ALL. B[1]
Decreto Rettore Università di Roma "La Sapienza" **n. 877/2019 del 08/03/2019**

Paolo GASBARRI
Curriculum Vitae

Completed in Roma, 5/4/2019

Part I – General Information

Full Name	Paolo GASBARRI
Date of Birth	
Place of Birth	
Citizenship	
Permanent Address	
Mobile Phone Number	
E-mail	
Spoken Languages	

Part II – Education

Type	Year	Institution	Notes (Degree, Experience,…)
Laurea (5 years course)	1989	Università di Roma "La Sapienza"	Ingegneria Aeronautica, thesis in Aeroelasticity and Structural Dynamics
PhD	1993	Università di Roma "La Sapienza"	PhD in Aerospace Engineering, thesis on Generalized Aerodynamic Forces for Aeroelastic Applications

National Scientific Qualification as Full Professor, SC 09/A1 (INGEGNERIA AERONAUTICA, AEROSPAZIALE E NAVALE), SSD ING-IND/04, earned in the first session, year 2012

Part III – Appointments
III.A – Academic Appointments

Start	End	Institution	Position
8/1996	10/2005	Università degli Studi di Roma "La Sapienza", Facoltà di Ingegneria	Ricercatore (ING-IND/04 Costruzioni e Strutture Aerospaziali)
1/1997	8/1997	Deutschen Zentrum fur Luft-und Raumfahrt (DLR) (Germany)	Visiting Researcher
2005	2008	Sapienza Università di Roma, Facoltà di Ingegneria	Professore associato
2008	to date	Sapienza Università di Roma, Facoltà di Ingegneria	Professore associato confermato

[1] This CV has been prepared according to the general model defined by Sapienza. Following model instructions, and in order to address the peculiar requirements of this call, specific sentences and sub-paragraphs have been added *(in italic)* to the relevant, or the more relevant, headings already present in the standard form in order to directly refer to the specific evaluation criteria. As a recap for the Jury, a quick table reporting the links among relevant paragraphs and call's criteria has been included at the end of this document (part IX)

7/4/2011	27/4/2011	UNISINOS - Universidade do Vale do Rio dos Sinos, Applied Mathematics Department, Rio Grande do Sul, Brazil	Visiting Professor
15/7/2015	29/7/2015	ITA, Instituto Tecnológico de Aeronáutica, São José dos Campos, Brazil	Visiting Professor

III.B – Other Appointments

For the sake of clarity, and to allow for an easier referral to the subcriteria listed in the call, the classification of *Other Appointments* will be divided into four lists.

III.B.1 Research and Professional

Start	End	Institution	Position
5/1993	4/1996	Alenia Space (now Thales Alenia Space)	System Engineer in S/C dynamics and control
2000	2005	NATO, RTO Research and Technology Organization	Italian Representative at the Structural and Material Panel
2000	2005	NATO, RTO Research and Technology Organization	Co-Author for the AGARD-AVT 093 study on the Integration of Tools and Processes for Affordable Vehicle
2000	2004	NATO, RTO Research and Technology Organization	Member of the committee for the AGARD-AVT 093 study on the Qualification by Analysis
1/2001	12/2001	AVIO	Assement and optimization of the Vega Launcher Performances Analysis
12/2001	11/2002	Italian Ministry of Defense	Scientific Consultant, Testing and Verification of the Attitude and Orbital Control of SICRAL Satellite
2014	to date	Cluster Aerospaziale Nazionale	Member of the Steering Committee of the Programs Sapere Safe and Sapere Strong

III.B.2 Specific Appointments Concerning the Evaluation of Research Programs

2011	Regione Calabria – POR	Evaluator
2014-2015-2016-2017	Nat.l Center for Science and Technology, Kazakhstan	Expert Evaluator
2017	Univ. Padova – Ateneo Research Funding Call	Evaluator
2018	European Commission, Research Executive Agency	Monitor (Reviewer) H2020 FET-Open project DISCOVERER

III.B.3– Specific Appointments Concerning the Cooperation to Academic Organization

This table has been included to partly address the last sub-criterium of the individual evaluation as well as the 4th sub-criterium of the comparative evaluation (about helping University management by participating to government bodies and by promoting international cooperation)

2003-2010	La Sapienza, Faculty of Engineering	Member of the Faculty Committee for the implementation and development of university-industry cooperation program and the integration of the graduate students in the aerospace industries
2004-2010	La Sapienza	Member of the Board (Giunta) of Aerospace and Astronautics Department
2005-2010	La Sapienza	Member of the Board (Giunta) of the San Marco Project Research Centre (CRPSM)
2000-2004	La Sapienza, Aerospace Engineering Department	Promoter of an international cooperation between the Aerospace Engineering Dept. of La Sapienza and Laboratório Associado de Computação e Matemática Aplicada - INPE, Brazil
2008-to date	La Sapienza	Member of the Centro Ricerca Aerospaziale Sapienza (CRAS)
2011-2013	La Sapienza	Member of the Board (Giunta) of the Mechanics and Aerospace Engineering Department
2017	La Sapienza	Promoter of an international cooperation agreement between Sapienza and ITA, Instituto Tecnológico de Aeronáutica, São José dos Campos, Brazil
2016-2018	La Sapienza	Member of the commission of the Consiglio d'Area Didattica (CAD-Aerospaziale) for the European Certification of the Quality of the courses in Ingegneria Aerospaziale (L), Ingegneria Aeronautica (LM) and Ingegneria Spaziale e Astronautica (LM) [EUR-ACE]

2016-to date	La Sapienza	Member of the Focus Group Aziende of the Consiglio d'Area Didattica. The group operates on three main lines of action: definition of the professional profile of the students, job placement and information on companies.
2018	La Sapienza	Cooperation with the Institute of Robotics and Mechatronics of DLR Oberpfaffenhofen -Weßling
2019	La Sapienza	Promoter for the establishment of a cooperation between Sapienza and Luleå University of Technology (Dep. of Computer Science, Electrical and Space Engineering).

In addition, Paolo Gasbarri helped with service to the Department organization by acting several times as a member of the commissions of the selection procedures for technical and administrative staff, as well as of the juries for the award of Post-Doc grants, PhD grants, scholarships. He also represented Sapienza in juries for prizes devoted to best dissertations in the Aerospace field.

III.B.4 Other Academic Appointments

This table, reporting appointments related to PhD courses management, has been included to provide the grounds to understand the national/international expertise gained/exploited in fulfilling PhD related tasks, including the tutoring which will be later reported in section IV.F as closer to Teaching area

2006-to date	Sapienza Univ. Roma, member of the board of the PhD course in Aeronautics and Space Engineering

including the participation to the relevant panels for admission of the PhD candidates.
In addition, Paolo Gasbarri participated, according to the following appointments, in the evaluation of the final dissertations (PhD juries):

2003	Università di Pisa
2005	Politecnico di Milano
2012	Università La Sapienza
2014	Università La Sapienza
2013	Università Roma 3
2016	ISAE-SupAéro Toulouse
2016	Università di Padova
2018	Università La Sapienza, final dissertation external evaluator for the PhD course in Energy and Environment, aerospace curriculum

Furthermore, related to evaluation of young researchers, Paolo Gasbarri recently helped with:

2017	Università di Pisa, Member of the jury for a Researcher position (RTDA)

III.C Lab-related accomplishments

This section has been added to address the specific requirement of the call about the build-up and management of labs (3rd sub criterium of the other activities evaluation).

Paolo Gasbarri promoted and created since 2006 together with the colleague prof. Giovanni Palmerini a joint Lab investigating Guidance, Navigation and Control of Space Multibody Structures, aiming to combine their specific experiences and advance in the promising filed of autonomous space robotics. In 2010 the lab has been settled in a larger and more convenient facility in via Salaria at the Urbe site. Such an expansion allowed a remarkable improvement in the experimental research with the design, procurement and operation of a large granite polite surface and of the free floating PINOCCHIO (Platform Integrating Navigation and Orbital Control Capabilities Hosting Intelligence Onboard), a modular structure with 3 degrees of freedom adopted in a number of experiments to understand the connections among flexibility and control and to analyse rendez-vous and in-orbit servicing. Furthermore, additional specific testbeds for spacecraft dynamics, robotic arms with different kinematic chains, end effectors, autonomous rovers have been in time added (the outcome of these experimental activities appear in most of the publication, see later part VII). Today the lab, still co-led by prof. Paolo Gasbarri and prof. Giovanni Palmerini, carries on cooperative research involving staff from the Mechanical and Aerospace Engineering Dept, the School of Aerospace Engineering, and the Electrical, Energetic and Astronautics Dept of La Sapienza. The lab currently hosts 4 PhD candidates, 1 visiting student and a number of graduate students all performing their research and theses.
At the same time, as any serious experimental activity should be based on a preparation involving an accurate evaluation of the expected behaviour, the numerical simulation activities have been continuously stressed along the years. In such a frame, after the move of the Lab to the site of Urbe, Paolo Gasbarri managed to create – and currently lead as responsible – a Lab for Multibody Space Structures Modelling at the Mechanical and Aerospace Engineering Dept site of San Pietro in Vincoli, where state-of-the-art CAD and FEM activities including co-simulation advanced techniques combining Matlab are typically carries on.
Notice that these activities (experimental and numerical ones) can be considered as instrumental in ensuring a significant part of the funding reported later in part VI.

Part IV – Teaching experience

This section refers directly to the sub criterium 1 (teaching) of both the individual and comparative evaluations

IV.A Undergraduate courses:

Year	Institution	Lecture/Course
1996/2000	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Teaching Assistant for the course of Strutture Aeronautiche (Titolare Prof. Balis Crema)
1996/2000	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Teaching Assistant for the course of Sperimentazioe delle Strutture Aeronautiche (Titolare Prof. Balis Crema)
1996/2000	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Teaching Assistant for the course of Costruzioni Aeronautiche (Titolare Prof. Renato Barboni)
2000/2004	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Tecnologie delle costruzioni Aeronautiche (10 Cfu)

2001/2003	Sapienza, Facoltà di Ingegneria. (sede di Latina)	Fondamenti di Aerospaziale (4 cfu)
2002/2008	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Laboratorio di Calcolo delle Strutture (4 cfu)
2003/2004	Sapienza, Facoltà di Ingegneria. (sede di Latina)	Costruzioni Aerospaziali (10 cfu)
2007/present	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Costruzioni Aerospaziali (10 and 9 cfu)

IV.B Graduate courses:

2004/present	Sapienza, Facoltà di Ingegneria. (sede di Roma)	Strutture Spaziali Articolate, now Multibody Space Structures (6Cfu) [since 2014 taught in English]

For this graduate course, taught in English (and indeed quite similar to the task foreseen in this call, and therefore object of the 1st sub criterion of the comparative evaluation), it is possible to indicate also the results of the students' evaluation (published by Sapienza/CAD Ingegneria Aerospaziale). Last available public results are indeed reported to allow an evaluation of the quality, as expressed also by the 1st sub criterion of the comparative evaluation.

Questionario ↓ Anno accademico →	2013-14	2014-15
Soddisfazione complessiva Media delle risposte al quesito: *- Sono complessivamente soddisfatto di come è stato svolto questo insegnamento?*	MEDIO	ALTO
Aspetti organizzativi Media delle risposte ai quesiti: *- Il materiale didattico (indicato e disponibile) è adeguato per lo studio della materia?* *- Le modalità d'esame sono state definite in modo chiaro?* *- Gli orari di svolgimento di lezioni, esercitazioni e altre eventuali attività didattiche sono rispettati?* *- L'insegnamento è stato svolto in maniera coerente con quanto dichiarato sul sito web del corso di studio?*	ALTO	ALTO
Azione didattica Media delle risposte ai quesiti: *- Il docente stimola/motiva l'interesse verso la disciplina?* *- Il docente espone gli argomenti in modo chiaro?* *- Il docente è reperibile per chiarimenti e spiegazioni?*	ALTO	ALTO

Marks read as follows: alto (average between 8 and 10), medio (6 to 7.9), basso (1 to 5.9). As a benchmark, the general average for the Laurea magistrale in Ingegneria Spaziale e Astronautica, the curriculum this course belongs to, was 6.8/7.7/7.6 in the three areas in 2013/14, 7.5, 8.1, 7.9 in 2014/15.

IV.C Post-graduate courses:

2002	Sapienza, (Master in Satelliti e Piattaforme Orbitanti)	Dynamics and control of Large Space Structures

In addition, there are some short courses and seminars, taught at post graduate and PhD level:

12/3/2013	Faculty of Sciences of Lisbon University	Advanced School on Spaceflight Dynamics and Control: Mini-course on Dynamics of Large Space Structures in Space Environment: Analytical vs. Numerical Modelling.
7/2015	Instituto Tecnológico de Aeronáutica, São José dos Campos, Brazil	Two weeks mini-courses on Space Structures Dynamics and Control and on Space Robotics
16/3/2016	University of Beira Interior, Covilha, Portugal	Advanced School on Spaceflight Dynamics and Control: Mini-course on multibody space systems

IV.D Other Training Activities (1 CFU courses for graduate and undergraduate students)

The following courses have been organized in collaboration with MSC Software, CIRA, ALTRAN, AGT and Thales Alenia Space Italia to provide students with specific know-how on some advanced topics:

2015-present	Sapienza, Facoltà di Ingegneria	Metodi e strumenti di calcolo per la prototipazione virtuale: l'analisi multibody e multidisciplinare
2018-present	Sapienza, Facoltà di Ingegneria	Design Methodology and Process: the Role of Simulation
2018-present	Sapienza, Facoltà di Ingegneria	Additive Manufacturing

IV.E Tutoring:

Paolo Gasbarri has been the advisor (as professor) of more than 60 graduate theses, 100 undergraduate theses, and co-advisor (as teaching assistant, assistant professor and professor) of about 70 theses; and supervisor for several student internships (Northrop Grumman Italia, Thales Alenia Space, DLR Germany) for undergraduate and graduate students from Sapienza Università di Roma.

He was the main advisor for three PhD (Dr Francesco Coppola now at Hankook Tyres Experimental Works; Dr. Riccardo Monti, currently at Thales Alenia Space; Dr. Andrea Pisculli, now at AVIO) and co-advisor for 2 Phd (Dr. Chiara Toglia, now at Thales Alenia Space, and Dr. Leonard Felicetti at present lecturer at Cranfield University) with researches related to the following topics: a) *New technologies for electronic packages for space applications: thermo-structural problems.*; b) *Thermal and technological problems in primary and secondary space structures*; c) d) *Advanced techniques for effective modeling and control space multibody under gravity and gravity gradient forces;* e) *Dynamics and control of space flexible manipulators for in orbit activities.*

He has been also the external advisor for a Brazilian PhD (Dr. Leonardo Chiwiakowsky, now Professor at Universidade de Caxias do Sul (UCS) in Applied Mathematics titled: *Método Variacional e Algoritmo Genético em Identificação de Danos Estruturais* (in collaboration with INPE-Brazil) and for a Brazilian Post Doc (Dr. Elcio G. Oliveira, now Researcher at Luleå University of Technology) in *Dynamics Simulations of Aerospace Slender Flexible Bodies*.

Currently he is the advisor of two PhD students with researches on structural dynamics and adaptive control of large space structures as antennas and musts and on Space Robotics generating low impact contacts on target satellites.

IV.F Courses organization and evaluation:

With respect to the specific requirement of the call about the capabilities in proposing, preparing, managing curriculum, and in the accreditation of the courses (2nd sub criterium of the comparative evaluation):

1996-present	Sapienza/CAD Ing. Aerospaziale: member of the panel on Aerospace Engineering courses and curriculum
2016	Member of the commission of the Consiglio d'Area Didattica (CAD-Aerospaziale) for the European Certification of the Quality of the courses in Ingegneria Aerospaziale, Ingegneria Aeronautica and Ingegneria Spaziale e Astronautica- EUR-ACE
2016-present	Member of the Focus Group Aziende of the Consiglio d'Area Didattica. The group operates on four main lines of action: the contribution to the definition of the professional profile of the students and to the evaluation of the learning outcomes activities; initiatives for job placement; organization of 1 CFU monographic courses in collaboration with Italian aerospace industries and firms

*The last two bullets were already reported also among the appointments devoted to help the Academic Organization (section III.B.3)

Part V - Society memberships, Awards and Honours

V.A Membership of Academic and Professional Institutions

Year	Title
2019-to date	Vice-Chair of the Commission 4 (Space Systems Operations & Utilization) of the International Astronautical Academy (IAA).
2017-2018	Leader Member of the Commission 4 (Space Systems Operations & Utilization) of the International Astronautical Academy (IAA).
2015-2017	Member of the Commission 4 (Space Systems Operations & Utilization) International Astronautical Academy (IAA).
2014-to date	Member of the NAFEMS Multi Body Dynamics Working Group
2013-to date	Member of the National Board of the Italian Association of Aeronautics and Astronautics
2008-to date	Member of the Technical Committee of the International Astronautical Federation (IAF)
2008-to date	Full Member of the International Astronautical Academy (IAA).

2007-to date	Chair of the Material and Structures Committee of IAF
2006-2008	Corresponding Member of the International Astronautical Academy (IAA)
2004-to date	Member of the International Organizing Committee of the International Astronautical Congress (IAC)
2003-to date	Member of the Material and Structures Committee of the International Astronautical Federation (IAF)
2000-2005	Italian Representative at the Structural and Material Panel of the NATO Research Technology Agency (RTO)
1993-to date	Member Italian Association of Aeronautics and Astronautics (AIDAA)

V.B Roles and appointments at Specialist Conferences

Invited speaker at the following conferences:

2011	ISAEA 2011, International School of Aerospace Engineering Applications- CONTROL THEORY, Bertinoro, Italy
2012	8th International workshop and Advanced School Spacecraft Dynamics and Control (Porto, Portugal)
2016	10th International workshop and Advanced School Spacecraft Dynamics and Control (Covilha, Portugal)
2018	IAA SciTech Forum 2018, Moscow

Conference Organization tasks:

2007-to date	Coordinator and Chair of the Materials and Structures Symposium of the International Astronautical Federation
2003-to date	International Astronautical Congress – Technical Committee member, rapporteur for the session on "Dynamics and Microdynamics" (2003-2005), co-chair for the session on "Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures)" (since 2005) and co-chair for the interactive session on Materials and Structures (since 2016)
2019	Member of the organizing committee of the XXV AIDAA International Conference, Rome

In addition, there is the service as session chair at several national and international Conferences as the AIDAA National Congresses (2007-2009-2015-2017), the IAA Dynamics and Control of Space Systems (DYCOSS) Conferences (Lisbon 2012 and Rome 2014), the IAA Conferences on Small Satellites (2014 and 2017), the IET Space Robotics Symposium at the University of Strathclyde in Glasgow (2015), the IAA SciTech Forum at the RUDN University in Moscow (2018).

V.C Editorial Boards and Peer Review Invitations

Member of the Editorial Board (Co-Editor) of *Aerotecnica Missili and Spazio*, since 2008.
Member of the Editorial Board (Co-Editor) of the *International Journal of Aerospace Engineering* since 2018.

Reviewer – either in recent years or at the present time - for several specialist, highly ranked and indexed journals, including:

- *Acta Astronautica, Advances in Space Research, Aerospace Science and Technology, Journal of Sound and Vibration, Composite Structures, Journal of the Franklin Institute* (Elsevier)
- *Journal of Aerospace Engineering* (ASCE)
- *Journal of Guidance, Control and Dynamics and Journal of Spacecraft and Rockets* (AIAA),
- *Proceedings of the IMechE, Part G: Journal of Aerospace Engineering,* and *Part I: Journal of Systems and Control Engineering, Journal of Mechanical Engineering Science,* JMES (SAGE)
- *Sensors, Applied Sciences, Machines* (MDPI)
- *Space Science Review, Multibody System Dynamic, Journal of Optimization Theory and Applications* (Springer-Nature)
- *International Journal of Aerospace Engineering* (Hindawi)
- *IEEE Transactions on Automation Science and Engineering* (IEEE Robotic and Automation Soc.)
- *Aircraft Engineering and Aerospace Technology* (Emerald Pub.)
- *International Journal of Engineering, Science and Technology* (ENGG)
- *Aerotecnica Missili e Spazio* (AIDAA, now in cooperation with Springer-Nature)

Regarding this activity, Paolo Gasbarri has been awarded a "*Certificate for Outstanding Contribution in Reviewing"*:

January 2017 by the Editor of *Aerospace Science and Technology*.
June 2018 by the Editor of *Mechanical Systems and Signal Processing*

Part VI - Funding Information [grants as PI-principal investigator or I-investigator]

For the sake of clarity, according to the categories envisaged in the call, the information about grants will be divided in the two lists of scientific research programs (addressing specifically the 1st sub criterium of the individual evaluation, other activities section, and the 3rd sub criterium of the comparative evaluation) and industrial programs (partly addressing the 2nd sub criterium of the individual evaluation, section about other activities, while the formation aspects were dealt with Part IV.D).
The following table reports funding information since 2000. Grant value reported as "team" or "Rome" are the parts of the total funding relevant to the Research Team co-coordinated by Paolo Gasbarri indeed in full responsibility or co-responsibility.

TAB VI.A Scientific Programs

Year	Role	Funding Inst.	Program	Grant value(k€)
2019-2021	PI	ESA	Advanced collocated active control of large antennas structures. (prime Sapienza, sub-contractor TAS-F)	400

2017/19	PI	ESA	TECHNICAL SUPPORT ACTIVITIES FOR VEGA W.O 1/ VEGA-C Vehicle Structural Dynamic Assessment	34
2017	Recipient	MIUR	FABR (attività base ricerca)	3
2017	PI	Smart Structure Solutions	Monitoraggio di infrastrutture basato sull'integrazione di dati ottenuti grazie a dispositivi di sensoristica integrati	160
2015/16	PI	FiLaS Lazio	Laboratori a supporto Attività Spaziali	7
2015	I	Grandi Attrezz, Sapienza	3D prototyping: additive manufacturing technologies….	450 (team)
2015	PI	Sapienza	Multibody Techniques and Slosh Suppression on Flexible Satellites by Hybrid Control and Input Shaping	4
2014	I	Sapienza	Advanced composite structures with energy harvesting capability	10 (team)
2013/15	I	ESA	Weak GNSS Signal Navigation on the Moon	250/ Roma 55
2013	PI	ESA	Implementation of the MAC approach for Mode Shape Re-Ordering in DCAP	15
2012/13	PI	ESA	Flexibility in a multibody software for terrestrial and orbital applications	40
2011	PI	Sapienza	Tecniche per la sintesi dinamica e di controllo di strutture flessibili in orbita	8
2009	I	Sapienza	Tecniche integrate di navigazione satellitare e ottica	15
2007/09	I	ESA	Novel Time Synchronization Techniques for Deep Space Probes	40 (team)
2007/09	I	MIUR	(PRIN) Tecniche Tecnologie e Test per Formation Flying	142/Roma 32
2001	I	Fac. Ing.	Nuove metodologie per l'analisi ed il controllo delle vibrazioni nelle strutture d'impiego aeronautico e spaziale	4
2003/05	I	MIUR	(PRIN) Realizzazione di sensori in fibra ottica criogenici e per alte temperature e integrazione in materiali compositi ceramici e metallici per prove di monitoraggio strutturale	190/Roma 98
2000/02	I	MIUR	(PRIN) Modelli di Dinamica Strutturale e Sensibilita' Aeroelastiche per l'Ottimizzazione Multidisciplinare di Configurazioni Aeronautiche Innovative Navigazione relativa per il volo in formazione	322/Roma 62

TAB VI.B Industrial Programs

Year	Role	Funding Inst.	Program	Grant value(k€)
2018	I	EDA	Virtual and Real Constellations of Satellites	164 (team40)
2017	I	GAUSS	Small Satellite Platform Architecture	20 (team)

2014/17	PI and Manager	MIUR	Cluster SAPERE/STRONG Pride Robotic Operations	41
2014/17	I and Manager	MIUR	Cluster SAPERE/Mission and System Architectures	130 (team)
2014/17	Manager	MIUR	Cluster SAPERE/ Downstream Services and Data Exploitation	94 (team)
2012/14	PI	Astrium	Study on Debris Removal by means of Robotic Arms	85
2010/11	PI	TAS/ESA	New Design Methodologies to Control Very Large Space Flexible Structures	20

*The industrial (three years) research program, defined in the frame of CLUSTER Aerospaziale Nazionale, called Progetto Sapere Safe and Sapere Strong required the coordination of three Sapienza Teams with several researchers from different departments (DIMA, DIAEE, CRAS, etc). In this frame Paolo Gasbarri played different roles as representative of La Sapienza: a) **PI** of the task titled Pride Robotic Operations in SAPERE/STRONG; b) **I** of some tasks of Mission and System Architectures in SAPERE/SAFE. He was also responsible for the management of the overall activities of Sapienza with respect to Thales Alenia Space (coordinator of the SAPERE Project) and to MIUR. Finally, he was representative of La Sapienza in the Steering Committee of project Sapere. The total budget managed by Paolo Gasbarri during this industrial research program was 265K Euro.*

In addition to the projects listed, it is possible to mention the participation as investigator – and sometimes as proposal manager too - in a number of the projects funded by ASI and MIUR (PI for Sapienza teams prof. P.Santini) in the years from 1996 to 2000. Moreover Paolo Gasbarri participated to several research projects financed by Sapienza to improve interdepartmental laboratories.

Part VII – Research Activities

In the following, required short survey of the main research interests it has been attempted to provide some – even really partial - reference with respect to the published work. Indeed, indications like **[x]** are referred to the list of publications shortlisted for the evaluation, while – when a letter is also present – they instead refer to the complete list of publications that has been attached in a separate file to offer a global view of the activities carried on.

Keywords	Brief Description
Dynamics of Composite Wing Structures	The focus of this research activity was the modelling of composite wing box with a reduced order of degree of freedom for preliminary design of swept composite wings under static and dynamic loads. Different aspects for modelling considering the coupling effects between the anisotropicity of the materials and the wing geometric was analysed in view of aeroelastic applications. The results were published in [A52, A54, A55].
Aeroelasticity and Optimization	The follow up of the researches on dynamics of composite wing structures brought to some researches on the preliminary design of composite wing-box structures by taking the mutual interaction between the so called aeroelastic-tailoring and the wing swept angle on the aeroelastic performances of large aircraft [E97, E98] into account. The unsteady aerodynamic, based on the kernel function method, was developed in [A53] and then applied to determine the Generalized Aerodynamic forces. The results of this researches were published in [A50], [**16**], and [C7, C9] where the aeroelastic optimization of a composite wing was studied by introducing a multilevel/multidisciplinary approach. This topic, as well as the previous one, seems limited to the aeronautical field. Instead, it could mark the begin

	of a new cooperation in SIA where there is the interest to novel, booming suborbital flights is already present, with possible links to the activities of the colleagues of Flight Mechanics (there is a course on re-entry vehicles), Advanced Controls, Space Systems.
Inverse Problems for Structural Dynamics	The research topic is that of inverse problems in the field of structural dynamics [A47].Unlike the different approaches and methodologies that are used today to study these problems, based essentially on the analysis and comparison of the vibration modes and frequencies of the structure, the idea was to address the inverse problem as a optimization problem solved through the use of the Variational Method. The Variational Method, when applied to the solution of inverse problems, employs the approach of the added equation, coupled to the conjugate gradient method. The proposed methodology has led to extremely interesting results also for damage detection problems [A44, A45, A46], [E77, E81]. The same warning about applications not limited to classical Aeronautics already proposed for previous subjects extends to this area.
Thermal Control and Design of Space Systems	This research topic is essentially founded on solving thermal problems in micro electronic equipment insight space antennas. The use of pyroelectric material was proposed and experimental successfully tested in Thales Alenia Space to convert thermal flux in electrical charges the results can be found [A33, A34]. Further aspects related to thermal design for space applications can be found in [A12] and [A37]. The topic could offer the beginning of a new collaboration at SIA, where there is a course on Thermal Control and Thermomechanical Interactions in Space Vehicles.
Dynamics and Control of Large Space Structures	To address the guidance and control laws for large space orbiting structures it is firstly necessary to "correctly" define the space environment in terms also of its perturbing effects as studied in [A51, A57] and [B2]. Then orbital dynamics of flexible spacecraft must be developed by considering a suitable choice of kinematic variables and "filtered" equation able to catch the large differences due to the difference in time scales and space scales appearing in the governing equations. Along the years different studies have been performed by taking these cited issues into account, relevant results can be found in [**14**], [A30, A33, A38]. Other publications in the general list reports the contribution to several aspects of the dynamic and micro-dynamics of large flexible spacecraft including mission design and operational aspects, always looking at a correct understanding of the dynamics environment to decrease the required effort. Among sample papers [**5**] investigates the relative dynamics of tethered satellite and the attraction/repulsion behaviour which would provide a finely tuned control: specifically, the paper shares the interesting geometrical characteristics associated with the (yet-to-be-proven) electrostatic technique. [**9**] aims to experimentally investigate the vibration control the associated to the attitude motion of the spacecraft. It is well known that a time delay in a control system reduces the stability margin. In this work it was numerically and experimentally demonstrated that, by introducing a delay compensation by using a model-based prediction algorithm of the dynamics of flexible appendages the attitude instability problem can be eliminated. Other issues relevant to the interaction between attitude-control and flexible dynamics are studied in [**12**] and in [**3**]. The latter analyses some fundamental aspects related to the coupling effects among the dynamics, the vibration of flexural

	appendages and the fluid-sloshing motion in a spacecraft during station keeping or attitude manoeuvres. The research activities in the field of dynamics and control of large space structures led to the collaboration with a Chinese research group in the design of the mechanisms for deployment of mesh antennas [A1].
Active Vibrations of Flexible Structures	The ability to use intelligent materials for the control of structural vibrations has been widely explored in the space sector during the last decade. To this end, the effects induced by orbital perturbations [B2] and by the adjustment maneuvers on the dynamics of very large space structures have been studied and methods based on the use of the so-called "intelligent structures" are proposed to dampen their induced vibrations as reported in [C10], [E79, E102]. Smart materials were also proposed to reduce vibrations induced on space manipulators during on orbit maneuvers [**13**]. Other approaches based on passive viscous dampers were also explored in [A42]. The synergy between piezo electric actuators and sensors coupled with ad hoc attitude dynamic control was also investigated experimentally in [**1**] showing that the classical attitude control of large space structure if co-designed with the active vibration control produce best results not only for performances but also in terms of attitude control power consumption.
Multibody Dynamics for Space Applications	In the context of the structural problems of orbiting spacecraft like large space structures and/or complex systems such as space manipulators mounted on orbiting platforms, a number of studies were carried out on dynamic modelling of multibody systems in a space environment. In this frame different researches, also funded by the European Space Agency were developed among which it is worth to mention: a) studies on the interaction among the attitude, the orbital and the structural dynamics with the guidance and the control of complex space systems [**11**] [A49, A48, A38, A17]; b) optimization of rendezvous and docking maneuvers between flexible satellites [A40].
Manipulators	Space manipulators offer a challenging domain to combine the structural dynamics and the control skills. Advanced, modelling approaches were investigated (among the multibody approaches) – also to tackle the inverse kinematic problem which characterizes the multiple link arms - and a number of control schemes – optimal in time or in torque requirements or in the capability to accommodate a poorly know dynamics of the target - were studied and simulated [A36]. The optimization of the deployment phases of robotic arms and studies on deployment control with minimum interaction with attitude dynamics were addressed in [**10,15**]. The contact problems of the manipulator end-effector during the grasping phase are also an important aspect in space missions as studied in [**2**] and [A6] whereas the post- grasping maneuvers between a chaser and a target satellite are discussed in [**6, 7**] also considering the mutual interaction of rigid and flexible dynamics with the control. In all the cited works mathematical formulations and control schemes are also presented. Works [A9, A25, A27] report some initial experimental studies to implement and verify the control algorithms.
Floating Platform and experimental activities	PINOCCHIO, a floating Platform Integrating Navigation and Orbital Control Capabilities Hosting Intelligence Onboard, whose design and operations are pursued at the Joint Lab for *Guidance-Navigation and Space Multibody Structures*, was deemed to simulate frictionless planar motion. In

	time, PINOCCHIO enabled a number of experimental studies – always based on the original autonomous platform having 3 degrees of freedom (along the horizontal axis and about the vertical one – i.e. the yaw). The modular avionics allowed to investigate different GNC loops for proximity manoeuvers considering inertial and visual sensors, and a simplified star tracker model too. On the other hand, by completing the platform with flexible appendages – and even with a small robotic arm, it was possible to investigate the coupling between structural flexibility or the arm manoeuvers and the commanded attitude. To notice that elastic displacements have been sensed with either piezo accelerometers or visual techniques. Publications [**8**], [A18, A29] and [D5, D6, D7] provide some insight about this research path. Moreover, the same platform was used to experimentally test the synergy on monitoring the elastic deformations of the flexible appendages by means of the embedded piezoelectric sensors and on-board cameras [**1**]. Finally, the platform was used to verify, experimentally, the effects of a high-fidelity filter on the attitude stabilization of a flexible spacecraft [A3]
Debris Removal	In the last decade interests in proximity operations and manoeuvres for space debris removal increased in the space community. In this frame researches focussed on the removal of space debris by means of robotic arms where developed. According to a specific grant from Astrium (now Airbus Defence and Space), targets of interest were identified in spent final stages, orbiting since a long time and with poor knowledge of the resulting structural and inertial properties ([**4**], [E30] to summarize the contributions). A very interesting aspect is given by the proposed co-simulation approach, where the in-house Matlab code is capable to take into account space environment characteristics and control architecture, while a commercial codes as MSC.ADAMS – although lacking the space perspective - offers a perfect representation of the mechanical interface at the grasping, including complex and already validated contact forces models necessary to test and verify impedance control approaches before grasping operations [C1]. It is worth to note that this research clearly matches the know how in the field of structural analysis as it requires the capability to understand and effectively manage the poorly known structural integrity of elements left, even for very long period, in an aggressive environment with strong (and very frequent in LEO) thermal cycling and hit and weakened by radiations. This is a typical aerospace structures and material topic, to be obviously carefully integrated in the overall mission design.
Application of Visual Navigation Techniques to Space Structures Dynamics	Electro-optical sensors are increasingly appealing due to the improved performance and to the accuracy granted (basically the only suitable for precise proximity operations). Furthermore, current computational power availability allows to consider image-based navigation. Sophisticated visual techniques including feature identification methods as SURF or SIFT that can be employed also with moderate cost of the equipment allowed to carry on experimental studies with testbeds fed by passive sensors and dedicated to docking or to proximity navigation [**8],** [A18,A28,A29], [D7] these techniques were also applied for the identification of the dynamic behaviour of flexible appendages [A40] which fall in the Operational Modal Analysis Techniques.

Part VIII – Summary of Scientific Achievements

The full contribution in terms of scientific papers has been reported in the attached "Complete List of Publications" (file name: 8_Elenco_Completo_Pub_PGasbarri.docx), where a possible partition among different categories (journal article, contributions to specialist publications, indexed publications, papers accepted and presented to conferences on the basis of the abstracts or peer reviewed process) has been attempted. According to the original form proposed, relevant global bibliometric parameters are instead reported here, considering both Scopus and the more restrictive Web of Science (WoS) databases. The evaluation of the total IF is made on the basis of 41 papers for which the impact factor (years 1997-2017) is officially available.

The academic seniority for the evaluation of the normalized H index is here considered starting at the beginning of the Academic career at University of Rome La Sapienza as Researcher, i.e. 1996 leading to a 23 years value. The 1991 and 1993 publications present in the indexes are the result of some graduation studies; in the following period, till 1996, the candidate was an Alenia Space employee and any publishing initiative needed to be stopped.

Product type	Number	Data Base	Start	End
Papers [international]	**113**	Scopus	1991	2018
Papers [international]	**56**	WoS	1993	2018

Total Impact Factor	**38.939**
Total Citations	**861** (Scopus) - **452** (WoS)
Average Citations per Product	**7.62** (Scopus) - **8.07** (WoS)
Hirsch (H) index	**18** (Scopus) - **15** (WoS)
Normalized H index*	**0.78** (Scopus) - **0.65** (WoS),

*****H index divided by the academic seniority.

With regard to the researches related to space topics, Paolo Gasbarri has been recognized among the top five scholars/authors (indeed N.2) for publishing papers in the Elsevier journals during the years 2011-2016.

Considering the full technical contribution, it could be useful to remark that – with respect to the contributions indexed in Scopus, the database allowing such a kind of analysis – 108 papers out of 113 – according to Scopus – belong to Engineering subjects, and the H index equal to 18 is still fully valid for this large subset, clearly the most interesting for this call.

With respect to co-authors, the total number of colleagues involved is 61 with respect to the 113 papers (always according to Scopus= and there are two only extreme cases of a 8-coauthors paper (cooperation ESA-TAS(I)-Sapienza) and of a 7-coauthors paper (a new cooperation with Chinese scientists, where Paolo Gasbarri is the only foreign researcher involved).

Part IX – ***Adherence to the evaluation criteria***

With the only scope to help with the link between the information included in this inevitably schematic CV obeying to the general model prescribed by the universal call template and the set of evaluation criteria specific to this call (Art.1), the candidate includes the following "compliance" table:

Evaluation	Section and sub criterium	Part of this CV where relevant data have been reported
Individual	Teaching / volume, continuity and quality of the activities belonging to ING/IND-04 area	Part IV (all in ING/IND-04 area), with quality specifically reported in section IV.B for courses similar to the ones foreseen in the call as main task.
Individual	Teaching / tutoring in courses and PhD	Part IV, sections IV.D (courses) and IV.E (PhD), as well as part III.B.4 concerning the general expertise on managing and tutoring PhD
Individual	Research / Volume, quality and continuity referred to ING-IND/04 topics	Part VII, as well as the shortlisted publications and the attached global publications' list
Individual	Research / International recognition	PART V, sections V.A, V.B and V.C, and also Part III, section III.A for teaching appointments abroad, section III.B.1 for international appointments, section III.B.2 for international invitations as evaluator
Individual	Other activities / Research Proposals of high international interest	PART III.B.1 as co-author of prestigious Agardograph, part VI as ESA and Astrium contracts have been awarded on a competitive basis, showing indeed the actual stakeholder interest
Individual	Other activities / Partnership with aerospace firms	Part VI, Tab VI.A and VI.B (TAS-F, Astrium, TAS-I, GAUSS)
Individual	Other activities / Build-up and management of Labs	Part III, section III.C
Individual	Other activities / participation and cooperation in Academic Organization	Part VI, Tab VI.B and note about help in managing the complex situation of SAPERE contract in Sapienza
Comparative	Teaching ING/IND-04 in English	Part IV, section IV.B
Comparative	Teaching Effectiveness through proposal of valuable programs	Part IV, section IV.F
Comparative	Research skills especially in topics of interest of national and international agencies	PART VI, TAB VI.A (multiple important studies for ESA), TAB VI.B (EDA and ESA)
Comparative	Help in Academic Organization	Part VI, Tab VI.B and note about help in managing the complex situation of SAPERE contract in Sapienza; part III, section III.B for help in Education-related boards,

Part X– Selected Publications

List of the publications selected for the evaluation. Each publication report title, authors, reference data, journal IF (if applicable), citations, press/media release (if any). Publications are listed in descending chronological index to highlight as required the contributions of the last 5 years, and their order corresponds to the label used for the attached documents.

1. M.Ribet, M.Sabatini, L.Lampani, P.Gasbarri (2018) Monitoring of a controlled space flexible multibody by means of embedded piezoelectric sensors and cameras synergy, Journal of Intelligent Material Systems and Structures, Vol. 29(14) 2966–2978, 2018

2. A.Stolfi, P. Gasbarri, M.Sabatini (2017), A combined impedance-PD approach for controlling a dual-arm space manipulator in the capture of a non-cooperative target, ACTA ASTRONAUTICA, Vol. 139, Pages 243-253, October 2017 IF=2.22, citations WoS 4, Scopus 8.

3. P. Gasbarri, M. Sabatini, A. Pisculli, (2016), Dynamic modelling and stability parametric analysis of a flexible spacecraft with fuel slosh, ACTA ASTRONAUTICA, Vol.127, October-November 2016, Pages 141-159, IF=1.536, citations WoS 12, Scopus 14.

4. L.Felicetti, P.Gasbarri, A.Pisculli, M.Sabatini, G.B.Palmerini, (2016), Design of robotic manipulators for orbit removal of spent launchers' stages, ACTA ASTRONAUTICA, Volume 119, Feb-Mar.2016, Pages 118-130, IF=1.536, citations WoS 14, Scopus 23.

5. M. Sabatini, P. Gasbarri G.B. Palmerini, (2016), Elastic issues and vibration reduction in a tethered deorbiting mission, Advances in Space Research, Vol.57 Issue 9, 1 May 2016, Pages 1951-1964, IF=1.401, citations WoS 10, Scopus 11.

6. A.Pisculli, P. Gasbarri (2015), A Minimum State Multibody/FEM Approach for Modelling Flexible Orbiting Space Systems, ACTA ASTRONAUTICA, Vol.110, May–June 2015, Pages 324–340, IF=1.095, citations WoS 10, Scopus 19.

7. P. Gasbarri, A. Pisculli (2015), Dynamic/control interactions between flexible orbiting space-robot during grasping, docking and post-docking maneuvers, ACTA ASTRONAUTICA, Volume 110, May–June 2015, Pages 225-238, IF=1.095, citations WoS 21, Scopus 27.

8. M. Sabatini, P. Gasbarri G.B. Palmerini, (2015), Delay Compensation for Controlling Flexible Space Multibodies: Dynamic Modeling and Experiments, Control Engineering Practice, Vol.45, Dec. 2015, pp. 147-162, IF=1.83, citations WoS 15, Scopus 21.

9. P. Gasbarri, M.Sabatini, G.B. Palmerini (2014), Ground Tests for Vision Based Determination and Control of Formation Flying Spacecraft Trajectories, ACTA ASTRONAUTICA, Vol.102, Pages.378-391, 2014, IF=1.122, citations WoS 16, Scopus 25.

10. P. Gasbarri, M. Sabatini, N.Leonangeli, G.B. Palmerini (2014), Flexibility Issues in Discrete On-Off Actuated Spacecraft, ACTA ASTRONAUTICA, Vol.101, Pages. 81-97,2014, IF=1.122, citations WoS 13, Scopus 35.

11. A.Pisculli, L.Felicetti, P.Gasbarri, G.B.Palmerini, M.Sabatini (2014), A reaction-null/Jacobian transpose control strategy with gravity gradient compensation for on-orbit space manipulators. Aerospace Science and Technology, Vol.38, Pages.30-40, October 2014, IF=0.94, citations WoS 20, Scopus 30. *This publication, submitted to VQR11-14 has been awarded with the maximum score (Excellence, mark 1.0) therefore remarkably contributing to the ranking of Sapienza*.

12. P. Gasbarri, R. Monti, M. Sabatini (2014), Very Large Space Structures: Non-Linear Control and Robustness to Structural uncertainties, ACTA ASTRONAUTICA Vol. 93, Pages 252-265,2014, IF=1.122, citations WoS 28, Scopus 39.

13. M. Sabatini, P. Gasbarri, R. Monti, G.B. Palmerini (2012), Vibration Control of a Flexible Space Manipulator During On Orbit Operations, ACTA ASTRONAUTICA, Pages 109-121, Vol.73, 2012, IF=0.701, citations WoS 49, Scopus 87. This publication, submitted to VQR11-14 has been awarded with the maximum score (Excellence, mark 1.0) therefore remarkably contributing to the ranking of Sapienza.
This article was long-time listed in the journal website among the five top cited papers recently published

14. P.Gasbarri, R. Monti, G. Campolo, C. Toglia, (2012), Control-Oriented Modelization of a Satellite with Large Flexible Appendages and Use of Worst-Case Analysis to Verify Robustness To Model Uncertainties Of Attitude Control, ACTA ASTRONAUTICA, Vol.81,Issue1,December2012,Pages 214-226, IF=0.701, citations WoS 16, Scopus 18.

15. C. Toglia, M. Sabatini, P. Gasbarri, G. Palmerini (2011). Optimal Target Grasping of a Flexible Space Manipulator for a Class of Objectives, ACTA ASTRONAUTICA, Vol. 68, Issues 7-8, Pages 1031-1041, April- May 2011, IF=0.614, citations WoS 17, Scopus 27.

16. P. Gasbarri, L.D. Chiwiacowsky, H. F. De Campos Velho (2009), A hybrid multilevel approach for aeroelastic optimization of composite wing-box, Structural And Multidisciplinary Optimization, Pages 607- 624, Volume 39, Issue 6, 2009, IF=1.516, citations WoS 10, Scopus 11.

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