia F., Lovera M., Trainelli L., "Aeromobili a Pilotaggio Remoto: Cenni di Storia, Tecnologia e Applicazioni", *Rivista AEIT*, Associazione Italiana di Elettrotecnica, Elettronica, Automazione, Informatica e Telecomunicazioni, **1/2**, 2018.