INCAS - NATIONAL INSTITUTE FOR AEROSPACE RESEARCH "ELIE CARAFOLI"

(under the aegis of The Romanian Academy)

PROCEEDINGS

of the International Conference of Aerospace Sciences

AEROSPATIAL 2016

26 - 27 October 2016

Bucharest, Romania

AEROSPATIAL 2016

Proceedings
of the International Conference of Aerospace Sciences
"AEROSPATIAL 2016"
26 - 27 October 2016,
Bucharest, Romania

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International Conference of Aerospace Sciences
"AEROSPATIAL 2016"
Bucharest, 26-27 October 2016

GRAPHIC PROGRAM

Hour	26 October 2016			Hour	27 October 2016		
$8.^{30}-9.^{30}$	REGISTRATION *Coffee Break*			$8.^{30}-9.^{00}$	REGISTRATION *Coffee Break*		
$9.^{30}-10.^{00}$	OPENING SESSIONS			$9.^{00}-10.^{00}$	The "Nicolae Tipei" Prize Award Ceremony		
$10.^{00}-10.^{30}$	PL – Jochen WILD (Germany)			$10.^{00}-10.^{30}$	PL – Ruxandra M. BOTEZ (Canada)		
$10.^{30}-11.^{00}$	PL – Hans BARNERSSOI (Germany)			$10.^{30}-11.^{00}$	PL – Adi ADUMITROAIE (Austria)		
$11.^{00}-11.^{30}$	*Coffee Break*			$11.^{00}-11.^{20}$	*Coffee Break*		
$11.^{30}-12.^{00}$	PL – Eric COUSTOLS (France)			$11.^{20}-11.^{50}$	PL – Virgil STANCIU (Romania)		
$12.^{00}-12.^{30}$	PL – Adriana NASTASE (Germany)			$11.^{50}-12.^{20}$	PL – Yassir ABBAS (Sudan)		
$12.^{30}-13.^{00}$	PL – Octavian Thor PLETER (Romania)			$12.^{20}-12.^{40}$	*S1.1.7*	*S5.1.1*	*S4.1.7*
$13.^{00}-14.^{00}$	*Lunch*			$12.^{40}-13.^{00}$	*S1.1.8*	*S5.1.2*	*S4.1.8*
$14.^{00}-14.^{30}$	PL – Horia DUMITRESCU (Romania)			$13.^{00}-14.^{00}$	*Lunch*		
$14.^{30}-14.^{50}$	*S1.2.1*	*S.2.2.1*	*S4.2.1*	$14.^{00}-14.^{20}$	*S1.2.9*	*S5.2.3*	*S4.2.9*
$14.^{50}-15.^{10}$	*S1.2.2*	*S.2.2.2*	*S4.2.2*	$14.^{20}-14.^{40}$	*S1.2.10*	*S5.2.4*	*S4.2.10*
$15.^{10}-15.^{30}$	*S1.2.3*	*S.2.2.3*	*S4.2.3*	$14.^{40}-15.^{00}$	*S1.2.11*	*S5.2.5*	*S4.2.11*
$15.^{30}-15.^{50}$	*S1.2.4*	*S.2.2.4*	*S4.2.4*	$15.^{00}-15.^{20}$	*S1.2.12*	*S5.2.6*	*S4.2.12*
$15.^{50}-16.^{10}$	*S1.2.5*	*S.2.2.5*	*S4.2.5*	$15.^{20}-15.^{40}$	*S1.2.13*	*S5.2.7*	*S4.2.13*
$16.^{10}-16.^{40}$	*Coffee Break*			$15.^{40}-16.^{00}$	*Coffee Break*		
$16.^{40}-17.^{00}$	*S1.2.6*	*S2.2.6*	*S4.2.6*	$16.^{00}-16.^{20}$	*S1.2.14*	*S5.2.8*	*S8.2.1*
$17.^{00}-17.^{20}$	*S3.2.1*	*S2.2.7*	*S6.2.1*	$16.^{20}-16.^{40}$	*S1.2.15*	*S7.2.1*	*S8.2.2*
$17.^{20}-17.^{40}$	*S3.2.2*	*S2.2.8*	*S6.2.2*	$16.^{40}-17.^{00}$	*S1.2.16*	*S7.2.2*	*S8.2.3*
$17.^{40}-18.^{00}$	*S3.2.3*	*S2.2.9*	*S6.2.3*	$17.^{00}-17.^{20}$			*S8.2.4*
$18.^{00}-18.^{20}$	*S3.2.4*		*S6.2.4*	$17.^{20}-17.^{40}$			*S8.2.5*
$18.^{20}-18.^{40}$	*Q & A*			$17.^{40}-18.^{00}$			*S8.2.6*
$19.^{00}$	*Gala Dinner*			$18.^{00}$	*Closing Sessions*		

PL - Plenary lecture
S1 - Section 1. Aerodynamics
S2 - Section 2. Flight Mechanics and Systems Integration
S3 - Section 3. Astronautics and Astrophysics
S4 - Section 4. Materials and Structures
S5 - Section 5. Systems, Subsystems and Control in Aeronautics
S6 - Section 6. Experimental Investigations in Aerospace Sciences
S7 - Section 7. ATS and full automation ATM
S8 - Section 8. Management in Aerospace Activities

- The "Nicolae Tipei" Prize Award Ceremony

- "ELIE CARAFOLI" Amphitheatre
- "Nicolae TIPEI" Amphitheatre
- "Conference room", et. 2, corp B

CONFERENCE PROGRAM

Wednesday 26.10.2016 – "ELIE CARAFOLI" Amphitheatre

8.^{30} - 9.^{30} **REGISTRATION**

Coffee Break

9.^{30} - 10.^{00} **OPENING SESSIONS**

***Welcome speech*:**

- **Catalin NAE**, General Manager, INCAS − National Institute for Aerospace Research "Elie Carafoli", Bucharest, Romania
- **Anton ANTON**, Technical University of Civil Engineering Bucharest, Romania

PLENARY SESSIONS

PL **Chairman:**

Catalin NAE

10.^{00} - 10.^{30}

PL 1 **Jochen WILD** (German Aerospace Center, Institute of Aerodynamics and Flow Technology, Lilienthalplatz 7, 38108 Braunschweig, Germany), ***On the most common misunderstandings of high-lift flows***.

10.^{30} - 11.^{00}

PL 2 **Hans BARNERSSOI** (Ex-Project Manager, Airbus Helicopters Germany, Industriestrasse 4, 86609 Donauwörth, Germany), ***Setting up of a Fast Rotorcraft Project. Experience gained by a Project Manager.***

11.^{00} - 11.^{30}

Coffee Break

11.^{30} - 12.^{00}

PL 3 **Eric COUSTOLS** (Director of Clean Sky 2 Programme at ONERA, ONERA Centre of Toulouse, 2 Avenue Edouard Belin FR-31055 Toulouse CEDEX 4, France), ***"Review of Research Activities conducted at ONERA on Laminar Flows and Wing Buffet Control".***

12.^{00} - 12.^{30}

PL 4 **Adriana NASTASE** (RWTH, Aachen University, Germany), ***Theoretical and Experimental Exploration of Supersonic Flow (Part 1).***

12.^{30} - 13.^{00}

PL 5 **Octavian Thor PLETER, Cristian Emil CONSTANTINESCU** ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania), ***Global Air and Maritime Co-operative Surveillance.***

13.^{00} - 14.^{00}

Lunch

"ELIE CARAFOLI" Amphitheatre

Wednesday 26.10.2016. Afternoon session

PLENARY SESSIONS

PL **Co-Chairman:**

Sorin RADNEF
Mircea BOSCOIANU

14.^{00} - 14.^{30}

PL 6 **Horia DUMITRESCU, Vladimir CARDOS** *("Gheorghe Mihoc – Caius Iacob" Institute of Mathematical Statistics and Applied Mathematics of the Romanian Academy, Calea 13 Septembrie no. 13, 050711 Bucharest, Romania)*, ***Issues of Paradigmatic Nature of Origin of Turbulence***

Wednesday 26.10.2016 – "ELIE CARAFOLI" Amphitheatre

Section 1 – Aerodynamics

Wednesday 26.10.2016. Afternoon session

S1.2 **Co-Chairman:**

Sterian DANAILA
Florin FRUNZULICA

14.[30] - 14.[50]

S1.2.1 ***Numerical illustration of the global and local stability and instability of the constant spatially developing 1D gas flow***, Agneta M. BALINT[1], Stefan BALINT[*,2] ([1]West University of Timisoara, Department of Physics, Bulv. V. Parvan 4, 300223 Timisoara, Romania, [2]West University of Timisoara, Department of Computer Science, Bulv. V. Parvan 4, 300223 Timisoara, Romania).

14.[50] - 15.[10]

S1.2.2 ***Numerical illustration of the global and local stability and instability of the constant spatially developing 2D gas flow,*** Agneta M. BALINT[1], Stefan BALINT*[,2] ([1]West University of Timisoara, Department of Physics, Bulv. V. Parvan 4, 300223 Timisoara, Romania, [2]West University of Timisoara, Department of Computer Science, Bulv. V. Parvan 4, 300223 Timisoara, Romania).

15.[10] - 15.[30]

S1.2.3 ***Assessment of some high-order finite difference schemes on the scalar conservation law with periodical conditions,*** Alina BOGOI, Dragos ISVORANU, Sterian DANAILA* ("POLITEHNICA" University of Bucharest, Department of Aerospace Engineering, Splaiul Independenţei 313, 060042, Bucharest, Romania).

15.[30] - 15.[50]

S1.2.4 ***Ice Accretion Prediction for 2D Geometries in the Presence of Ice Crystals,*** Marius Gabriel COJOCARU*, Mihai Leonida NICULESCU, Dumitru PEPELEA, Mihaita Gilbert STOICAN, Mihai Victor PRICOP (INCAS – National Institute for Aerospace Research "Elie Carafoli", Flow Physics Department, Numerical Simulation Unit, B-dul Iuliu Maniu 220, Bucharest 061136, Romania).

15.[50] - 16.[10]

S1.2.5 ***Hybrid Methods for Design and Analysis for Small UAV Rotor Blades,*** Alexandru DUMITRACHE, Florin FRUNZULICA, Alexandru MITREA ("Gheorghe Mihoc – Caius Iacob" Institute of Mathematical Statistics and Applied Mathematics of the Romanian Academy, Bucharest, Calea 13 Septembrie no. 13, 050711 Bucharest, Romania and "POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania).

16.[10] - 16.[40]

Coffee Break

16.[40] - 17.[00]

S1.2.6 ***Numerical Investigation of a Vertical-Axis Wind Turbine with Variable-Pitch,*** Florin FRUNZULICĂ*[,1,2], Ciprian OLTEANU[3] (*[,1]POLITEHNICA University of Bucharest, Faculty of Aerospace Engineering, Polizu 1-6, RO-011061, Bucharest, Romania; [2]Institute of Statistics and Applied Mathematics, 13 Septembrie 13, sect.5, RO-050711, Bucharest, Romania; [3]Turbomecanica S.A., Iuliu Maniu 244, sect 6, RO-061126, Bucharest, Romania).

Wednesday 26.10.2016 – "ELIE CARAFOLI" Amphitheatre

Section 3 – Astronautics and Astrophysics

Wednesday 26.10.2016. Afternoon session

S3.2 **Co-Chairman:**
Corneliu BERBENTE
Dan N. DUMITRIU

17.^{00} - 17.^{20}
S3.2.1 ***A Possible Universe in Pulsation by Using a Hydro-Dynamical Model for Gravity,*** Corneliu BERBENTE ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Department "Elie Carafoli" Aerospace Science, Polizu Street 1-7, postal code 011061, sector 1, Bucharest).

17.^{20} - 17.^{40}
S3.2.2 ***General Oscillatory Motion of a Large Spacecraft around its Equilibrium Attitude Posture, due to the Gravitational Moments Effect,*** Ion STROE[1], Dan N. DUMITRIU[2] ([1]"POLITEHNICA" University of Bucharest, 313 Splaiul Independenţei, Bucharest 060042, Romania; [2]Institute of Solid Mechanics of the Romanian Academy, Str. Constantin Mille 15, Bucharest 010141, Romania).

17.^{40}- 18.^{00}
S3.2.3 ***Using Binet type of equation for relative motion,*** Roxana Alexandra PETRE*, Thien Van NGUYEN, Ion STROE ("POLITEHNICA" University of Bucharest, Department of Mechanics, 313 Splaiul Independentei, Bucharest, Romania).

18.^{00} - 18.^{20}
S3.2.4 ***Concept Study of Radio Frequency (RF) Plasma Thruster for Space Propulsion,*** Anna-Maria Theodora ANDREESCU[1], Maximilian-Vlad TEODORESCU[2], Jeni Alina POPESCU[1], Valeriu-Alexandru VILAG[1], Adrian STOICESCU[1] ([1]Romanian Research and Development Institute for Gas Turbines COMOTI, http://www.comoti.ro; [2]National Institute for Laser, Plasma and Radiation Physics INFLPR, http://www.inflpr.ro).

18.^{20} - 18.^{40} ***Q & A***

19.^{00} ***GALA DINNER***

Wednesday 26.10.2016 – "Nicolae TIPEI" Amphitheatre

Section 2 – Flight Mechanics and Systems Integration

Wednesday 26.10.2016. Afternoon session

S2.2. **Co-Chairman:**

Marius STOIA-DJESKA
Ion STROE

14.^{30} - 14.^{50}

S2.2.1 ***A Local Sensitivity Analysis of Some Performances of Reactive Projectiles, Rockets and Missiles,*** Florin MINGIREANU[1], Marius STOIA-DJESKA[2] ([1]Romanian Space Agency, Mendeleev Street, nr. 21-25, Bucharest, 010362/ Romania; [2]"POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Polizu Street 1-7, postal code 011061, sector 1, Bucharest).

14.^{50} - 15.^{10}

S2.2.2 ***Analysis of Dynamic Stability on Ground Roll for a Jet Transport Under Crosswind and Slippery Conditions***, Achim IONITA[1], Andreea-Irina AFLOARE[2] ([1]AEROSPACE Consulting, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [2]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{10} - 15.^{30}

S2.2.3 ***Efficiency Analysis of Earth-Mars Interplanetary Travel Using a Solar Sail Propulsion Device plant***, Radu BLIDERAN, Alexandru IONEL, Mihaela NASTASE (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{30} - 15.^{50}

S2.2.4 ***A Preliminary Tool for Trajectory Optimization for a Small Launcher***, Ana-Maria NECULAESCU[1], Ion STROE[2] ([1]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [2]"POLITEHNICA" University of Bucharest, 313 Splaiul Independenţei, Bucharest 060042, Romania).

15.^{50} - 16.^{10}

S2.2.5 ***Decelerator systems for the atmospheric reentry of launcher upper stages***, Bogdan DOBRESCU, Radu BLIDERAN, Adrian CHELARU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

16.^{10} - 16.^{40}

` ***Coffee Break***

S2.2. **Co-Chairman:**

Florin MINGIREANU
Mihai Victor PRICOP

16.^{40} - 17.^{00}

S2.2.6 ***Direct Spatial Motion Simulation of Aircraft Subjected to Engine Failure***, Yassir ABBAS[1], Mohammed MADBOULI[2], Gamal EL-BAYOUMI[2] ([1]Aeronautical Engineering Department, Engineering College, Karary University, Khartoum, Sudan; [2]Aeronautical Engineering Department, Engineering College, Cairo University, Giza State, Egypt).

17.^{00} - 17.^{20}

S2.2.7 ***Performance Analysis of the IAR 99 SOIM and IAR 99 TD Propulsion Systems***, Alexandru IONEL, Stefan PALAS, Irina-Carmen ANDREI (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

$17.^{20}$ - $17.^{40}$

S2.2.8 ***Numerical Simulation on the Efficiency of Propulsion Systems as Leo Deorbiting Devices***, Mihaela NASTASE, Radu BLIDERAN, Alexandru IONEL (INCAS – National Institute for Aerospace Research “Elie Carafoli”, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

$17.^{40}$ - $18.^{00}$

S2.2.9 ***Dynamic Stability of Earth Re-Entry Capsule***, Dumitru PEPELEA, Marius Gabriel COJOCARU, Mihai Victor PRICOP, Mihai Leonida NICULESCU (INCAS – National Institute for Aerospace Research “Elie Carafoli”, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

$18.^{20}$ - $18.^{40}$ ***Q & A***

$19.^{00}$ ***GALA DINNER***

Wednesday 26.10.2016 – "Conference room", et. 2, corp B

Section 4 – Materials and Structures

Wednesday 26.10.2016. Afternoon session

S4.2 **Co-Chairman:**

Daniela BARAN
Stefan SOROHAN

14.30 - 14.50

S4.2.1 ***Materials in Extreme Environments at ELI-NP***, Theodor ASAVEI[1], Marilena TOMUT[2], Mariana BOBEICA[1], Sohichiroh AOGAKI[1], Mihail CERNAIANU[1], Daniel URSESCU[1], Dan STUTMAN[1] ([1]ELI-NP, "Horia Hulubei" National Institute for Physics and Nuclear Engineering, 30 Reactorului Street, RO-077125, Bucharest-Magurele, Romania; [2]GSI Helmholzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany).

14.50 - 15.10

S4.2.2 ***Dimensioning of a Sandwich Panel with Orthotropic Core Consisting of Lightweight Profiles***, Adriana Georgeta SANDU*, Marin SANDU, Stefan SOROHAN, Dan Mihai CONSTANTINESCU ("POLITEHNICA" University of Bucharest, Department of Strength of Materials, Splaiul Independenţei 313, 060042, Bucharest, Romania).

15.10 - 15.30

S4.2.3 ***Use of Modal Fea for Accurate Estimation of out of Plane Shear Moduli of Honeycomb Cores in Sandwich Panels***, Stefan SOROHAN*, Dan Mihai CONSTANTINESCU, Marin SANDU, Adriana Georgeta SANDU ("POLITEHNICA" University of Bucharest, Department of Strength of Materials, Splaiul Independenţei 313, 060042, Bucharest, Romania).

15.30 - 15.50

S4.2.4 ***Multipurpose Interaction Chamber for Evaluation of the Outer Space Effects in Condensed Matter***, Cristian POSTOLACHE, Viorel FUGARU (Horia Hulubei National Institute for Physics and Nuclear Engineering, 30, Reactorului St., Magurele, Ilfov, Romania).

15.50 - 16.10

S4.2.5 ***Zirconia Compounds Coatings on C Substrates: Combinatorial EB-PVD Deposition and Thermal Characterisation***, Radu-Robert PITICESCU[1], Victor MANOLIU[2], Alexandru MIHAILESCU[3], Arcadii SOBETKII[1], Gheorghe IONESCU[2], Adrian Mihail MOTOC[1] ([1]National R&D Institute for Nonferous and Rare Metals, 102 Biruintei Blvd, Pantelimon 077145, Romania; [2]AEROSPACE Consulting, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [3]INCAS – National Institute for Aerospace Research "Elie Carafoli", Materials Unit, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

16.10 - 16.40

Coffee Break

16.40 - 17.00

S4.2.6 ***Harness/Container Equipment for Parachutes with Variable Volume,*** Claudia NICULESCU, Adrian SALISTEAN, Georgeta POPESCU (National R&D Institute for Textile and Leather Bucharest (INCDTP), 16 Lucretiu Patrascanu, 030508 Bucharest, Romania).

Wednesday 26.10.2016 – "Conference room", et. 2, corp B

Section 6 – Experimental Investigations in Aerospace Sciences

Wednesday 26.10.2016. Afternoon session

S3.2 **Co-Chairman:**
Cristian POSTOLACHE
Ioan URSU

17.^{00} - 17.^{20}
S6.2.1 ***Radiobiology Experiment Design and Modeling for Space Applications at ELI-NP***, Mariana BOBEICA[1], Sohichiroh AOGAKI[1], Theodor ASAVEI[1], Mihail CERNAIANU[1], Petru GHENUCHE[1], Florin NEGOITA[1], Dan STUTMAN[1,2] ([1]"Horia Hulubei" National Institute for Physics and Nuclear Engineering, Extreme Light Infrastructure Nuclear Physics ELI-NP, 30 Reactorului Street, RO-077125, Bucharest-Magurele, Romania; [2]Johns Hopkins University, 3400 N Charles St., Baltimore, Maryland 21218, USA).

17.^{20} - 17.^{40}
S6.2.2 ***Redox Biology in Space Missions - Towards New Molecular Targets for Radioprotection***, Gina MANDA[1], Ionela Victoria NEAGOE[1], Cristian POSTOLACHE[2], Mariana BOBEICA[3] ([1]"Victor Babes" National institute of Pathology, Bucharest, Romania; [2]"Horia Hulubei" National Institute for R&D in Physics and Nuclear Engineering, Magurele, Romania; [3]ELI-NP, "Horia Hulubei" National Institute for Physics and Nuclear Engineering, Magurele, Romania).

17.^{40} - 18.^{00}
S6.2.3 ***Characterization of Gamma Radiation Fields Emitted by 60-CO Sources Inside of Multifunctional Interaction Chamber***, Cristian POSTOLACHE, Viorel FUGARU, Sorin BERCEA, Aurelia CELAREL, Constantin CENUSA, Daniel NEGUT (Horia Hulubei National Institute for Physics and Nuclear Engineering, 30, Reactorului St., Magurele, Ilfov, Romania).

18.^{00} - 18.^{20}
S6.2.4 ***Introduction to Zero Point Energy Sample Calculations With Case Studies for Prolific Applications***, Alexandru IONEL, Tiberiu SALAORU, Mihaela NASTASE (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

18.^{20} - 18.^{40} ***Q & A***

19.^{00} ***GALA DINNER***

Thursday 27.10.2016 – "ELIE CARAFOLI" Amphitheatre

8.30 - 9.00 **REGISTRATION**
Coffee Break

9.00 - 10.00 **The "Nicolae Tipei" Prize Award Ceremony**

PLENARY SESSIONS

PL **Co-Chairman:**

Catalin NAE
Sorin RADNEF

10.00 - 10.30

PL 7 **Ruxandra Mihaela BOTEZ** (ETS, University of Quebec, Laboratory of Applied Research in Active Controls, Avionics and AeroServoElasticity LARCASE, www.larcase.etsmtl.ca, 1100 Notre Dame West, Montreal, Canada), ***New Methodologies for Missed Approach Computing in Terms of Fuel Consumption and Emissions for a Boeing B-737-400.***

10.30 - 11.00

PL 8 **Adi ADUMITROAIE** (Institute for Constructional Lightweight Design, JOHANNES KEPLER, UNIVERSITY LINZ, Altenberger Straße 69, Science Park I, MT0220, 4040 Linz, Austria), ***Synergy between Safety Concepts and Damage Tolerance Capabilities of FRP Composite Structures*.**

11.00 - 11.20

Coffee Break

11.20 - 11.50

PL 9 **Virgil STANCIU** ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania), ***Design, the Way to Aerospace Metaengineering.***

11.50 - 12.20

PL 10 **Yassir ABBAS** (Aeronautical Engineering Department, Engineering College, Karary University, Khartoum, Sudan), ***Aerodynamic of Damaged Aircraft.***

Thursday 27.10.2016 – "ELIE CARAFOLI" Amphitheatre

Section 1 – Aerodynamics

Thursday 27.10.2016. Morning session

S1.1 **Co-Chairman:**

Ruxandra Mihaela BOTEZ
Virgil STANCIU

12.^{20} - 12.^{40}

S1.1.7 ***Holistic Treatment of Double Flow Turbofan Performance Using Harmonic Hyperbolic Law***, Virgil STANCIU, Cristina PAVEL ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania).

12.^{40} - 13.^{00}

S1.1.8 ***The Development of a Reduced Order Model for The Aeroelastic Analysis of a Test Wing Used for Wind-Tunnel Aeroelastic Experiments***, Marius STOIA-DJESKA ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania).

13.^{00} - 14.^{00}

Lunch

Thursday 27.10.2016 – "ELIE CARAFOLI" Amphitheatre

Section 1 – Aerodynamics

Thursday 27.10.2016. Afternoon session

S1.2 **Co-Chairman:**

Doru SAFTA
Valentin Adrian Jean BUTOESCU

14.^{00} - 14.^{20}

S1.2.9 ***Evaluation of the Cmark Panel Method Software for the Solution of Flow Around Airfoils***, Yassir ABBAS*[,1], Ahmed ABBAS[2], Qussay ALSANOSSI[2] ([1]Aeronautical Engineering Department, Engineering College, Karary University, Khartoum, Sudan; [2]Aeronautical Research Centre, Khartoum, Sudan).

14.^{20} - 14.^{40}

S1.2.10 ***Study on the aerodynamic forces acting on a passenger train consisting of two railcars Siemens Desiro***, Sorin ARSENE*, Ioan SEBESAN "POLITEHNICA" University of Bucharest, Transport Faculty, Depart Rolling Stock Railway, Splaiul Independentei no. 313, Sector 6, 060042, Bucharest, Romania).

14.^{40} - 15.^{00}

S1.2.11 ***Influence of the Rigid Wind Tunnel Walls on a Harmonically Oscillating Wing***, Valentin Adrian Jean BUTOESCU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{00} - 15.^{20}

S1.2.12 ***Towards The Effects of Initial Grain Temperatures and Erosive Burning on Homogeneous Solid Propellant Combustion,*** Doru SAFTA[1], Ioan ION[2] ([1]MTA - Military Technical Academy, B-dul George Cosbuc 81-83, Bucharest 050141, Romania; [2]University "Eftimie Murgu", Piata Traian Vuia 1-4, Resita 320085, Romania).

15.^{20} - 15.^{40}

S1.2.13 ***QUASI-3D 1D Quasi-Steady Flow Solid Rocket Motor Grain Burnback Analysis,*** Alexandru IONEL, Mihaela NASTASE (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{40} - 16.^{00}

Coffee Break

S1.2 **Co-Chairman:**

Valentin Adrian Jean BUTOESCU
Marius Gabriel COJOCARU

16.^{00} - 16.^{20}

S1.2.14 ***Hypersonic Aerodynamics for Several Test Cases,*** Mihai Leonida NICULESCU, Maria Cristina FADGYAS, Marius Gabriel COJOCARU, Mihai Victor PRICOP, Dumitru PEPELEA, Mihaita Gilbert STOICAN INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania.

16.^{20} - 16.^{40}

S1.2.15 ***Simulation Tool for Predicting Ground Test Performance of a Turbofan Propulsion System Air Inlet***, Andreea CERNAT, Alexandru IONEL, Irina-Carmen ANDREI, Stefan PALAS, Adrian MIHAI, Tiberiu SALAORU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

16.^{40} - 17.^{00}

S1.2.16 ***2D 0-D Unsteady Flow Numerical Modelling of Solid Rocket Motor Grain Burnback of Complex Propellant Geometries***, Mihaela NASTASE, Alexandru IONEL (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

18.^{00} ***CLOSING SESSIONS***

Thursday 27.10.2016 – "Nicolae TIPEI" Amphitheatre

Section 5 – Systems, Subsystems and Control in Aeronautics

Thursday 27.10.2016. Morning session

S5.1 **Co-Chairman:**

Stefan BOGOS
Grigore CICAN

12.^{20} - 12.^{40}

S5.1.1 ***Optimizing Ion Propulsion Systems Depending on the Nature of the Propellant***, Grigore CICAN[1], Ionut-Florian POPA[2] ([1]"POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania; [2]National Research and Developmnet Institute for Gas Turbines COMOTI, 220 D Iuliu Maniu, Bd., sector 6, cod 061126, OP76, CP174, Bucharest, Romania).

12.^{40} - 13.^{00}

S5.1.2 ***A Brief Discussion Regarding Types of Cavitation in Squeeze Film Dampers and Cavitation's Effects***, Laurentiu MORARU ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania).

13.^{00} - 14.^{00}

Lunch

Thursday 27.10.2016 – "Nicolae TIPEI" Amphitheatre

Section 5 – Systems, Subsystems and Control in Aeronautics

Thursday 27.10.2016. Afternoon session

S5.2 **Co-Chairman:**

Laurentiu MORARU
Jeni Alina POPESCU

14.^{00} - 14.^{20}

S5.2.3 ***On $\mathcal{H}_\infty$ Control and its UAV Applications,*** Elfatih G. HAMDI*, Gamal M. Sayed EL-BAYOUMI, Ayman H. M. KASEM (Aeronautical Engineering Department, Engineering College, Cairo University, Giza State, Egypt).

14.^{20} - 14.^{40}

S5.2.4 ***Performance Estimation on Micro Gas Turbine Plant Recuperator***, Laura Alina STIKA, Jeni Alina POPESCU, Sorin Gabriel TOMESCU, Valeriu-Alexandru VILAG (Romanian Research and Development Institute for Gas Turbines COMOTI, web page: http://www.comoti.ro).

14.^{40} - 15.^{00}

S5.2.5 ***Longitudinal automatic control system for a light weight aircraft***, Cristian VIDAN*, Silviu Ionut BADEA (Military Technical Academy, Faculty of Mechatronics and Integrated Armament Systems, M2 Department of Aircraft Integrated Systems and Mechanics, 39-49 George Coşbuc Avenue, Sector 5, Bucharest 050141, Romania).

15.^{00} - 15.^{20}

S5.2.6 ***Software Generated Fuel Consumption Profile for a Light Attack and Jet Trainer Mission***, Adrian MIHAI, Alexandru IONEL, Tiberiu SALAORU, Stefan PALAS, Radu BOGATEANU, Manuela CALCEA, Viorica ILINOIU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.20 - 15.40

S5.2.7 ***Modelling of Selected Performance Criteria in Developing a VTVL Liquid Propulsion System***, Irina-Carmen ANDREI, Alexandru IONEL, Stefan PALAS (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.40 - 16.00

Coffee Break

S5.2 **Co-Chairman:**

Jeni Alina POPESCU
Laurentiu MORARU

16.00 - 16.20

S5.2.8 ***Numerical Modelling Application for Simulating Engine Test Cell Validation Methodology of a Turbofan Exhaust System,*** Irina-Carmen ANDREI, Alexandru IONEL, Adrian MIHAI, Stefan PALAS, Tiberiu SALAORU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

Thursday 27.10.2016 – "Nicolae TIPEI" Amphitheatre

Section 7 – ATS and full Automation ATM

Thursday 27.10.2016. Afternoon session

S7.2 **Co-Chairman:**

Simion TATARU
Mihai Leonida NICULESCU

16.20 - 16.40

S7.2.1 ***Automation and Systems Issues in Air Traffic Control***, Gabriela STROE[1], Irina-Carmen ANDREI[2] ([1]"POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Polizu Street 1-7, postal code 011061, sector 1, Bucharest; [2]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

16.40- 17.00

S7.2.2 ***Automated Conflict Resolution in Air Traffic Management***, Gabriela STROE[1], Irina-Carmen ANDREI[2] ([1]"POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Polizu Street 1-7, postal code 011061, sector 1, Bucharest; [2]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

18.00 ***CLOSING SESSIONS***

Thursday 27.10.2016– "Conference room", et. 2, corp B

Section 4 – Materials and Structure

Thursday 27.10.2016. Morning session

S4.1 .**Co-Chairman:**

Adriana STEFAN
Viorel ANGHEL

12.^{20} - 12.^{40}

S4.1.7 ***On The Buckling Analysis of a Cold Formed Steel Profile Arch Structure***, Viorel ANGHEL, Stefan SOROHAN, Ioan STOICA ("POLITEHNICA" University of Bucharest, Strength of Materials Department, Splaiul Independentei no. 313, Sector 6, Code 060042, Bucharest, Romania).

12.^{40} - 13.^{00}

S4.1.8 ***The oxidation behavior of classical thermal barrier coatings exposed to extreme temperature***, Alina DRAGOMIRESCU*[,1], Adriana STEFAN[1], Victor MANOLIU[2], Alexandru MIHAILESCU[1], Gheorghe IONESCU[2], Mihail BOTAN[1] ([1]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [2]AEROSPACE Consulting, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

13.^{00} - 14.^{00}

Lunch

Thursday 27.10.2016– "Conference room", et. 2, corp B

Section 4 – Materials and Structure

Thursday 27.10.2016. Afternoon session

S4.2 **Co-Chairman:**

Radu-Robert PITICESCU
Victor MANOLIU
Ioan URSU

14.^{00} - 14.^{20}

S4.2.9 ***Rocket Solid Propellant Alternative Based on Ammonium Dinitramide***, Grigore CICAN, Alexandru-Daniel MITRACHE ("POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu Street 1-5, 011061, Bucharest, Romania).

14.^{20} - 14.^{40}

S4.2.10 ***Advanced Ceramic Coatings in Aeronautics***, Victor MANOLIU[1], Gheorghe IONESCU[1], Mihai BOTAN[2], Adriana STEFAN[2], Alina DRAGOMIRESCU*[,2], Alexandru MIHAILESCU[2] ([1]AEROSPACE Consulting, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [2]INCAS – National Institute for Aerospace Research "Elie Carafoli", Materials Unit, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

14.^{40} - 15.^{00}

S4.2.11 ***VTVL concept optimisation of the landing gear***, Camelia Elena MUNTEANU, Alexandru-Mihai CISMILIANU (INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{00} - 15.^{20}

S4.2.12 ***Mechanical Tests and Model Finite Element Analysis for Ablative Phenolic Composites Nanofilled with Silicon Carbide***, George PELIN[1,2], Camelia MUNTEANU[1], Cristina-Elisabeta PELIN[1], Adriana STEFAN[1] ([1]INCAS – National Institute for Aerospace Research "Elie Carafoli", Materials Unit, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania; [2]"POLITEHNICA" University of Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Gh. Polizu St, 011061, Bucharest, Romania).

15.^{20} - 15.^{40}

S4.2.13 ***Bird strike damage assessment in the case of an aircraft tailplane***, Cătălin PÎRVU, Corina Elena BOȘCOIANU, Mihai Victor PRICOP (INCAS – National Institute for Aerospace Research "Elie Carafoli", Materials Unit, B-dul Iuliu Maniu 220, Sector 6, Bucharest 061126, Romania).

15.^{40} - 16.^{00}

Coffee Break

Thursday 27.10.2016– "Conference room", et. 2, corp B

Section 8 – Management in Aerospace Activities

Thursday 27.10.2016. Afternoon session

S8.2 **Co-Chairman:**

Claudia DOBRE
Mircea BOSCOIANU
Aurelian Virgil BALUTA
Casandra Venera BALAN

16.^{00} - 16.^{20}

S8.2.1 ***The Mix of Laws Involved in The Activity of the Companies in the Aerospace Field***, Aurelian Virgil BALUTA ("Spiru Haret" University, 13 Ion Ghica Str., District 3, Bucharest, 030045).

16.^{20} - 16.^{40}

S8.2.2 ***Communications Principles for Team/ Group Performance in Aerospace Field of Activities,*** Aurelian Virgil BALUTA[1], Gabriela IOSIF[2] ([1]"Spiru Haret" University, 13 Ion Ghica Str., District 3, Bucharest, 030045; [2]National Institute for R & D in Electrical Engineering ICPE-CA, Splaiul Unirii, Nr. 313, Sector 3, 030138, Bucuresti, Romania).

16.^{40} - 17.^{00}

S8.2.3 ***Identification of Gaps and Bottlenecks to Innovation in the European Aeronautics Research Landscape***, Claudia DOBRE[1,2] ([1]INCAS – National Institute for Aerospace Research "Elie Carafoli", B-dul Iuliu Maniu 220, Bucharest 061126, Romania; [2]Bucharest University of Economic Studies, ASE, Piata Romana 6, Bucharest 010374, Romania).

17.^{00} - 17.^{20}

S8.2.4 ***Weather related general aviation accidents in Europe from a pilot's point of view***, Vlad MARAZAN (Aircraft Owners and Pilots Association of Romania).

17.^{20} - 17.^{40}

S8.2.5 ***Limitations of systemic accident analysis methods***, Casandra Venera BALAN (PIETREANU)*, Valentin-Marian IORDACHE ("POLITEHNICA" University of Bucharest, Aerospace Engineering Department, Polizu Street 1-7, sector 1, Bucharest 011061, Romania).

17.^{40} - 18.^{00}

S8.2.6 ***The Safety Management System of the Nigerian Aerospace. Corporate Safety Commitment***, Taofik OLAYIWOLA*, Adim Kingsley OBUH (Concord Hangar Limited, Concord Terminal Building, Murtala Muhammed Airport, Lagos, Nigeria).

18.^{00} ***CLOSING SESSIONS***

CONTENTS

***Note*:**

- ***The works are published in the volume by sections, in order of their presentation at the conference "AEROSPATIAL 2016, according to the Program of the conference (see the Graphic Program, pp. iii).***
- ***We mention that the authors is responsible for the correctness of the English language.***

PLENARY LECTURES

Theoretical and Experimental Exploration of Supersonic Flow (part 1)

Adriana NASTASE*

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Abstract: *The exploration of supersonic flow over flying configurations was performed by using eight models designed by the author, The measurements of the lift and pitching moment coefficients and of the pressure coefficients on the upper side of the models were performed in the trisonic wind tunnel of DLR Cologne in the frame of the research projects of the author, sponsored by the DFG.r. The theoretical predicted pressure, lift and pitching moment coefficients are obtained by using the three-dimensional hyperbolic potential solutions and the corresponding software of the author. The aims of this exploration are: to check the capability of these shock less solutions to simulate the real world, to verify if these developed software are in good agreements with the experimental results and to determine the limits of the use of these solutions with characteristic surfaces, which are more economical. These solutions with characteristics are used by the author for the analytical hybridization of numerical solutions of the full Navier-Stokes PDEs and for the determination of high performant surrogate models, which are used as the first step of an iterative optimum-optimorum theory for the determination of the global optimized shapes of flying configurations. A comparison between the experimental and the theoretical results, for the wedged delta wing and for the wedged delta wing fitted with a central conical fuselage models, is here performed.*

Key Words: *Supersonic Flow, Three-Dimensional Hyperbolic Potential Solutions, Experimental Results, Hybrid Navier-Stokes Solutions, Surrogate Models for Shapes Optimization.*

1. INTRODUCTION

The exploration of supersonic flow over flying configurations was performed by using eight models designed by the author, namely: a wedged delta wing, a double wedged delta wing, a wedged delta wing fitted with a central conical fuselage, a wedged rectangular wing a cambered rectangular wing, a delta wing alone ADELA, global optimized at cruising Mach number $M_\infty = 2$, presented in the (Fig.1) and two, more recent designed and experimental cheked, are the fully integrated wing-fuselage configurations FADET I and FADET II; global optimized at $M_\infty = 2.2$ and, respectively, at $M_\infty = 3$, presented in the (Fig. 2). All these models have sharp leading edges in order to avoid the bow shock wave. The six delta configurations have the same area of their planforms and the both rectangular wings have the same planforms. The three global optimized flying configurations fulfil additionally the Kuta condition on their subsonic leading edges, in order to avoid the detachment of the flow along their leading edges, to cancel the induced drag and to increase the lift. The measurements of the lift, pitching moment and pressure coefficients on the upper side of the models were performed in the trisonic wind tunnel of DLR Cologne, in the frame of research projects of the author, sponsored by the DFG. Correlation and interpolation software, developed by the author were used by herself and by her young collaborators of Aerodynamics of Flight, at RWTH, Aachen University, for the evaluation and for the plot-ting of these experimental results. The theoretical predicted pressure, lift and pitching moment coefficients, obtained by using the three-dimensional hyperbolic potential solutions and the corresponding software of the author are here used.

Fig. 1 Six of the models used for the exploration of supersonic flow

Section 1. Aerodynamics

Hybrid methods for design and analysis of small UAV rotor blades

Alexandru DUMITRACHE*,[1], Florin FRUNZULICA[2,1], Mihai NICULESCU[3],
Alexandru MITREA[2]

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[3]INCAS – National Institute for Aerospace Research "Elie Carafoli",
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Abstract: *A design method and analysis tool of an UAV propeller based on Blade Element Momentum Theory (BEMT) for low-Reynolds number flow is presented. BEMT is completed with 3D equilibrium- implementation, a post-stall model and swirl velocity considerations to improve the accuracy of the results. An open-source code, Jblade, based on BEMT is used to obtain performance curves in off-design cases for a given propeller. Finally, the results are analyzed for a UAV Hirrus propeller. This methodology can be used successfully in the preliminary design phase of an UAV propeller, whose data can then be used as input in an optimization method.*

Key Words: *Blade Element Momentum Theory, low-Reynolds number flow, UAV propeller, JBLADE*

1. INTRODUCTION

The propeller has several application areas, but the most spectacular application is its use as a propeller propulsion system, particularly for aircraft. It has been found that the use of propeller engines driving becoming more improved is not enough without the improved propeller efficiency, requiring theoretical and experimental studies [1].

The procedure used in aerodynamic design of a propeller is essential to determine aerodynamic loads on the basis of which the required thrust and torque are then determined. The most important aerodynamic characteristics of the propeller, the efficiency and the power required are then obtained from the values of thrust and torque. Since these loads must be accurately determined for different operating conditions of the propeller, the choice of the calculation method is an important issue.

In recent years more researches on unmanned aircraft (UAV) have been carried out, especially for those of small size, since they are less observable and they can be exploring in smaller spaces. In these conditions the study of suitable profiles of rotor blades used in propelling of these aircrafts. i.e. at low Reynolds numbers, has been imposed. Although UAV systems are composed of several elements apart from air vehicle, they are usually classified based on the capacity of air vehicle to perform the required tasks [3].

Fig. 1 – Small UAV launch from an air-powered catapult

Holistic treatment of double flow turbojet engine performance using harmonic hyperbolic law

Virgil STANCIU*[,1], Cristina PAVEL[1]

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Abstract: *This paper aims addressing a scientific issues based on a new model of treatment, called holistic or global. This model requires a different way of thinking things, so, treating and settlement of a study to be made using an overview, without resorting to a reductionist model, ie a decomposition of the whole into parts, analyze them and finally, by integration, to obtain the whole. It is obviously that, dividing the whole leads to eliminate interdependence, interactions and esthetics. The concept, of engine, in this situation, include all relations between all subcomponents and not only their summing.*

Key Words: *holistic, harmonic, hyperbolic, engine*

1. INTRODUCTION

The model propose is considering determination of two principles that must be

- Complementary,
- Different nature
- In harmony,

Characteristics of the whole, that is, in a word, natural, are expressed by the four attributes of the universe

- Total,
- Relationship,
- Structure,
- Aesthetics of assembly.

Engine domain allows air-jets engine such an approach from two reasons:

- The shape is symmetric axial, circular;
- System operation is cyclical.

Taking as principles what is offering us by the engine thrust, through gas dynamics impulse function $z(\lambda)$ and the mass driven by gas dynamics flow function $q(\lambda)$ and, taking into account the complementarity and harmonic relation between them

$$z(\lambda) \cdot q(\lambda) \simeq 1 \tag{1}$$

is hyperbolic type, we can determine the thrust force of a turbofan engine, without appealing to classic system "step by step", section by section. It starts from a schematic diagram of double flow turbojet engine with separate streams, shown below, figure No.1.

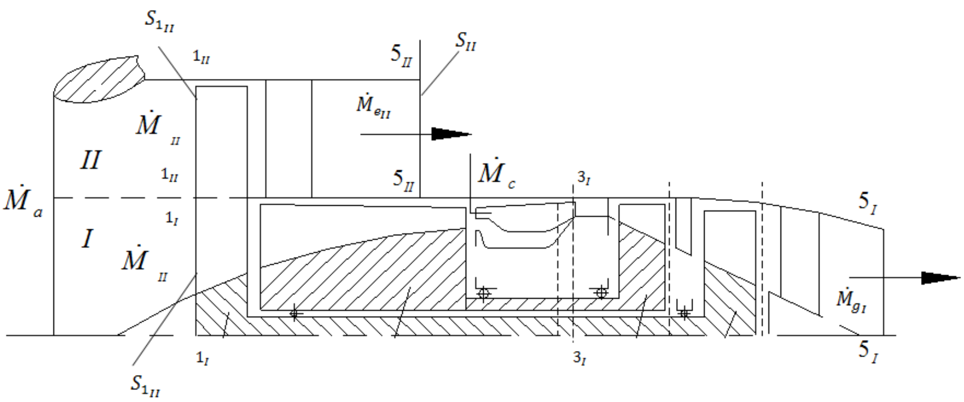

Figure 1

Section 2. Flight Mechanics and Systems Integration

A Local Sensitivity Analysis of Some Performances of Reactive Projectiles, Rockets and Missiles

Florin MINGIREANU*[,1], Marius STOIA-DJESKA[2]

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Abstract: *During the operation of various reactive projectiles, rockets and missiles it is important to know how a slight variation in one of the constructive parameters can affect the relevant final flight parameters/performance indexes of the vehicle (ex.: range, impact velocity, impact angle). A six degrees of freedom (6 DOF) numerical model is developed and sensitivity analysis on several relevant parameters. A GRAD 122 mm artillery rocket is used as an example on which the sensitivity analysis is applied. The sensitivity analysis is performed for the following flight parameters: range, angle of impact and impact velocity. The largest influence is shown to be produced by the drag coefficient and the burn-time for all the studied flight parameters.*

Key Words: *reactive, missiles, sensitivity, numerical simulation*

1. INTRODUCTION

During the operation of various reactive projectiles, rockets and missiles it is important to know how a slight variation in one of the constructive parameters can affect the relevant final flight parameters/performance indices of the vehicle (ex.: range, impact velocity, impact angle).

Usually, the behavior of a dynamic system is mathematically modeled using a nonlinear model, which includes a number of parameters with their values only approximately known, [1]. The dynamic behavior is obtained numerically using a computer code. Thus, the evaluation of uncertainty in the numerical results represents a critical point. The problem is even more complicated if the numerical calculations cannot be always verified and/or validated using experimental results. In the framework of code uncertainty evaluation, whatever the methodology used is, a basic problem arises: how sensitive is the solution from a code to the parameters whose values are defined with an uncertainty? The answer to this question is given by the uncertainty and, respectively, sensitivity analysis, [2].

The objective of the uncertainty analysis is to assess the effects of parameter uncertainties on the uncertainties of the calculated results. In a deterministic approach, the uncertainty analysis is based on the sensitivities of the results with respect to model's parameters [2]. The objective of the sensitivity analysis is to quantify the effects of parameter variations on calculated results. Therefore, the scientific goal of sensitivity and uncertainty analysis is to discover and quantify the most important features of the physical system under investigation. Sensitivity and uncertainty analysis are nowadays rigorous methods for evaluating mathematical models of the physical reality because they are associated with the computation of quantitative results, which allow the analysts to perform objective comparison and judgments [2]. The sensitivity of variation of flight parameters in respect to the variation of constructive parameters provides the manufacturer an important information regarding the needed precision of manufacturing for key components of a given reactive projectile, missile or rocket.

In the next chapter we briefly present the six degrees of freedom model on which this work is based on. Then, some numerical results obtained for the GRAD 122 mm artillery rocket are shown in the third chapter and for the same artillery rocket we perform a sensitivity analysis using several key manufacturing parameters. The conclusions and future work proposals are presented in the last chapter.

2. THE SELECTED SIX DEGREES OF FREEDOM FLIGHT DYNAMICS MODEL

A six degrees of freedom (6DOF) numerical model was implemented in order to study the flight dynamics characteristics of various projectiles, missiles and rockets [1]. The model is using flat Earth approximation

Section 3. Astronautics and Astrophysics

A Possible Universe in Pulsation by Using a Hydro-Dynamical Model for Gravity

Corneliu BERBENTE

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***Abstract**: By using a hydro-dynamical model for gravity previously given by author a pulsating universe is possible to describe. This is allowed because two hydro-dynamical sources are in attraction both when they are emitting and absorbing fluid. In our model bodies (matter and energy) are interacting via an incompressible fluid made of gravitons (photon-like particles having a wave length of the order of magnitude of the radius of universe). One considers the universe uniform at large scale, the effects of general relativity type being local and negligible at global scale. The expansion of universe stops when the ratio between the energy density of the fluid of gravitons and the energy density of other forms (sources) exceeds a critical value. An elastic sphere model for universe is suggested to describe the possible inversion. The differential equation for the universe in expansion is adapted to contraction. Analytical solutions are given.*

***Key Words:** graviton emission/absorption, critical point, elastic sphere model.*

1. INTRODUCTION

The possibility of a pulsating universe - an idea attributed to Einstein - was discussed many times [1-5]. The main reason for the universe to stop was a large enough density of the matter in universe. Of course the gravity is playing its role.

In a previous paper [6] we have presented a hydro-dynamical model for gravity at the universe scale by using an analogy with the interaction of sources in an incompressible fluid. Only the case of emitting sources was then considered although an attraction modeling the gravity takes also place in case the absorption. Some information was taken from [7].

In the following, one considers both situations: emission and absorption.

2. MODEL PRESENTATION

Let Q_1, Q_2 be the volume rates of two sources of fluid located in two points as seen in Fig 1. The hydro-dynamical force of interaction, F_H, is oriented along the direction which connects the two sources and has the expression [8]:

$$F_H = \frac{\rho\, Q_1\, Q_2}{4\,\pi\, R_{12}^2}; \rho = const., \tag{1}$$

where ρ is the mass density of the fluid which fills the space and R_{12} the distance between sources.

A source is positive /negative if it injects / absorbs fluid (of the same density). The force is attraction for sources of the same sign and rejection in case of different signs. On the other hand, the Newton law of the universal attraction of two bodies is:

$$F_N = f_N \frac{m_1\, m_2}{R_{12}^2}, \tag{2}$$

where m_1, m_2 are the body masses and $f_N = 6.67\,E - 11 m^3 / kg / \sec^2$ is the Newton constant of universal attraction.

One introduces after necessity the total energy, *E (Joule)*, using the special relativity formulas [11]:

$$E = m\,c^2;\; m = m_0 / \sqrt{1 - V^2 / c^2}, \tag{3}$$

General Oscillatory Motion of a Large Spacecraft Around its Equilibrium Attitude Posture, Due to the Gravitational Moments Effect

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***Abstract**: For large spacecraft, such as ISS, having different principal moments of inertia $A \neq B \neq C$, it exists an equilibrium attitude posture characterized by $\varphi_{1,\mathrm{EQ}}$, $\varphi_{2,\mathrm{EQ}}$ and $\varphi_{3,\mathrm{EQ}}$. The following basic/orbit reference frame is considered: x-axis is oriented towards zenith direction, z-axis is normal to the orbital plane, with the same direction as the angular momentum vector of the reference orbit, while y-axis completes the orthogonal frame. With respect to this reference frame, using the x-y-z sequence of rotations attitude parameterization and considering the $A < B < C$ case, then the equilibrium attitude posture for this case study is characterized by $\varphi_{1,\mathrm{EQ}} = 0$, $\varphi_{2,\mathrm{EQ}} = 0$ and $\varphi_{3,\mathrm{EQ}} = 0$. The equations of attitude motion of the large spacecraft around its center of mass are provided in general form, concerning also the case of gravitational stabilization. For some particular case studies, a direct dynamics numerical study is presented by integrating these attitude motion equations.*

***Key Words**: gravitational moments, large spacecraft, ISS, equilibrium attitude posture, oscillatory motion, gravitational stabilization.*

1. INTRODUCTION

For small size satellites, the gravitational moments are negligible, i.e., the term in $1/r_G^3$ of the Taylor series expansion of the gravitational potential can be neglected. In this case, each attitude posture characterized by non-null *x-y-z* sequence of rotations ($\varphi_1 \neq 0$, $\varphi_2 \neq 0$ and $\varphi_3 \neq 0$) is also an equilibrium posture/position in what concerns the attitude [1], of course if the rotational velocity is null: $\dot{\varphi}_1 = \dot{\varphi}_2 = \dot{\varphi}_3 = 0$.

A similar situation of multiple/infinite equilibrium postures occurs for large satellites/spacecraft with equal principal moments of inertia $A = B = C$. For such an inertially-balanced large spacecraft with sizes of tens of meters, the term in $1/r_G^3$ of the gravitational potential Taylor series expansion is null, so it happens the same situation that each attitude posture $\varphi_1 \neq 0$, $\varphi_2 \neq 0$, $\varphi_3 \neq 0$ with null velocity $\dot{\varphi}_1 = \dot{\varphi}_2 = \dot{\varphi}_3 = 0$ represents a rotational equilibrium posture.

In reality, most large spacecraft such as ISS (International Space Station) have different principal moments of inertia $A \neq B \neq C$, for which it exists an unique equilibrium attitude posture characterized by $\varphi_{1,\mathrm{EQ}}$, $\varphi_{2,\mathrm{EQ}}$ and $\varphi_{3,\mathrm{EQ}}$. Using the *x-y-z* sequence of rotations attitude parameterization and considering the $A < B < C$ case, then the equilibrium attitude posture for this case study is characterized by $\varphi_{1,\mathrm{EQ}} = 0$, $\varphi_{2,\mathrm{EQ}} = 0$ and $\varphi_{3,\mathrm{EQ}} = 0$.

If moved from its equilibrium position to another random attitude posture, but with initial null velocity, the large spacecraft will perform a free oscillatory motion around the equilibrium attitude posture/position, called "gravitational stabilization".

2. SPACECRAFT EQUATIONS OF ROTATIONAL MOTION AROUND ITS MASS CENTER

The rotational motion of a spacecraft around its center of mass is described by the angles φ_1, φ_2 and φ_3 corresponding to a sequence of rotations 1-2-3 (or *x-y-z*) which allows the transformation/passage from a basic/orbit reference frame to the reference frame attached to the spacecraft (rigid body). In this paper, the following basic reference frame is considered: *x*-axis is oriented towards zenith direction, *z*-axis is normal to

Using Binet Type of Equation for Relative Motion

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Abstract: *In this paper a Binet type of equation is used for the study of the relative motion of a system of bodies in non-inertial reference frame with known path. It is considered that the system of bodies is comprised by a large orbital station, and if it is described within reference frames having the origin in the center of the attractive body, it is difficult to integrate the motion equations for the system due to the fact that values are either too small or too big. Some of these difficulties can be avoided if the relative motion of the system is studied with respect to a reference frame with a known motion. The Matlab program is used in order to determine the path of the relative motion of the system.*

Key Words: *path, relative motion, non-inertial frames.*

1. INTRODUCTION

In order to study the relative motion of a system of bodies in a non-inertial reference frame, a Binet type of equation was used, assuming that the system of bodies is comprised out of a large orbital station.

In order to obtain the equations of motion, two reference frames will be used, that is: the non-inertial reference frame Oxyz and the inertial reference frame $O_1x_1y_1z_1$.

The Oxyz frame, that is the non-inertial reference frame, is moving with respect to the inertial reference frame $O_1x_1y_1z_1$ (figure 1).

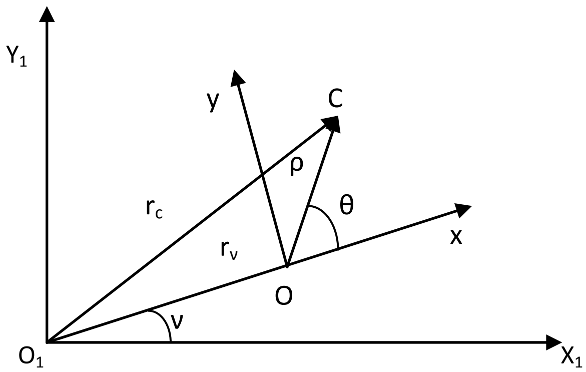

Fig. 1. Reference frames

Where r_v,ν are the polar coordinates used for the inertial reference frame and ρ,θ,z are the cylindrical coordinates for the moving frame.

The equations of motion that characterizes the system can be obtained in two ways, either applying the theorem of linear momentum with respect to the moving frame, or by using specific equations from analytical mechanics.

Between the two options, the latter one is preferable due to the fact that it results in a compact form of the equations.

2. EQUATIONS OF MOTION

To find the equations of motion for the system, the Lagrange equations,

$$\frac{d}{dt}\left(\frac{\partial E}{\partial \dot{q}_k}\right)-\frac{\partial E}{\partial q_k}=Q_k, k=\overline{1,n} \tag{1}$$

are used.

Concept Study of Radio Frequency (RF) Plasma Thruster for Space Propulsion

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Abstract: *Electric thrusters are capable of accelerating ions to speeds that are impossible using chemical reaction. Recent advances in plasma-based concepts have led to the identification of electromagnetic (RF) generation and acceleration systems as able to provide not only continuous thrust, but also highly controllable and wide-range exhaust velocities. For Future Space Propulsion there is a pronounced need for low pressure, high mass flow rate and controlled ion energies. This paper explores the potential of using RF heated plasmas for space propulsion in order to mitigate the electric propulsion problems caused by erosion and gain flexibility in plasma manipulation. The main key components of RF thruster architecture are: a feeding system able to provide the required neutral gas flow, plasma source chamber, antenna/electrodes wrapped around the discharge tube and optimized electromagnetic field coils for plasma confinement. A preliminary analysis of system performance (thrust, specific impulse, efficiency) is performed along with future plans of Space Propulsion based on this new concept of plasma mechanism.*

Key Words: *radio frequency, thruster, plasma, electric propulsion, magnetic confinement, space propulsion.*

1. INTRODUCTION

Recently a big interest in electromagnetic propulsion arose within the space community. Electric propulsion offers several advantages over chemical rocket engines for in-space propulsion, including higher thrust efficiency, lower propellant mass for any given mission and large plume exhaust velocities.

Space electric propulsion has become a suitable alternative to classical chemical propulsion due to its multiple strengths. In electric propulsion, propellant is accelerated with energy from an external electric power source, such as solar panels or nuclear reactor, instead internal chemical energy stored in fuels.

Given the increment of spacecraft velocity (Δv) desired in a specific mission and the dry mass of the spacecraft (m_f), the required propellant mass is given by the Tsiolkovsky`s equation: [1]

$$m_f = m_0\left(e^{\Delta v/v_e} - 1\right) \tag{1}$$

The amount of propellant needed to accelerate a given mass to a given velocity depends exponentially on the exhaust velocity v_e. As v_e increases, the mass ratio m_f/m_0 increases as well.

Ideally this ratio should be as close to 1 as possible, so the spacecraft will require as little propellant as possible. Thus, chemical rockets are fundamentally limited systems for a number of mission types. A higher specific impulse I_{sp} enables larger missions (larger Δv) with the same amount of propellant, therefore it allows a reduction in propellant consumption in a given mission. The specific impulse is limited by the energy delivered per unit mass of propellant:

$$I_{sp}^2 = \frac{P}{\dot{M}} \tag{2}$$

where P is the total power available, and $\dot{M}$ is the mass flow rate. In the electric propulsion system, I_{sp} is limited by the total on board power. Thus, by selecting a low $\dot{M}$ it is possible to achieve a higher value of I_{sp}. As a consequence, operating at high I_{sp} and low $\dot{M}$ will give a low thrust F, since $F = I_{sp}\dot{M} = 2\dot{\eta}_T P/I_{sp}$. In this case a trade-off will be imposed between thrust and specific impulse; electric propulsion is restricted to

Gravity Interaction- -a Conceptual Approach from Mechanics View Point

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Abstract: *The paper brings into attention the well known interaction of gravity by side of the so well known of inertia property of mechanical movement. The results are based on the general concept that all physical entities interact between them and the natural interaction is balanced, that is there is an equilibrium natural interaction. Considering the first mechanics principle and finding that this stability property is the only property that this natural interaction manifests in the equilibrium state, it is approached the quantitative description of this interaction, which is the gravity interaction actually. This way we found that gravity interaction is, in fact, an inertia interaction preserving and respecting the Newtonian mechanics principles.*

Key Words: *gravity interaction, mechanics principles*

1. INTRODUCTION

Sir Isaac Newton derive from Kepler's laws the algebraic structure of the force that represents the gravity interaction between two punctual bodies, that we denote by "body-point", having m_1 and m_2 their gravitational masses, with the well known today expression

$$f\,\frac{m_1 m_2}{d^2}$$

where $f=6{,}67384\times 10^{-11}$[$m^3/kg/s^2$] is the universal gravity attraction constant and d is the rectilinear distance between the two geometrical points which represents the bodies.

The main goal of this paper is to deduce this algebraic formula using a rational model based on the inertia property as the intrinsic physical existence of any physical entity and the wide accepted concepts regarding the knowledge of physical phenomena.

2. BASIC CONSIDERATIONS

We will start from the concept that all the physical entities exert each other influences by virtue of what there are phenomena and processes as we found from physical viewpoint. These interactions are continually exerted and are in an equilibrium state so that to constitute the support for the physical existence that is not affected in its constitutive structure.

This natural interaction is between any structural components of a physical entity and between any components of two of them.

If we accept this viewpoint it is necessary to analyse such an interaction for components no matter how small there are, but preserving the inertia property in the interactional process. This is a supplementary idea, which sustain the concept of the body-point used by the mechanics principles.

Because the physical entities and their interactions exists without any mechanical altering/ alteration of their properties, so that it is possible to determine their properties with a high degree of invariability, we may derive that these entities and their interactions have a stable behavior and, perhaps, the translation between such stable states is a slow one, or it is another less known way.

From mechanical viewpoint, this physical state is a relative and continue movement, during which every body (that is a physical entity in the form of substance) shows/ exhibits opposition to other/ external actions applied on it, actions that try to modify this natural relative movement.

The property of stability of the natural interactional equilibrium has the name "inertia". This property of the interactional equilibrium is the only one that is emphasized from mechanical viewpoint. If this interactional equilibrium becomes more and more week the stability property is preserved and at a limit we

Section 4. Materials and Structures

On the buckling analysis of a cold formed steel profile arch structure

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Abstract: *This paper deals with the buckling behavior analysis of thin-walled cold formed steel arches. They are self-supporting members which are used as solution for buildings and roofing structures. Some numerical calculations are presented in order to discuss the effect of the longitudinal corrugations on buckling behavior of such a structure subjected to the usual snow and wind loads. A shell finite element representation of the analyzed structure has been considered by using ANSYS software.*

Key Words: *Cold Formed Profile, Arch Structure, Corrugations, Buckling, FEM, ANSYS.*

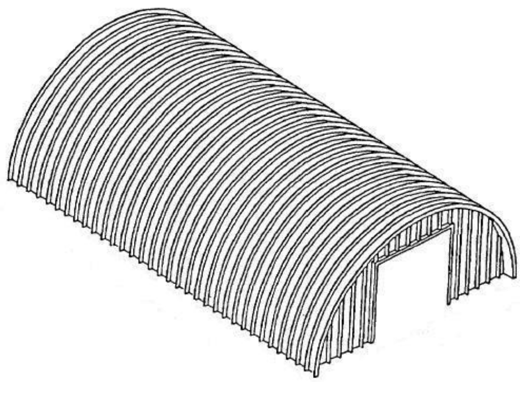
1. INTRODUCTION

In some previous papers ([1],[2]) the authors showed that the buckling represents one of the critical failure cases for the so called K-span structures.

These structures, used especially as commercial centers, show rooms, aircraft hangars or other military buildings, are low cost products, totally self-supporting structures with or without side walls (see Fig. 1).

They can be picked out on site very quick in an economic way consisting in individual cold formed steel profile arches obtained by a cold roll forming process starting from coil and then joined together by an electric seaming machine.

For this reason they do not require nuts, bolts or fasteners and also any water proofing. Advanced analysis of this type of arch structures, by using FEM and experimental models are presented in [3], [4].



a) Typical

b) Hangars

Fig. 1 – Roofing structures

The present work deals with the local buckling behavior of such a structure and studies especially the role of the longitudinal corrugations for an usual profile configuration.

Figure 2 shows typical symmetric snow load distribution and wind load distribution on a cylindrical arched roof.

The numerical data considered for snow loads was: $p = 2.875\ kN/m^2$ (estimated acc. to SREN: CR 1-1-3/2012 and CR 1-1-4/2012).

Dimensioning of a sandwich panel having orthotropic core consisting of lightweight profiles

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Abstract: *This paper deals with an approximate dimensioning and with a static and buckling finite element study of a sandwich panel having orthotropic core consisting of parallel and equidistant lightweight profiles. The behaviour of the panel under three point bending is analyzed. The material of faces is an aluminium alloy and the profiles are made either from the same material or galvanized steel. The assembling of these components is considered as being achieved by bonding with a structural adhesive. Based on an initial geometry, a static finite element analysis emphasized the critical and less loaded zones in the panel subjected to cylindrical bending. In order to obtain a convenient rigidity/weight ratio, the thicknesses of the components and the number of the profiles were modified successively. The configuration for which the maximum equivalent stresses are equal to the allowable ones for each material was considered as final variant. For this variant, using finite element analysis, the stress state and the buckling risk was evaluated.*

Key Words: *sandwich panels, orthotropic core, cylindrical bending, eigenbuckling analysis*

1. INTRODUCTION

One of the most widely used structural component having high strength and increased rigidity is the sandwich panel consisting of two faces and a core between them.

Many types of metallic cores are used: honeycomb, web-core, Z-core, C-core, X-core, O-core, V-core and others [1]-[4]. Metallic sandwich panels are very useful in marine, aircraft, automotive, bridge, rail and building applications.

The assembling technology of the panel components is depending on their materials, similar or dissimilar, and may be achieved by laser welding, by brazing or by bonding with structural adhesives.

In this paper a sandwich panel with the core consisting of parallel T profiles disposed alternatively standing and overturned (Fig. 1) will be analysed.

Comparatively to the variant with I profiles, the proposed solution may lead to an increased strength and rigidity due to the possibility to keep a reduced weight of ensemble despite of raised density of thin walled T profiles.

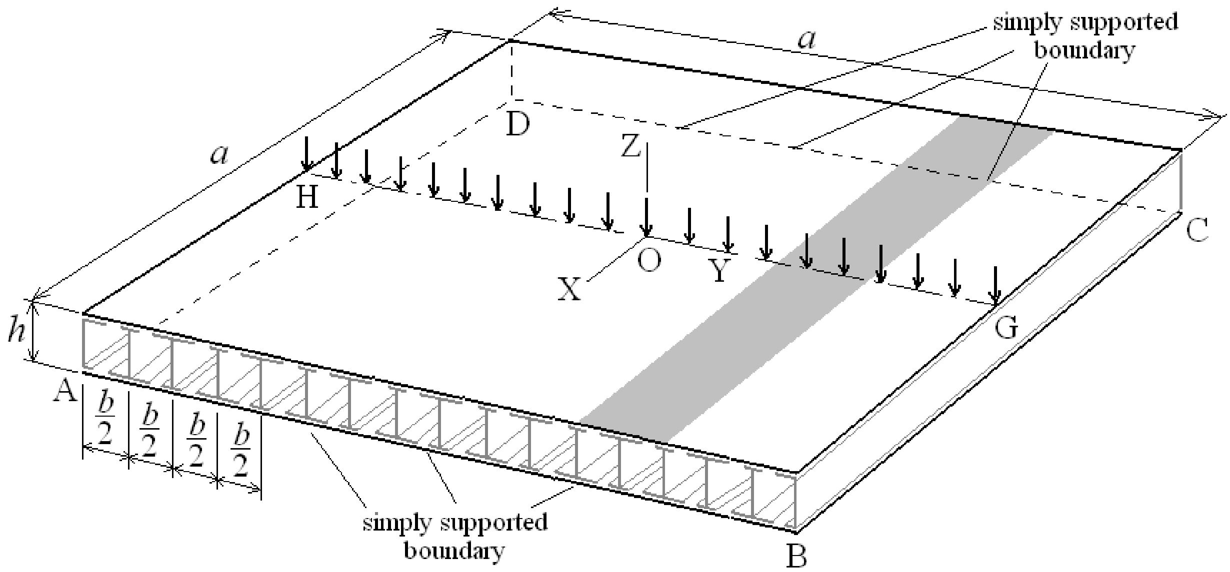

Fig. 1. Geometry of the panel

Accurate homogenized out of plane shear moduli of honeycomb cores estimation using modal finite element analyses of sandwich panels

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Abstract: *The most important problem in analyzing honeycomb structures is the substantial computational effort which has to be spent in modelling and analyzing such a structure with a multi-cell construction core by maintaining the real geometry. The common practice in the finite element modelling of such structures is to replace them by an equivalent orthotropic material. The determination of these equivalent properties of the homogenized core are based on analytical or numerical relationships which usually are based on free or rigid skin effect. If the honeycomb core are part of a sandwich panel then the most important elastic constants for bending loading are the out of plane effective shear moduli* G_{13} *and* G_{23}*. The paper presents a numerical method that can be used to correct these two effective elastic properties of the homogenized core material in conjunction with real thickness of the sandwich skins. The method is based on modal analysis applied for a given real honeycomb panel, to obtain a reference solution, and then on the homogenized orthotropic sandwich panel where these effective elastic constants of the core are iteratively improved by an optimization algorithm to fit the reference solution. Three cell configurations of the core: square, regular hexagonal and re-entrant shapes are considered for simulations. The material of the core and the skin is aluminium. The in plane dimensions of the sandwich panels analyzed in modal analysis for effective properties determination are around of* 400×400 *mm*^{2} *for two different core thicknesses 5 mm and 25 mm and four different skin thickness in the range of 0.25–4 mm. The obtained results show that the effective elastic properties obtained in the classical way must be corrected to obtain an accurate response in modal analysis. Supplementary the influence of both the core and the skin thickness is analyzed for the three cell configurations.*

Key Words*: Honeycomb, Sandwich panel, Homogenization, Effective properties, Finite element, Modal analysis.*

1. INTRODUCTION

The use of sheet metals or laminate composites as skins and low density cellular materials as cores in sandwich constructions has enabled a very good utilization of the constituent materials providing structural components with high stiffness and strength to weight ratios. These composite panels are incorporated in civil, automotive and aerospace engineering, where, usually, for structural analysis, the finite element method is used. The main problem in analyzing such honeycomb sandwich structures is the substantial computational effort that has to be spent in modelling and analyzing a sandwich structure with a multi-cell construction core by maintaining the authentic honeycomb core geometry. Therefore, the common practice in the finite element modelling of honeycomb sandwich structures is to replace the core by an equivalent two or three dimensional orthotropic material. Replacement of the actual honeycomb core by an equivalent continuum model (homogenization) works well, especially in problems involving global structural analyses such as deflection, eigenbuckling and vibration analysis.

Due to its array construction, the honeycomb core should exhibit orthotropic behaviour. Usually the constitutive model approximates the honeycomb core as a homogeneous material rather than a structural assembly of shells. The characterization of a constitutive model for an orthotropic material can be difficult due to the nine distinct parameters that must be determined (three Young's moduli, three shear moduli and three Poisson's ratios). There are some researches which present analytical relationships for these nine constants [1-5], obtained using homogenization theory and considering only axial and pure shearing loads. It was observed that using these analytical formulae, which are obtained using the beam theory, for relatively small core height, in a homogenized sandwich model which deforms in bending and torsion, the obtained results introduce large errors [6], due to the core thickness effect [7-11], therefore, considering the authors' previous experience [12,13] in this field and some similar papers [14,15], a procedure to extract some of the orthotropic elastic constants of analyzed honeycombs core using modal analysis is presented in this paper. In the recent papers [15-17], a similar procedure is used, but only for a regular honeycomb core panel, whereas

Multipurpose Interaction Chamber for Evaluation of the Outer Space Effects in Condensed Matter

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Abstract: *In this paper, we will be showing a new facility for evaluating the effects induced on materials by the cosmic rays, extreme temperatures and vacuum with application into space technologies. The new testing equipment consists of a cylindrical interaction chamber, with a sample support plate, vacuum pump with a vacuum measurement system, thermostat and cryostat systems. The cosmic rays were simulated using two Co-60 sources, which do not induce residual radioactivity in the analysed samples.*

Key Words: *Testing facilities, space environment, cosmic rays, gamma sources*

1. INTRODUCTION

Development of space programs involve fundamental and applied researches into the negative effects of space environment on condensed mater area. The space vehicles, satellites, equipment and astronauts must perform current activities in a hostile environment. The main stress agents are:

- Cosmic rays [1-4],
- Exposure at cryogenic or high temperature conditions [5-7],
- High vacuum pressure environment [6],
- High velocity cosmic dust and micrometeorites [8].

The aim of this research is to develop a new experimental facility and to establish the experimental protocols to study the effects of cosmic environment on materials.
Table 1 presents the main research directions targeted.

Table 1. Research areas targeted

Tested materials	**Purpose**
Organic/inorganic compounds	Radiation chemistry
Polymeric materials	Endurance testing & Validation
Composite material	
Optical glass devices, metals and alloys, etc.	
Electronic devices with space and nuclear application	
Cell cultures, tissues and small animals	Evaluation of cosmic rays effects on biological systems

In accordance with the described purposes in table 1, a new experimental facility was designed, built and tested. The concept of the new facility is in accordance with the specifications described in the Technical Design Report "*Radiation hardness assurance testing of electronic devices for space applications "*/ 2013 [9]. The experimental results were used to establish the technical solution for the interaction chamber which will be implemented in the future ELI NP (Extreme Light Infrastructure-Nuclear Physic)/E5 Experimental Area Bucharest-Magurele, Romania [4,10].

2. TESTING FACILITY

The new testing facility consists of:

- A modular cylindrical interaction chamber, designed to work at a pressure ranging from ambient pressure to 10^{-4} Pa and temperatures from -196 ^{0}C to 350 ^{0}C, with thermostat/cryostat plates, access door, thermal insulation mantle and vacuum valves and connection at
- A vacuum pump with vacuum measurement systems,
- Thermostat and cryostat systems

Rocket solid propellant alternative based on ammonium dinitramide

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***Abstract**: Due to the continuous run for a green environment the current article proposes a new type of solid propellant based on the fairly new synthesized oxidizer, ammonium dinitramide (ADN). Apart of having a higher specific impulse than the worldwide renowned oxidizer, ammonium perchlorate, ADN has the advantage, after decomposing at high temperatures, of leaving behind only nitrogen, oxygen and water and therefore totally avoiding the formation of hydrogen chloride fumes.*

Based on the oxidizer to fuel ratios of the current formulations of the major rocket solid booster (e.g Space Shuttle's SRB, Ariane 5's SRB) which comprises of mass variations of ammonium perchlorate oxidizer (70-75%), atomized aluminum powder (10-18%) and polybutadiene binder (12-20%) a new solid propellant was formulated.

As previously stated, the new propellant formula and its variations use ADN as oxidizer and erythritol tetranitrate as fuel, keeping the same polybutadiene as binder.

***Key Words:** ammonium dinitramide, rocket, propellant, green, specific impulse*

1. INTRODUCTION

The space industry is under an exponential growth and advances are made on a daily basis regardless of their field application. Whether is for surveillance, telecommunication or research purposes, satellites are being sent into space by dozens each year, with 52 orbital launches (including ISS logistics) to take place in 2016 alone. Adding to these figures the flourishing business that space tourism is predicted to create, there is only one direction for this industry. But while the number of yearly launches goes up, the impact created by chemical propulsion upon the environment also increases and therefore raising serious concerns on a global scale.

Most of the current space launchers use solid propellant in one or several of their stages and almost all of them use *ammonium perchlorate* (AP, NH_4Cl_4O)[2] based propellant while alternating the type of fuel, majority still using aluminum (Al) powder. Binding the oxidizer and the fuel together through a polymer matrix, the composite propellant has excellent performance characteristics, good thermal stability, as well as low friction and shock sensitivity. Unfortunately its combustion results in the formation of various chlorinated and hazardous exhaust products

The flagship of the European Space Agency, Ariane-5 as well as the newly commissioned Vega launcher contains no less than 476 and 122 tons of composite propellant. For each launch this burns into the equivalence of 270 and respectively 71 tons of concentrated hydrochloric acid. Even the American prime orbital launcher, the Space Shuttle, had its solid rocket boosters containing 998 tons of ammonium perchlorate based propellant. From the complete combustion, 580 tons of concentrated hydrochloric acid was exhausted. [3].

Even when it comes to altitude or maneuverability thrusters or monopropellant rocket engines, their liquid fuel is commonly based on *hydrazine* (N_2H_4) derivatives such as mono methyl hydrazine (MMH) or unsymmetrical dimethyl hydrazine (UDMH). Due to its high toxicity this fuel even creates occupational hazards during handling and fueling.[5] All these facts lead to the necessity of replacing the ammonium perchlorate and hydrazine-based formulations with more *green propellants* and searching for replacements has proved to be a difficult task due to the reduced options for a green oxidizer.

Hydrazinium nitroformate (HNF, N_2H_5 $+C(NO_2)_3$ $^-$) is one of the oxidizers that are being seriously considered as a replacement but due to unresolved problems concerning thermal stability and friction sensitivity, as well as various compatibility problems.[6] HNF can hardly be considered an option, especially that is also expensive to produce and presents carcinogenic risks.

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Advanced Ceramic Coatings in Aeronautics

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Abstract: *Achieving higher performances in the aeronautic industry translates into increasing the speed, flight altitude, acceptable payload, turbo engine power. Advanced materials intended for turbo engines and other spacecraft devices fabrication are actually thermal barrier coatings (TBC). Modern TBC are in fact a complex coating system of multiple layers laid down using complicated and expensive multi-stage processes that exercise praise control of coating composition, morphology and micro structure. The use of TBC is the way generally accepted, to increase the functional performances and life time of aircraft devices and turbo engine reliability. The fundamental unanimously accepted issue of this class of materials is their behavior in the presence of complexes wear factors such as erosion at high speed above 3 Mach, moderate and rapid thermal shock with high cooling/heating rates, chemical corrosion, fretting wear, all these factors acting simultaneously at high temperature values. The hot parts of the turbo engines – burning chamber, flap, cover plate, turbine blades, etc. - are stressed supplementary at quick thermal shock with high heating-cooling gradients on short period of time during the takeoff, engine stop, etc. One element of novelty of the presentation is represented by the achievement and the comparative study of some duplex coatings consisting of a dense MeCrAlY bond coat (where Me: Ni, Co, Cr) and different top ceramic layers inclusive micro-structured type $ZrO_2{\cdot}8Y_2O_3$ or $ZrO_2{\cdot}7Y_2O_3$ nanostructured, CeO_2. The deposition techniques utilized for powder processing are HVAF (high velocity air fuel) and APS (air plasma spray). The testing in extreme thermal conditions of the elaborated duplex structures were realized on an original quick thermal shock test installation QTS-2 INCAS. The installation integrated in the infrastructure European network, works in semiautomatic regime, is versatile and covers the range of the high heating-cooling gradients. The SEM investigations will put into evidence the microstructural modifications induced, especially in the bond coat/top coat adherence zone, by the quick thermal shock.*

Key Words: *turbo engine, duplex TBC coatings*

1. INTRODUCTION

The new turbo engines generation, co generative systems, and metallurgical sub-assemblies moderns impose new functional conditions, increasing of technological parameters. The fundamental parameter especially for the "hot parts" of the turbo engines represented by high working temperatures, over 1200°C associated to some complex and hard tribological strains which act simultaneously. In order to increase the working temperatures of the aimed parts, these are coated with TBC- thermal barrier coatings. Thermal Barrier Coatings consists of multilayers and then a ceramic layer will resist temperature in excess of 1200°C. [fig.1]

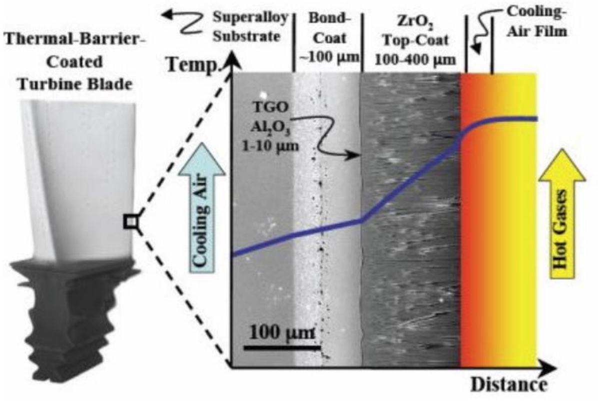

Fig. 1 Basic configuration of a multilayer TBC system observed in turbine blade cross section by scanning electron microscopy [1]

Mechanical tests and model finite element analysis for ablative phenolic composites nanofilled with silicon carbide

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Abstract: *The paper presents the development of numerical experiences using finite element commercial codes, based on experimental mechanical tests performed on ablative composite materials. The studied ablative materials were obtained using liquid phenolic resin matrix nanofilled with silicon carbide nanoparticles (added in different weight contents values: 0, 1 and 2 wt.% relative to the resin) that was impregnated into ablative preforms. The results of the numerical simulations are in accordance with the experimental data obtained for the tested specimens, showing that finite element analysis is a promising tool for development of a realistic simulation for advanced materials used in aerospace applications.*

1. INTRODUCTION

Recently the aerospace community has shown a great interest in developing some novel materials, the nanocomposites, because of the excellent properties of strength and stiffness of the nanoparticles embedded in the matrix. These improved materials are of great value for the aerospace structures, the aim being to produce long lasting components that can perform in the harsh environment. However, the mechanical properties and the material mechanics are yet to be fully discovered and encompassed. Therefore, in this work, are developed a series of numerical simulations using the Finite Element Method (FEM) in order to obtain more information about the material mechanics. In this method, the structure is decomposed in many simple and small elements and the behavior of each of them is described with a simple set of equations.

An accurate discretization using FEM of a realistic structure may be composed of thousands and even millions of elements and nodes so they are now solved with commercially available software packages developed with similar methodology. The software used in this paper is PATRAN/NASTRAN.

The experimental part of the laboratory study focused on mechanical testing of two classes of ablative materials with matrix consisting of phenolic resin (PR) with different weight loadings of nanometric silicon carbide (nSiC), based on carbon fiber felt preform and cork respectively. The ablative materials with nanometric loadings were obtained using ultrasonic homogenization, followed by a thermal treatment process with multiple temperature stages from room temperature to 150°C.

The two ablative material sets differ by the reinforcing material. One set is based on cork particles, one is based on carbon fiber felt, while both sets have the same matrix, consisting of phenolic resin (PR), simple or nanofilled with two nanofiller weight contents (1 and 2% nSiC). The following nomenclature will be used for the sample: PR/cork and PR/felt for the control samples with no nanofiller and PR+1%nSiC/cork, PR+2%nSiC/cork for the samples with cork and phenolic resin with 1 and 2% nSiC respectively, PR+1%nSiC/felt, PR+2%nSiC/felt for the samples with carbon felt and phenolic resin with 1 and 2% nSiC respectively.

Nanometric silicon carbide was added to improve the properties of the basic carbon/phenolic materials, especially from thermal and tribological perspective. However, it is essential for the mechanical properties not to be negatively affected by the nanofiller presence, moreover one can aim for an improvement to be desirable, as conducted studies regarding phenolic resin with nanometric silicon carbide addition [1] proved that low contents of this nanofiller are able to improve mechanical, thermal and ablative properties.

Ablative materials are widely used in aerospace application as parts of thermal protection systems of space vehicles. Although their main advantage is their excellent thermal and ablative resistance, during space missions they are subjected to different mechanical loadings (such as compression, bending etc.). Therefore,

Section 5. Systems, Subsystems and Control in Aeronautics

Optimizing ideal ion propulsion systems depending on the nature of the propellant

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Abstract: *From all accounts the ion thrusters are characterized by the fact that they produce a very high exhaust velocity and specific impulse, sometimes too high for many missions. The exhaust velocity of the ionized particles is a function of the ratio between electrical charge and mass. The obvious solution is the use of ions with low electrical charge – mass ratio, but many of these substances have a corrosive effect on the acceleration grids, they are toxic and hard to store on board the spacecraft. Currently the most used propellant for the ionic propulsion systems is xenon gas having many advantages, but it is expensive when compared to other propellants.*
The current paper aims to make an optimization study of ideal ion thrusters depending on the nature of the propellant using for studying a significant number of substances. It will study the variation of the performances: force, specific impulse, efficiency, etc for the same power available on board, for the same accelerating voltage and the same ionic current.

Key Words: *ionization, propellant, exhaust velocity, optimization*

1. INTRODUCTION

Since old times, humankind desired to explore the cosmic space. This fact ensured the development of spacecraft, starting with the first ones used to explore the Moon, communication satellites and space probes meant to explore the planets of the Solar System and other secrets of the Universe. However, classic chemical rockets are impractical when it comes to such applications due to the fact that they need large amounts of propellants to finish an interplanetary or intergalactic travel which can take years. Thus, the development of new propulsion systems is required.

One of the best alternatives for such applications is the electric propulsion, based on the acceleration of an ionized gas using electricity. This type of propulsion was considered somehow atypical due to the fact that it wasn't used for the applications foreseen by the visionaries of this technology, namely the human exploration of other planets [1].

The performance of the ion propulsion systems is influenced by various elements. One of these elements is the nature of the propellant. As stated by [2], the ideal propellant is easy to ionize and has a high mass/ionization energy ratio. Also, the propellant should not affect or erode the metallic structure of the thrusters in order to ensure a long life span.

The first engine designs used caesium due to its high vapour pressure and ease of ionization, but caesium is hard storable because its reactivity is rather hard to isolate. The first demonstration of this propulsion technology in space took place in 1964, following to the launch of the "Space Electric Rocket Test – 1" [3]. The spacecraft was equipped with two types of thrusters using different propellants. One of the thrusters was based on electronic bombardment using mercury electrons (Kaufman ion thrusters), running for about half an hour. Unfortunately, the second ion thrusters, based on caesium ions, never functioned because of a short circuit. The developments achieved in the previous mission were used for the "Space Electric Rocket Test – 2" which also demonstrated the functionality of the ion thrusters using mercury, this time for thousands of hours. However, mercury is toxic, expensive and tends to contaminate the spacecraft, reason why in the 1980 time frame it was decided to replace mercury with xenon because xenon was less

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A Brief Discussion Regarding Types of Cavitation in Squeeze Film Dampers and Cavitation Effects

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Abstract: *Squeeze film dampers (SFD) are probably the most used shaft control devices in aircraft jet engines; SFDs consist in oil films, elastic elements and various antirotational devices that tune the stiffness and damping of the shafts' supports and consequently adjust the lateral dynamics of the shaft. Fluid layers in SFDs are usually thin, hence the modeling can often be done using the Reynolds' theory, however, some of the main features of the film, namely the behavior of the fluid in the divergent, negative squeeze area, where discontinuities may appear in the liquid, are still subject to intense research. This paper will discuss some aspects regarding the types of cavitation that appear in squeeze film dampers and some of the effects of cavitation on the SFDs.*

Key Words: *Squeeze film dampers (SFD), hydrodynamic bearings, rotor dynamics*

1. INTRODUCTION

Stability and appropriate behavior of turbomachinery is only possible when staft's dynamics is adequate. The dynamics of rotors, on the other hand, depends upon the properties of the shaft, (mass distribution and elasticity) and upon the properties of the supports of the shaft. Changes in stiffness and damping of the shaft supports can modify significantly the dynamic of the machine; turbomachinery that operate on land can be, theoretically at least, be equipped with a quite wide variety of bearings and shaft's mounts can be design without minimal weight concerns; moreover, since, in may cases, size requirements are not extremely severe, various methods of adding stiffness and damping exists, from which the designer can choose. However, the rotors of the aircraft propulsion systems must be installed on ball bearings, because of safety concern related to failure of the bearings. Moreover, both space and weight requirements for aircraft propulsion systems are very severe so design selections are limited. At present, squeeze film dampers, Fig.1, and mechanical devices within the squeeze film dampers are the only practical way to adjust the stiffness and damping of propulsion systems shafts. A squeeze film damper basically consists in a layer of oil that separates two surfaces (like in any regular bearing), however, the spin of the surfaces is blocked, so the oil film is only affected by the precession and nutation of the shaft, while the spin rotation is supported by the ball bearings. The spin of the surfaces separated by the oil film is prevented by various rigid or elastic devices, e.g. a pin.

SFD research have been reviewed, for example, in Refs. 0, 0. The current paper presents a brief discussion regarding the cavitation in SFD and its effect upon the dynamic of SFD supported rotors.

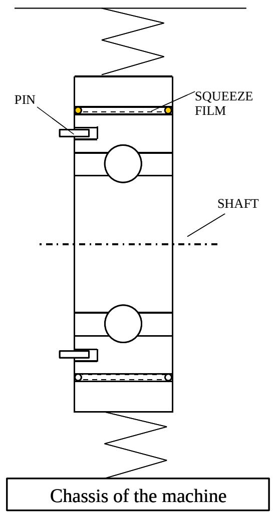

Fig.1. SFD with springs

Performance Estimation on Micro Gas Turbine Plant Recuperator

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Abstract: *In order to accomplish a thermodynamic analysis of a micro gas turbine plant, while satisfying conditions related to different configurations, different input data sets and a series of imposed thermodynamic parameters, assumptions are necessary regarding the individual performance of the components, for enabling the correlation of overall performance with the performance of the components. The use of a recuperator, even if it can improve a micro gas turbine cycle efficiency, by reducing the fuel consumption for an imposed turbine inlet temperature, will induce a pressure loss on the hot and cold sections, with possible negative influence on the cycle efficiency. In order to investigate this pressure loss, a numerical study was conducted on several cases, by modifying the geometry of a simplified recuperator, using as input a reference micro gas turbine thermodynamic cycle. The comparison between the different results led to the quantification of recuperator's performance as a function of its geometry.*

Key Words: *micro gas turbine, recuperator, CFD, effectiveness*

1. INTRODUCTION

In the context of the UE dependency of imports, in proportion of 50%, in the energetic field, and of the forecast of mitigation and depletion of traditional energy resources [1], without sufficient development of renewable resources, which led to issuing directives on energy saving, the focus is on using high efficiency cogenerative plants for combined production of electric and thermal energy, as a solution solution for producing energy under standard costs, which achieves a significant saving of energy resources, a high level of energy efficiency up to 90% [2], with low pollutant emissions.

From a technical standpoint, the current trend is to increase the efficiency by optimizing the gas-dynamics and the combustion; to increase the global efficiency of the micro gas turbines by introducing waste heat from flue gases; to increase the mechanical efficiency by reducing the mechanical losses of transmissions; to develop high speeds bearings; to simplify the constructive solutions by eliminating the reducing gear box and directly driving the electric generator by the micro gas turbine; to reduce the emission level by optimizing the combustion process; to improve the heat transfer in recuperators through gas dynamics and geometry optimization; to use the latest technologies and materials; and to reduce the need for maintenance [3]. Although the capacity of generating of the micro gas turbines is beyond the limits defined for the regime of micro-cogeneration, they are well suited to generating combined (thermal/ electrical) power for locations such as apartment complexes, groups of commercial buildings, small businesses [4]. Another advantage of the micro gas turbines is their small size relative to the amount of energy that is produced.

The main components of a cogeneration group are: the air inlet, also with noise reduction role; the micro gas turbine, which is a reduced scale single-shaft turbomachine, usually equipped with a centrifugal compressor and a radial turbine; heat exchanger/ recuperator, generally used to increase the overall efficiency, the compressed air from the compressor taking part of the thermal energy of the flue gases exiting the turbine.

2. METHOD

The objective of the work presented in this section is to study the heat transfer inside a recuperator channel for estimation of the performance of its cold channel, in terms of exit total temperature and pressure loss.

In order to investigate the impact of the geometry of a heat exchanger on heat transfer and pressure losses, several numerical simulations were performed on a simplified shape of a recuperator, using the CFD software Ansys CFX. The configurations used for the computations are built on variation of:

- The cross-section area of the channel of the recuperator.

Longitudinal automatic control system for a light weight aircraft

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Abstract: *This paper presents the design of an automatic control system for longitudinal axis of a light weight aircraft. To achieve this goal it is important to start from the mathematical model in longitudinal plane and then to determine steady-state parameters for a given velocity and altitude. Using MATLAB Software the mathematical model in longitudinal plane was linearized and the system transfer functions were obtained. To determinate the automatic control design we analyzed the stability of the linearized model for each input. After the stability problem was solved, using MATLAB-Simulink Software we designed the control system architecture and we considered that the objective for a stable flight was to continuously adjust the pitch angle θ through control of elevator and velocity through control of the throttle. Finally, we analyzed the performance of the designed longitudinal control system and the results highlighted in graphs outline that the purpose for which it was designed was fulfilled.*

Key Words: *control, system, MATLAB, Simulink, longitudinal, aircraft.*

1. INTRODUCTION

Light weight aircrafts flying around the world and the number or licensed pilots on this category of aircrafts is increasing from year to year.

Flight safety of these aircrafts depends on skills and experience of the pilots but it is more important to have on board a flight stabilization system (autopilot). Autopilots do not replace a human operator, but assist them in controlling the vehicle, allowing them to focus on broader aspects of operation, such as monitoring the trajectory, weather and systems [1].

This work is focused on the modelling of longitudinal automatic control system which is able to ensure rapid damping of oscillations due to the effect of the disturbance or the elevator command and maintaining constant speed and steering angle.

To create a link with the real world of lightweight aircrafts we chose an aircraft with the follow characteristics: weight is equal to 1000 kg, moment of inertia about a lateral axis is equal to 10 000 kg.m^2, the wing reference surface is equal to 20 m^2 and the wing reference length is equal to 2 m.

Without wind tunnel testing of the scaled model or flight tests we use analytical prediction to determine aerodynamic coefficients and that was quite complicated.

2. MATHEMATICAL MODEL OF THE AIRCRAFT IN LONGITUDINAL PLANE

The evolution of a lightweight aircraft in longitudinal plane, without roll and yaw movements can be described as a system of differential equations of the following form:

$$\begin{cases} \dot{v} = \dfrac{T\cos\alpha}{m} - \dfrac{\rho v^2 S C_x}{2m} - g\sin\theta \\ \dot{\theta} = \dfrac{T\sin\alpha}{m} + \dfrac{\rho v S C_z}{2m} - \dfrac{g\cos\theta}{v} \\ \dot{q} = -\dfrac{\rho v^2 b S C_{m_\alpha}\alpha}{2J_y} - \dfrac{\rho v b^2 S C_{m_q} q}{2J_y} + \dfrac{\rho v^2 b S C_{m_\delta}\delta_p}{2J_y} \\ \dot{h} - v\sin\theta \\ \dot{\phi} = q \\ \theta = \phi - \alpha \end{cases} \tag{1}$$

Section 6. Experimental Investigations in Aerospace Sciences

Radiobiology experiment design and modeling for space applications at ELI-NP

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Abstract: *Space radiation fields are mixed radiations with broadband energy spectra that will affect astronauts health during deep space missions or in permanent human habitats on Mars. Solar flares are large, unpredictable, explosive events consisting of accelerated protons and electrons with an energy around 100 MeV and up to 10 GeV. Relevant radiation backgrounds were reported in the literature and measured with the Mars Science Laboratory during a cruise to Mars plus an additional 500 days stay on the Martian surface. The total dose was estimated at 1.01 Sv, while ESA career dose limit is also 1 Sv. To find adequate countermeasures to chronic exposure to multi-energetic, mixed radiation fields, more radiobiology experiments are necessary. At ELI-NP research facility, such mixed radiation fields could be obtained through the interaction of two high power lasers (1PW, 25 fs each) with solid or gaseous targets that can generate pulsed proton or electron beams, gamma- and X-rays. Mimicking the space radiation would become possible by overlapping these beams on the same biological sample. In addition, the laser accelerated particle beams have broadband spectra, unlike radiation obtained with classical accelerators. An experimental irradiation set-up and preliminary Geant4 dose estimations for a laser accelerated proton beam will be presented.*

Key Words: *radiobiology, laser-driven proton beam, experimental setup, dose estimations, Geant4 simulations*.

1. INTRODUCTION

There is an increased interest and plans for long term space missions and building of permanent extra-planetary bases with human crews. However, it is recognized that there is an increased risk of chronic radiation exposure and health consequences from travel through intense space radiation fields, [1]. For instance, solar flares are large, unpredictable, explosive events consisting of accelerated protons and electrons with an energy around 100 MeV and up to 10 GeV, [2].

Radiation backgrounds were also measured with the Mars Science Laboratory, [1] during a cruise to Mars plus an additional 500 days stay on the Martian surface. The total dose was estimated at 1.01 Sv, while ESA career dose limit is also 1 Sv. Therefor a number of space and ground based laboratories are trying to measure and quantify as accurately as possible the radiation levels and health effects caused by the high radiation doses experienced by astronauts in long term missions.

Currently the existing radiation sources mimicking the space radiation can provide only mono-energetic spectra. Recently with the development of high power lasers a new type of particle acceleration is possible.

First results in laser-generated radiation have been reported in the literature less than two decades ago [3,4]. Proton and ion acceleration is possible through a mechanism called Target Normal Sheath Acceleration (TNSA), [5] which in principle occurs at the interaction of a focused high power laser with a solid target that has a thickness of the order of hundreds of nm up to tens of microns. Other mechanisms are also being investigated as Radiation Pressure Acceleration (RPA), [6] and Break -Out After-burner (BOA), [7]. Due to an increase in the number of high power laser facilities around the world, the laser accelerated particles will play a higher role in the future assessments of space radiation effects, especially that their energetic spectrum is exponential, similar to those of radiation fields in the outer space.

One of these high power laser facilities is Extreme Light Infrastructure - Nuclear Physics (ELI-NP) that will host two 10 PW, two 1 PW and two 0.1 PW lasers, based on the Ti:sapphire technology, capable of

Characterization of Gamma Radiation Fields Emitted by 60-Co Sources Inside of Multifunctional Interaction Chamber

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Abstract: *A new multifunctional interaction chamber was designed, built and tested in order to establish the technical solution for the future experimental facilities dedicated to simulate the cosmic space environment at ELI NP /E5 Experimental Area, Bucharest-Magurele, Romania.*
The research team chose to simulate cosmic radiation by a Co-60 gamma radiation source, because the gamma radiation is slightly attenuated in the simulation chamber walls, the absorbed dose rate is easy to determined and also a high dose rate is easily obtained and the Co-60 gamma radiation does not induce nuclear reactions into the exposed samples.
The gamma radiation fields, emitted by the Co-60 source placed inside of the interaction chamber, were analysed from the point of view of the axial and transverse dose distribution and the uniformity of dose rate by using: an electronic debit-meter UNIDOS T10021 type with Ionization Chamber TM 30013 type, alanine tablet EPR dosimeters and Gafchromic films.

Key Words: *Testing facilities, gamma sources, absorbed dose, dosimetry*

1. INTRODUCTION

The National Aeronautics and Space Administration and the European Space Agency have developed ambitious programs in the last decade involving long-term space missions to the moon, Mars, and beyond.

The new programs implied fundamental and applied researches in negative effect of space environment in condensed mater field, including biological systems (astronauts). The main stress agents are: cosmic rays, exposure at cryogenic or high temperature conditions, high vacuum pressure environment, high velocity cosmic dust and micrometeorites [1-4].

The goal of this research is to create a new infrastructure designed to simulate the outer space conditions (cosmic rays, extreme temperature and high vacuum pressure). A new facility [5] will be used to evaluate and quantify the cosmic rays effects in condensed matter, including biological systems, to test and validate the materials and devices used in future space missions.

The new testing facility consists of a cylindrical interaction chamber (IC) with a 43.5 external diameter, a 35.5 cm internal diameter and a 70 cm length.

The IC wall is made of 304 L stainless steel with 4 mm thickness. The IC is equipped inside with an interchangeable thermostatic plate support for samples, an access door for manipulation of samples and a thermal insulation mantle.

The IC is connected at a vacuum system and at a thermostat or cryostat, according to the type of experiment.

The IC was designed to work at a pressure ranging from ambient pressure up to 10^{-4} Pa and temperatures from -196 ^{0}C to 350 ^{0}C.

For the simulation of cosmic rays, the preliminary researches were made using gamma radiation fields emitted by 60-Co sources. Gamma radiations are not representative because they have a low value for Linear Energy Transfer, associated with reduced radio-induced effects in electronic devices and biological systems.

For a preliminary research, gamma radiation is recommended because: it is slightly attenuated in the materials, can be easily obtained at high dose rates and the absorbed dose rate is easy to predict and determine.

Also, gamma radiations emitted by the Co-60 does not induce nuclear reactions associated with the activation of the exposed samples. The exposed samples can be transferred without restriction to other laboratories [6].

Section 7. ATS and full Automation ATM

Automation and Systems Issues in Air Traffic Control

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Abstract: *This paper is dedicated to the study and analysis of a successfully designed control system in ATM. The aircraft's motion is affected by other factors, besides the pilot controls in the form of external disturbances, such as wind, and internal errors, due to unmodelled dynamics, tracking error and system noise. Navigation equipment tracks the exact real-time location of the aircraft in 4D space and provides feedback to both the pilot in the cockpit and ATC via ADS-B. ATM was expressed as a large, decentralized, dynamic, variable size, infinite horizon, multi-parameter, constrained, nonlinear, non-causal, non-convex, multi-objective, high-dimensionality, hybrid (continuous and combinatorial), optimal control problem. Rapidly increasing growth and demand in CNS/ATM, the advanced scheme for ATM, ADS-B system which is based on digital communication is being implemented in the field of surveillance. ADS-B is radically new technology that is redefining the paradigm of CNS in ATM today. Automatic Dependent Surveillance-Broadcast (ADS-B) is the next generation air surveillance system which supplants and complements the limitations of conventional radar, since conventional ATM radar systems will reach their limits soon due to the increases in air traffic.*

Key Words: *ATM Automation, ATC, ADS-B.*

1. INTRODUCTION

Air Traffic Management ensures the safety of flight by optimizing flows and maintaining separation between aircraft. Aircraft trajectory is one of the most fundamental objects within the frame of ATM. However, partly due to the fact that aircraft positions are most of the time represented as radar plots, the time dependence is generally overlooked so that many trajectory statistics conducted in ATM are spatial only. Even in the most favorable setting, with time explicitly taken into account, trajectory data is expressed as an ordered list of plots labeled with a time stamp, forgetting the underlying aircraft dynamics. [1-5] Furthermore, the collection of radar plots describing the same trajectory can have tenths more samples, nearly all of them redundant.

From the trajectory design point of view, this redundancy is real handicap for the optimization process. In this survey, alternative trajectory representations are presented with a description of their advantages and limits. Currently those trajectories are represented by the mean of plot lists which are manipulated by ATM software. [1-5] Every day, all aircraft trajectories are registered into large database for which huge capacity is needed. Based on this new trajectory representation for which redundancy has been removed, the trajectories database may be strongly improved from the capacity point of view. This compressed trajectory format may also be used for improving the trajectories transmission between ATM entities. A key issue in performance evaluation of ATM decision support tools (DST) is the distance metric that determines the similarity of trajectories. Some proposed representation may be used to enhance trajectory distance computation. Control input includes condition and model parameters. The model refinement (and computational complexity) ranges from tabular to many degrees of freedom. [1-5]

2. OPTIMAL CONTROL FOR AIRCRAFT TRAJECTORY DESIGN

To improve Air Traffic Management, projects have been initialized in order to compel the aircraft in position and in time (4D trajectory) so as to avoid potential conflict and allow for some optimality with respect to a given user cost index, environmental criteria (noise abatement, pollutant emission). When trajectories samples are available (from radar for instance), one can build a dedicated bases which will minimize the number of coefficient for trajectory reconstruction. [1]

Automated Conflict Resolution in Air Traffic Management

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Abstract: *Collision prevention strategy in ATM is not only a short-term coordination between safety and efficiency, but also a long-term planning for national policy of airspace and air transportation system. The optimization of system should be based on good command of equipment, staff, procedure and operation restriction to meet the real-time requirement and integrity.*
Essentially, collision prevention strategy in ATM is to seek synthetically and effective automatized avoidance methods in order to reduce possibility of dangerous approach or collision, of which conflict detection, conflict resolution and resolution trajectory optimization are the key technology.
This paper gives a research on the standard of intelligent prevention of collision, and theory and methodology of optimization from systems engineering perspective.
This paper detailed describes the decision-making procedure of ATC, establishes the optimized target for ATC's decision-making, and puts forward an optimization of conflict detection and conflict resolution between several aircrafts in 4D space.
The medium and long term collision prevention strategy through adjusting speed or altitude and short-term collision prevention strategy through adjusting heading makes the intelligent ATC system a perfect one.

Key Words: *ATM, ATC, Automated Conflict Resolution.*

1. INTRODUCTION

Air Traffic Conflict Detection and Resolution (CDR) involves multiple domains, the modeling of physical systems such as aircraft, encoding conflict detection algorithms as well as the procedures (tasks) for conflict resolution.

In Air Traffic Management research there exists a multitude of conflict detection and resolution methods, each with its own specific modeling method.

A common trait in most of these systems is that the various agents in the system exhibit hybrid behavior, continuous dynamics due to the physical systems such as aircraft dynamics, and discrete modes of operation such as the modes of the Flight Management System (FMS). [1], [3-4]

A key aspect of landing multiple aircraft on a single runway is Conflict Detection and Resolution. In the context aircraft landing, a conflict is defined as the situation of loss of minimum safe separation between two aircraft.

The conflict detection and resolution process consists of predicting, communicating to the pilot, and resolving the conflict.

Typically, evaluating the likelihood of a conflict is based on the current position and velocity of an aircraft. The conflict is then resolved by determining a maneuver required by one or more aircraft to avoid the predicted conflict.

The required information is then provided to the Air Traffic Controller who communicates with the pilot to resolve the conflict. [1], [3-4]

In the current organization of the Air Traffic Management (ATM) system the centralized Air Traffic Control (ATC) is in complete control of air traffic and ultimately responsible for safety. Before take off, aircraft file flight plans which cover the entire flight.

During the flight, ATC sends additional instructions to them, depending on the actual traffic, to improve traffic flow and avoid dangerous encounters.

The primary concern of ATC is to maintain safe separation between the aircraft. The level of accepted minimum safe separation may depend on the density of air traffic and the region of the airspace. [3-4]

Section 8. Management in Aerospace Activities

The laws and the companies in the development of aerospace field

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Abstract: *The life of companies, including the aerospace companies, depends on the business cycle. The paper presents the trends of law in ascending and descending period of the business cycle. A point of the paper is the separation of military and civil law in aerospace, public and private law, national and corporate security systems. Also the laws to be apply in relation with public authorities, private organizations, citizens are approched. In the paper are included some keys for interpretation such as the hierarchy of social values. In modern times, the humans life, rights and property must be the main protected values. The paper shows the methods to be accepted for the analyse/analysis of law in aerospace field: logical analysis, hystorical method, comparative method, social research, experimental method. In the aerospace field each of them has some particularities. The classification of laws depending of economic impact in the aerospace field is an other section. There are presented implications on cost, income, receipts, payments, duration of the activities, other restrictions.*

Key Words: *law, business cycle, aerospace activities, economic impact, aerospace companies.*

1. INTRODUCTION

The evolution of a field of activity, an economic branch like aerospace, depends on companies acting in the field and the laws involved. The time for a field of activity may be outrun or delayed by the quality of the companies involved or by laws in force for that field of activity. Research and development are not possible in any area if the companies of that field lose money or if their work is not supported by legislation.

A thorough understanding of the legislation in force is a necessary condition of an efficient management, not only in order to develop the companies but also for limiting their activity. Usually at the national level law creates many problems to the employees occupying various management positions in companies.

More than other fields, the Aerospace has an "international" expansion. There are relevant national, confederative, international, bilateral rules, proffessional rules (self-regulation of activity) and corporative rules (rules of the companies approved and maintained on the national or international basis). The competition and national rules require these special rules to be at the highest standards. The paper is a legally and managerial point of view about this mix of laws involved in the activity of the companies in the aerospace field.

2. THE TRENDS OF LAW IN ASCENDING AND DESCENDING PERIOD OF THE BUSINESS CYCLE

The ascending and descending period of the business cycle involves changes in statutary laws of the companies. In many countries Governments change the fiscal and budgetary laws depending of the economic cycle. In some cases the changes are favorable to companies but in other cases the government interventions harm the economic running of the companies, impeding their progress.

United States during the Great Depression of 1929/1933 and Romania during the 2008 crisis are examples of the assertions above. The companies that act in a field depending on general business cycle like aerospace have to adapt quickly their projects to every change of the economic business environment [1].

The time is an independent main factor of action with impact on advantages and costs of any kind of projects [4]. The speed of changes is important in a dynamic field like aerospace. The synchronizing of resources for permanent innovation will be the challenge of the future in the fields depending of the updates and renewal.

The changes in internal law of the companies help the process of decison making and increase the quality of this process.

In case of decision making for changing the business cycle, we may assume that there is a risk, an uncertainty category of decision. The general steps that have to be done in all types of company are: consider

Communication and work principles for team/group performance in aerospace

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Abstract: *The paper outlines rules for employees in the aerospace field about general procedures, accounting, budgets, employees involvement in the companies goals as a team or as a group. The quality of all communications activities is presented in correlation with performance. For us, performance means economic and social references, stability and credibility of the business and, not least, a good communication within the existing groups or teams. We take in account long-term, medium and short performance for a new and modern field such as the aerospace industry.*
The paper highlights the group communication aspects, the process needed to optimize communication within a group, the team characteristics and mission, the team involvement versus group involvement, organization of the work team and defining/definition of roles in a team according to individual skills and some technics; to apply the Belbin test for determining the role of individuals within the team, for identifying the types of communication in order to get the information transmitted to the different types of individuals such as "analytical type", "director type", "friendly type", "expressive type", the needs and interest of these individuals, assessing how the information was received and the impact of the feedback.

Key Words: *Communication, Performance, Organization, Aerospace activities, Companies*

1. INTRODUCTION

Overall, organizational communication in modern society has known changes which emphasized the importance of information exchanges, based on new principles: autonomy, cross-sectional organization, project teams, participation.

All this has led to an increased organizational coordination, coordination being a critical process of this organization.

Internal institutional communication brings together all the communication forms within an organization, being a consciously and voluntarily process of exchange messages between its members for individual and collective goals fulfillment.

2. COMMUNICATION: FROM THEORY TO WORK PRINCIPLES IN AEROSPACE ACTIVITY

Today, we talk not only about communication as a phenomenon of transmission and reception of words, letters, images, signals. Communication involves much more than that. It is an integrator phenomenon, through which the fundamental structures of society are built every day. [1]. The progress means more and more communication. As the aerospace companies are representative for the ideea of progress, it is normal to find into their activity a path towards a new era of communication.

Basic elements of communication as described by the science have to be clear when the aerospace companies have to design the information flows. The communication science says that "Communication involves the reversibility of messages within the relationship which brings together two entities, even if the messages are not of the same order". In the same time "it involves creating a sense, in respect with the uninterrupted correlation between our faculties for perceiving signals, the richness of vocabulary, to decode them, the imagination, to interpret them, as well as the memory, in order to maintain their consistency when, in our turn, we become emitters and address return messages" [2]. The elements that apply to aerospace companies are the following: the importance of the "uninterrupted" information flows (mainly in security

Limitations of systemic accident analysis methods

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Abstract: *In terms of system theory, the description of complex accidents is not limited to the analysis of the sequence of events / individual conditions, but highlights nonlinear functional characteristics and frames human or technical performance in relation to normal functioning of the system, in safety conditions. Thus, the research of the system entities as a whole is no longer an abstraction of a concrete situation, but an exceeding of the theoretical limits set by analysis based on linear methods.*
Despite the issues outlined above, the hypothesis that there isn't a complete method for accident analysis is supported by the nonlinearity of the considered function or restrictions, imposing a broad vision of the elements introduced in the analysis, so it can identify elements corresponding to nominal parameters or trigger factors.

Key Words: *Accident analysis, Systemic methods, STAMP, FRAM.*

1. INTRODUCTION

Designed safety requires knowledge, understanding of the environment and stakeholders/involved factors and is not based on formal identification of threats and vulnerabilities of a system, but on analysis that requires increased performance, technology development and levels of safety. Airborne systems have a particular structure, but similar to other systems, their inadequate operation leads to the possibility of a failure of a structural element or of the system as a whole. Therefore, if we treat the problem of risk, in order to keep it at a low/acceptable level, control structures should be implemented in the early stages, starting from the design phases [1].

In the context of 8727691 commercial flights in 2015 and 23911 each day, 2246004 passengers travel daily by 7523 commercial aircraft to 19 299 airports in the world. The entire spectrum of major accidents overlaps 5 classes that allow analysis of existing threats, causal relationships and ultimately identify the causes of accidents (human factors, organizational, faulty assumptions, unintentional or latent errors) [10]. In parallel with developments in technology, a series of interconnected systems vulnerabilities have been outlined as a cobweb pattern. Starting from the first development of accident modeling tools in the early 1930s, which mirrored in a simplistic manner, a linear extension of the causes of an event in its results and consequences, subsequent exposures experienced a progressive evolution by developing rigorous mathematical models built at the base of exhaustive playing of the systematic factors and nonlinear interactions between them. Therefore, the imposition of an abstract accident exposure through a descriptive understanding of an accident's stages (through the Domino model) and shaping as a way of unraveling and conceptual figurative solving of a critical situation by canceling or removing one of the pieces of the assembly, imposing barriers and adequate control to each process type and each category of possible error has become an important custom for which a dispensation is not considered [1]. In 86 years of evolutionary study upon considerations that highlight a wide range of processes whose unplanned interactions can reflect in an accident, corresponding stages of progress achieved follows a technical-systemic line with frequent imposition of human factor and, by extension, an organizational alternative. The need to understand the complexity of human error was driven by the failure to further explain accidents by simple cause-effect chaining and the fact that accidents involve successive penetration of the defense lines of the system; therefore the event modeling is useful to highlight potential risks, to assess and implement actions designed to prevent occurrence of other accidents [9].

2. CHARACTERISTICS OF SYSTEMIC METHODS. A NONLINEAR APPROACH

Analytical models must reflect the research in the area and the results of safety investigations, describe the system's performance by establishing connections between functions and components of the analyzed

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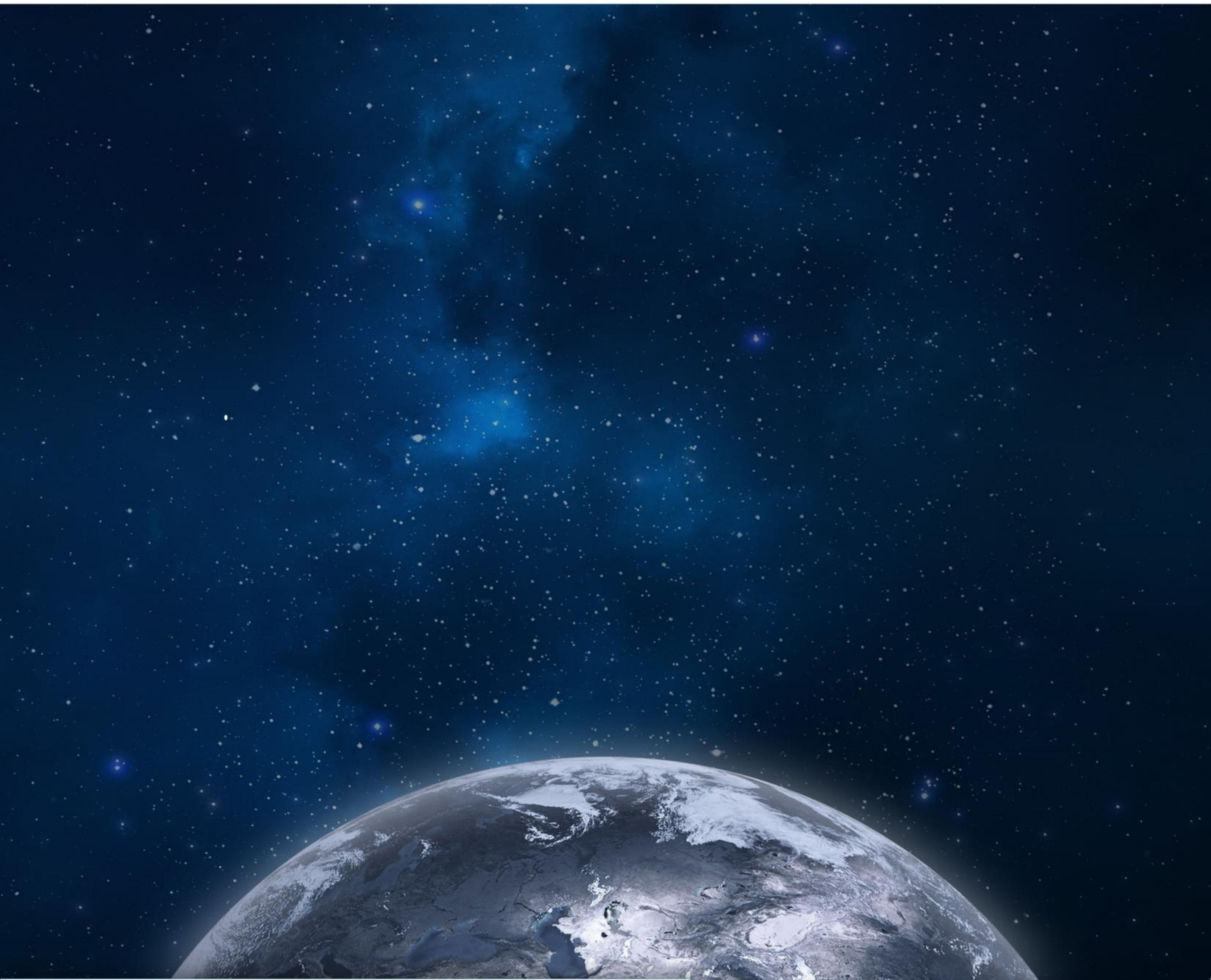

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