Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

SCIENTIFIC CURRICULUM – NABIL SOUHAIR

Personal data:

Place and date of birth: Legnago (VR) Italy, July 31, 1992
Phone: +39 345 3283457
E-mail: nabil.souhair2@unibo.it; nabil.souhair@gmail.com
Website: http://www.unibo.it/sitoweb/nabil.souhair2/en/

EDUCATION

Years	Degree
From: 2011 To: 2014	Bachelor degree in Mechanical Engineering, **Università di Bologna**
From: 2014 To: 2015	Post-graduate master in Race Engineering, **Motorsport Technical School of Monza**
From: 2015 To: 2018	Master degree in Aerospace Engineering, **Università di Bologna**
From: 2019 To: 2022	Doctor of Philosophy degree in Mechanics and Advanced Sciences of Engineering, **Università di Bologna**

RESEARCH ACTIVITIES

Dr. Eng. Souhair carries out many research projects within a wide range of topics such as, and not limited to, Plasma Propulsion, Chemical Rockets & Aerospikes, Aeronautical Propulsion Systems, Spacecraft platform & subsystems development. Notable projects in which he participated include the development of a numerical suite for the optimization of Plasma Thrusters, the development of experimental hardware for the qualification campaign of Plasma Thrusters and the **launch and in-orbit demonstration of REGULUS-50-I2, the first ever Helicon Plasma Thruster flown** in space. Moreover, he took part at the development of a numerical tool for the qualification of several solid rocket boosters currently employed by the European Space Agency. Furthermore, he cooperates with a comprehensive network of research groups and major players in the European space sector, such as AVIO, T4i, Pangea Aerospace, as well as with several institutions, universities, and research centres in Italy and Europe.

Electric Space Propulsion & Plasma Propulsion:

1. Helicon Plasma Thrusters modelling and simulation.
2. Cathode-less Plasma Thrusters and Magnetically Enhanced Thrusters modelling and simulation.
3. Development of Electro-Magnetic and Fluid codes for the analysis of the plasma generation and transport in Radio Frequency or Microwave electric propulsion systems.
4. Development of Particle-In-Cell codes for the analysis and performance predictions of plasma thrusters with Magnetic Nozzles.
5. Development of Global Models for the analysis of plasma chemistry with noble gases, atmospheric plasmas and halogens.
6. Analysis of alternative propellants such as Iodine, Carbon Dioxide, Air, Water.
7. Analysis of Atmosphere-Breathing-Electric-Propulsion (ABEP) systems.
8. Experimental activities on electric propulsion systems with thrust stands, momentum flux probes, and plasma diagnostics such as Langmuir probes, Retarded Potential Analysers, Interferometry, B-Dot probes and Faraday cups.

Solid Rocket Propulsion:

9. Internal ballistic modelling of a Solid Rocket Booster.
10. 3D modelling of the grain burning surface regression process accounting burning rate anisotropies.
11. Propellant casting process modelling finalized to the evaluation of anisotropies and non-uniformities of the produced grain.

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

Liquid Rocket Propulsion:

12. Development of a supersonic thermo-fluid-dynamics solver for plume analysis and performance prediction.
13. Development of a thermo-fluid-dynamics solver for analysis and optimization of liquid rockets combustion chamber.
14. Aerospike rockets design, modelling and simulation.

Aeronautical Propulsion and Gas Turbines:

15. Experimental characterization of gas turbines.
16. Conversion of a helicopter turbogas engine to work with hydrogen.

RESEARCH PROGRAMS IN WHICH I TOOK PART

Years	**Funded research projects**
From: 2017 To: 2018	Industrial grant for developing an internal ballistic simulation code for Solid Rocket Boosters. **AVIO & University of Bologna**
From: 2018 To: 2019	Industrial grant for developing the in-orbit demonstration of the REGULUS-I2 platform, the first Helicon Plasma Thruster in orbit. **T4i S.p.a.**
From: 2018 To: 2019	Industrial grant for developing a Thermal Vacuum Chamber and test hardware for the qualification campaign of REGULUS-I2. **T4i S.p.a. & University of Padova**
From: 2019 To: 2022	Industrial grant for developing a numerical suite for the design and optimization of Helicon Plasma Thrusters and RF Plasma Thrusters. **T4i S.p.a. & University of Bologna**
From: 2022 To: 2022	Horizon 2020 "DISCOVERER – Disruptive technologies for very low earth orbit platforms" for foundational research in spacecraft aerodynamic characterization, in material aerodynamics and atomic oxygen resistance, in electric propulsion, and control methods at Very Low Earth Orbits. **EU grant 737183 – University of Stuttgart**
From: 2022 To: active	Industrial research activities for the analysis and simulation of the DEMO-P1 Aerospike engine and for the performance assessment of the ARCOS Aerospike rocket. **PANGEA Aerospace Ltd**
From: 2023 To: 2023	Grant for the development of simulation methodologies for the analysis of Plasma Thrusters fed with alternative propellants such as Air and Iodine. **T4i & University of Bologna**
From: 2023 To: active	Grant for converting an aeronautical turbogas engine to work with hydrogen. **PRIN (Italian national project funding) & University of Bologna**

AFFILIATIONS

- Member of MENSA, the High IQ Society (2015 – 2017)
- Member of the Interdepartmental Center for Industrial Research: (CIRI) Aeronautica – Università di Bologna (2019 – to date)
- Member of the International Electric Rocket Propulsion Society (2022 – to date)
- Member of the Moroccan Initiative for Space Industry (2022 – to date)

HONORS, AWARDS AND INVITATIONS FOR SEMINARS/CONFERENCES

2015 Certified as ***Gifted Person*** by the *Mensa International High IQ society*, for demonstrating an Intelligence Quotient **higher than two standard deviations** w.r.t. the general population (IQ > 148).

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

2021 Received the **Italian Space Agency (ASI)** prize, for the best paper ***"Numerical Suite for Magnetically Enhanced Plasma Thrusters"*** presented at the *72nd International Astronautical Congress*.

2021 Shortlisted finalist for the ***Luigi G. Napolitano*** medal, an award issued by the *International Astronautical Federation* to the **best young scientist** in the field of aerospace science, who has **contributed significantly** to the field.

2022 Invited lectures/keynotes/plenary at the ***African Space Generation Workshop*** held at the *International University of Rabat* and organized by the *Space Generation Advisory Council for United Nations* and the *Moroccan Initiative for Space Industry*.

2022 Invited lectures and keynotes by the ***Moroccan Association of Material Sciences, Energy and Environment*** at the *University Chouaib Doukkali* in El Jadida.

2022 Invited keynote at the ***International Conference: Issues of Space Propulsion,*** held at the *National School of Applied Sciences (ENSA), Cadi Ayyad University* at Safi.

2022 Acknowledged by the Editorial Board to the reviewers of **MDPI *Aerospace*** 2022.

EDITORIAL ACTIVITES

- Referee for the journal **Aerospace (MDPI)**
- Referee for the journal **Contributions to Plasma Physics (Wiley)**
- Referee for the journal **Physica Scripta (IOP)**
- Guest Editor of the Special Issue "Numerical Simulations in Electric Propulsion" for the journal **Aerospace (MDPI)**

TEACHING AND MENTORING EXPERIENCE

From 2019 Served as assistant (teaching and examination) for the following Courses for Mechanical and Aerospace Engineering at the University of Bologna:
- Turbomachinery (6 ECTS)
- Fluid machinery (6 ECTS)
- Energetic Systems (6 ECTS)
- Aeronautical Propulsion (6 ECTS)
- Aerospace Propulsion Systems (9 ECTS)
- Laboratory of Aerospace Propulsion (3 ECTS)

From 2020 Responsible of a Lecture Series within the Course ***Aerospace Propulsion Systems*** (ECTS 9) of the **Master in Aerospace Engineering** about "Plasma Physics for Electric Propulsion" at the University of Bologna.

From 2021 Responsible of the course ***Aeronautical Turbine Engine*** for the IFTS master issued by **Isaers Enaip Forlì.**

From 2023 Responsible of the course ***Laboratory of Aerospace Propulsion*** (ECTS 3) of the B**achelor's degree in aerospace engineering** at the University of Bologna.

MENTORING ACTIVITIES

Co-supervisor of **2 PhD students** (ongoing):

Year	**Student, title and PhD degree**
Expected 2025	Raoul Andriulli, "*Numerical characterization of plasma thrusters for micro-satellites",* PhD in Aerospace Science and Technology, Università di Bologna.
Expected 2023-24	Luca Fadigati, "*Modeling and optimization of an aerospike engine for space applications",* PhD in Mechanics and Advanced Engineering Sciences, Università di Bologna.

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

Supervised or co-supervised of **16 Master thesis**:

Year	Student and thesis title	Degree	Institution
From: 2020 To: 2021	Enrico Majorana, *Development and implementation of a Plasma Chemistry model for Helicon Plasma Thruster analysis*	MSc	Università di Bologna
From: 2020 To: 2021	Gianluca Sibilio, *Modelling of the Boundary Conditions for a Numerical Simulation of a Helicon Plasma Thruster*	MSc	Università di Bologna
From: 2020 To: 2021	Giovanni Luddeni, *Improvement of a simulation platform for Helicon Plasma Thrusters: analysis of the Boundary Conditions and modelling of the Sheath*	MSc	Università di Bologna
From: 2020 To: 2021	Alberto Zorzetto, *Solution of the neutral species in a weakly ionized plasma by means of the SIMPLE algorithm*	MSc	KTH Royal Institute of technology
From: 2020 To: 2021	Leonardo Nesti, *Numerical Simulations of a Supersonic Flow in an Aerospike using OpenFOAM*	MSc	Università di Bologna
From: 2021 To: 2022	Simone Dalle Fabbriche, *Development of iodine and air chemistry models for the simulation of plasma in Helicon Plasma Thrusters*	MSc	Università di Bologna
From: 2022 To: 2022	Nedal Amsi, *Design of a lunar habitat with an isokinetic structure*	MSc	International University of Rabat
From: 2022 To: 2022	Marwa Chouikouk, *Design of a lunar habitat with an isokinetic structure*	MSc	International University of Rabat
From: 2022 To: 2022	Yassine Darbou, *Design of a lunar habitat with an isokinetic structure*	MSc	International University of Rabat
From: 2022 To: 2022	Ziad Britel, *Design of a lunar habitat with an isokinetic structure*	MSc	International University of Rabat
From: 2022 To: active	Willem Van Lynden, *Development of coupling techniques for the modelling of the ionization chamber and the magnetic nozzle in a Helicon Plasma Thrusters*	MSc	Tu Delft
From: 2023 To: active	Beshoy Talaat Shoukry Michael, *Development of iodine chemistry in fluid codes for simulating Helicon Plasma Thrusters*	MSc	Università di Bologna
From: 2023 To: active	Erica Falconi, *Development of air chemistry in fluid codes for simulating Helicon Plasma Thrusters*	MSc	Università di Bologna
From: 2023 To: active	Francesco Felicioni, *Feasibility analysis and design of a Martian Atmosphere Breathing Electric Thruster with Global Models*	MSc	Università di Bologna
From: 2023 To: active	Rosa Migliarini, *Design and Analysis of hydrogen fed Sounding Rockets*	MSc	Università di Bologna
From: 2023 To: active	Sebastian Blank, *Design and Implementation of Permanent Magnets on an RF Helicon-based Plasma Thruster*	MSc	University of Stuttgart

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

Supervised 9 **Bachelor thesis**:

Year	Student and thesis title	Degree	Institution
From: 2019 To: 2020	Stefano Cirulli, *Design of a Matching Network for Helicon Plasma Thrusters: numerical characterization of the plasma-antenna coupling*	BSc	Università di Bologna
From: 2021 To: 2021	Mattia Petrini, *Development of graphical interfaces for the numerical simulations of a Helicon Plasma Thruster*	BSc	Università di Bologna
From: 2021 To: 2021	Maurizio Saggiani, *Simulation of a Helicon Plasma Thruster*	BSc	Università di Bologna
From: 2022 To: 2022	Alessio Strambelli, *Analysis of the magnetic topology of permanent magnets applied to Helicon Plasma Thruster*	BSc	Università di Bologna
From: 2022 To: active	Bianca Guerrini, *Development of a Carbon Dioxide chemistry model for the simulation of plasma in Helicon Plasma Thrusters*	BSc	Università di Bologna
From: 2022 To: active	Brian Sebastiani, *Optimization of the magnetic topology of permanent magnets in a Helicon Plasma Thruster*	BSc	Università di Bologna
From: 2022 To: active	Riccardo Casali, S*imulation of the Magnetic Nozzle of an Atmosphere Breathing Electric Propulsion system by means of the Particle-In-Cell methodology*	BSc	Università di Bologna
From: 2022 To: active	Carlo Capuano, *Review of Thermal and Electric Nuclear Propulsion technologies*	BSc	Università di Bologna
From: 2022 To: active	Luca Piomboni, *Preliminary design of a Very Low Mars Orbit exploiting the atmosphere-breathing by means of a Helicon Plasma Thruster*	BSc	Università di Bologna

PUBLICATION SUMMARY

Starting from 2019 I produced the following scientific production:

- N° of papers published in peer reviewed journals: 10
- N° of papers proceedings of international conferences: 14

	N° papers	**N° citations**	**H-index**
Total	24	125	6
Scholar	23	98*	5 (6*)
Scopus indexed	10	54*	4 (5*)
* Retrieved the 01-04-2023. Scopus metrics is not up to date.			

JOURNALS

1. N. Souhair, M. Magarotto, E. Majorana, F. Ponti, D. Pavarin, ***Development of a lumping methodology for the analysis of the excited states in plasma discharges operated with argon, neon, krypton, and xenon,*** PHYSICS OF PLASMAS, VOL. 28, ISSUE 9, 1 2021, [DOI : 10.1063/5.0057494].
2. N. Souhair, M. Magarotto, F. Ponti, D. Pavarin, ***Analysis of the plasma transport in numerical simulations of helicon plasma thrusters,*** AIP ADVANCES, VOL. 11, ISSUE 11, 2021, Article number 115016, [DOI : 10.1063/5.0066221].
3. E. Majorana, N. Souhair, F. Ponti, M. Magarotto, ***Development of a Plasma Chemistry Model for Helicon Plasma Thruster analysis,*** AEROTECNICA MISSILI & SPAZIO, 2021, 100, pp. 225-238, [DOI : 10.1007/s42496-021-00095-1].

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

4. N. Bellomo, M. Magarotto,…, N. Souhair et al., ***Design and In-orbit Demonstration of REGULUS, an Iodine electric propulsion system***, CEAS SPACE JOURNAL, 2021, [DOI : 10.1007/s12567-021-00374-4].
5. M. Magarotto, S. Di Fede, N. Souhair, et al., ***Numerical Suite for Cathodeless Plasma Thrusters***, ACTA ASTRONAUTICA, 2022, [DOI : 10.1016/j.actaastro.2022.05.018].
6. N. Souhair, F. Ponti, M. Magarotto, et al, ***Different fluid strategies for the simulation of a Helicon Plasma Thruster***, CONTRIBUTIONS TO PLASMA PHYSICS, 2022 [DOI: 10.1002/ctpp.202200128].
7. N. Souhair, M. Magarotto, R. Andriulli, F. Ponti, ***Prediction of the Propulsive Performance of an Atmosphere-Breathing Electric Propulsion System on Cathode-Less Plasma Thruster,*** AEROSPACE, 2023, 10, 100, [DOI : 10.3390/aerospace10020100].
8. N. Souhair, M. Magarotto, R. Andriulli, F. Ponti, ***Coupled global and PIC modelling of the REGULUS cathode-less plasma thrusters operating on xenon, iodine and krypton,*** ACTA ASTRONAUTICA, 2023, 207:227-239, [DOI : 10.1016/j.actaastro.2023.03.015].
9. S. Dalle Fabbriche, N. Souhair, M. Magarotto, R. Andriulli, E. Corti, F. Ponti, ***Development of a Global Model for the Analysis of Plasma in an Atmosphere-Breathing Cathode-Less Thruster,*** AEROSPACE, 2023, [DOI : 10.3390/aerospace10050389].
10. Z. Harimech, Y. Hairch, M. Atamanov, K. Toshtay, N. Souhair, R. Amrousse, ***Carbon nanotubes Ir-CuO supported catalysts for decomposition of ammonium dinitramide (ADN) at liquid phase,*** INTERNATIONAL JOURNAL OF ENERGETIC MATERIALS AND CHEMICAL PROPULSION, 2023, [DOI : 10.1615/IntJEnergeticMaterialsChemProp.2023047555].

The following articles have been submitted in peer reviewed journals and currently under revision:

11. R. Andriulli, S. Andrews, N. Souhair, M. Magarotto, F. Ponti, ***Fully-kinetic study of facility pressure effects on Helicon source magnetic nozzles***, AEROSPACE SCIENCE AND TECHNOLOGY, 2023 [**submitted and in revision process**].
12. S. Andrews, R. Andriulli, N. Souhair, M. Magarotto, F. Ponti, ***Anomalous electron transport in the magnetic nozzle***, PLASMA SOURCES SCIENCE AND TECHNOLOGY, 2023 [**submitted and in revision process**].
13. L. Fadigati, F. Rossi, N. Souhair, F. Ponti, ***A Development and Simulation of a 3D Printed Liquid 2 Oxygen/Liquid Methane Aerospike,*** ACTA ASTRONAUTICA, 2023 [**submitted and in revision process**].
14. G. Herdrich, K. Papavramidis, P. Maier, J. Skalden, F. Hild, M. Pfeiffer, M. Fugmann, S. Klinker, S. Fasoulas, N. Souhair, F. Ponti, M. Walther, A. Wiegand, L. Walpot, B. Duesmann, E. B. Borras, P.C.E. Roberts, N.H. Crisp, ***System design study of a VLEO satellite platform using the IRS RF Helicon-based Plasma Thruster,*** ACTA ASTRONAUTICA, 2023 [**submitted and in revision process**].
15. Y. Hairch, A. Elmelouky, Z. Supiyeva, M. Atamanov, K. Toshtay, S. Azat, N. Souhair, R. Amrousse, ***Permeation of green hydrogen as clean energy resource via separation membrane: simulation study,*** INTERNATIONAL JOURNAL OF HYDROGEN ENERGY, 2023 [**submitted and in revision process**].

PROCEEDINGS IN INTERNATIONAL CONFERENCES

16. F. Ponti, N. Souhair, S. Mini, A. Annovazzi, ***0D Unsteady – 1D Quasi-Stationary internal ballistic coupling for ROBOOST simulation tool,*** in PROCEEDINGS OF THE AIAA PROPULSION AND ENERGY FORUM, 2019 [DOI : 10.2514/6.2019-4140].
17. M. Manente, F. Trezzolani,…, N. Souhair et al., ***REGULUS : Iodine fed Plasma Propulsion System for Small Satellites,*** in PROCEEDINGS OF THE 36TH INTERNATIONAL ELECTRIC PROPULSION CONFERENCE, Vienna, 2019.

Dr. Nabil Souhair
Adjunct Professor & Research Fellow
Alma Propulsion Laboratory - Department of Industrial Engineering
University of Bologna
Via Fontanelle 40, 47121 Forlì, Italy

18. N. Bellomo, M. Manente,…, N. Souhair et al., ***Enhancement of microsatellites' capabilities : integration of REGULUS electric propulsion module into UniSat-7,*** in PROCEEDINGS OF THE 70th INTERNATIONAL ASTRONAUTICAL CONGRESS, Washington D.C., 2019.
19. N. Souhair, M. Magarotto, M. Manente, D. Pavarin, F. Ponti, ***Improvement of a numerical tool for the simulation of a Helicon Plasma Thruster,*** in PROCEEDINGS OF THE 7th SPACE PROPULSION CONFERENCE SP2020-00070, Virtual Conference 2021.
20. N. Bellomo, M. Magarotto, M. Manente et al., ***REGULUS: integration and testing of an iodine electric propulsion system,*** in PROCEEDINGS OF THE 7th SPACE PROPULSION CONFERENCE SP2020-00070, Virtual Conference 2021.
21. M. Magarotto, S. Di Fede, N. Souhair et al, ***Numerical Suite for Magnetically Enhanced Plasma Thrusters,*** in PROCEEDINGS OF THE 72nd INTERNATIONAL ASTRONAUTICAL CONGRESS, Dubai, 2021.
22. N. Souhair, F. Ponti, M. Magarotto, D. Pavarin, ***Analysis of different numerical approaches for the simulation of a Helicon Plasma Thruster,*** in PROCEEDINGS OF THE 8th SPACE PROPULSION CONFERENCE, Estoril, 2022.
23. K. Papavramidis, J. Skalden, N. Souhair et al, ***Development Activities for the RF Helicon-based Plasma Thruster: Thrust Measurement and B-dot Probe Set-up,*** in PROCEEDINGS OF THE 37th INTERNATIONAL ELECTRIC PROPULSION CONFERENCE, MIT (Boston), 2022.
24. N. Souhair, M. Magarotto, S. Dalle Fabbriche et al, ***Simulation and modelling of an iodine fed Helicon Plasma Thruster***, in PROCEEDINGS OF THE 37th INTERNATIONAL ELECTRIC PROPULSION CONFERENCE, MIT (Boston), 2022.
25. N. Souhair, F. Ponti, M. Magarotto, D. Pavarin, ***Analysis of different numerical approaches for the simulation of a Helicon Plasma Thruster,*** in PROCEEDINGS OF THE 37th INTERNATIONAL ELECTRIC PROPULSION CONFERENCE, MIT (Boston), 2022.
26. S. Andrews, R. Andriulli, N. Souhair, S. Di Fede, M. Magarotto, D. Pavarin, F. Ponti, ***Multiscale Modelling of Alternative Propellants in Helicon Plasma Thruster,*** in PROCEEDINGS OF THE 73rd INTERNATIONAL ASTRONAUTICAL CONGRESS, Paris, 2022.
27. G. Herdrich, K. Papavramidis,…, N. Souhair et al., ***Platform and system design study of a VLEO satellite platform using the IRS RF Helicon-based Plasma Thruster,*** in PROCEEDINGS OF THE 73rd INTERNATIONAL ASTRONAUTICAL CONGRESS, Paris, 2022.
28. E. Boughad, N. Souitat,…, N. Souhair, et al., ***Space Education and Outreach in Morocco through the Introduction of the hands on CubeSat Farm experiment "Exolab-Mor-1" for K6 to 12 students,*** in PROCEEDINGS OF THE 73rd INTERNATIONAL ASTRONAUTICAL CONGRESS, Paris, 2022.
29. N. Souhair, H. Laarabi, H. Milani, N. Souitat, S. Hamouch, F. Ponti, ***Feasibility analysis of a Spaceport in Morocco as a pathway to meeting the growing international demand for space access,*** in PROCEEDINGS OF THE 73rd INTERNATIONAL ASTRONAUTICAL CONGRESS, Paris, 2022.