SMART NEST

Report on the Final Open Workshop

Venue:	Institute of Fundamental Technological Research Warsaw, Poland
Project Title:	Smart Technologies for Transport Safety – Innovation Cluster Nesting (Smart-Nest)
Date:	15-16 October 2015

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Contents

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Introduction

2-day thematic AIA'15 Workshop was held on October 15-16, 2015. It took place at the Institute of Fundamental Technological Research (IPPT PAN) in Warsaw. The Workshop was devoted to Adaptive Impact Absorption problems and related areas as well as the results of the SMART NEST Project.

The first day of the Workshop was devoted to the Adaptive Impact Absorption problems/technologies. The following topics were considered for discussion:

- optimum design and control of AIA systems,
- design and optimization of shock-absorbers (piezo-valve based, MRF-based, etc.),
- inerter devices in AIA applications,
- global and local adaptivity in impact absorption process,
- impact load identification (online and offline),
- new concepts of AIA systems.

The main goal was to start a new forum for discussion and exchanging ideas in the field of the Adaptive Impact Absorption.

The second day of the Workshop was dedicated to the results of the SMART-NEST Project. It consisted in two sessions. The first one was concerned with the short summaries from the Coordinator and Project Partners. In addition, the Weigh-on-Motion for Copernicous Science Centre in Warsaw was presented. During the last session selected fellows shared their experiences and accomplishments gained within the SMART-NEST Project.

The Workshop gathered together about 50 participants from many European countries. The invitation was accepted by exceptional speakers such as Professor John Mottershead, Professor Fabio Casciati, Professor Alfredo Guemes, Professor David Wagg, Professor Neil Sims, Professor Andre Preumont and Professor Wiesław Ostachowicz. The complete list of participants in the Workshop is attached as Annex A.

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First day of the Workshop – Adaptive Impact Absorptions problems

The first day of the Workshop was devoted to the Adaptive Impact Absorption problems/technologies. This day consisted in four sessions during which many high-quality keynote speeches were presented with topics covering optimum design and control of AIA systems, design and optimization of shock-absorbers (piezo-valve based, MRF-based, etc.), inerter devices in AIA applications, global and local adaptivity in impact absorption process, impact load identification (online and offline) as well as new concepts of AIA systems. The main goal was to start a new forum for discussion and exchanging ideas in the field of the Adaptive Impact Absorption.

The complete programme for the Workshop is given in Annex B. The major issues addressed within four sessions of the first day included:

Session 1

This session was concerned with the following: the tuned-inerter-damper for vibration suppression, prestress accumulation-release (PAR) for damping of free vibrations in frame structures, preliminary study of helicopter crashworthy stages adapted to different impact conditions.

Session 2

The topics discussed during session 2 are: modeling and experimental validation for low and high energy impacts on composite aircraft structures, Active Damping of Suspension Bridge, adaptive control for crash and impact, vibration control in smart buildings subjected to earthquake excitation and SPINMAN device for inertial impact absorption.

Session 3

This session dealt with pole placement and active vibration control in structures, observer-based linearised semi-active control, novel type of tuned mass damper with inerter which enables changes of inertance as well as high performance valves for adaptive pneumatic impact absorbing systems.

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Session 4

The session 4 concerned with soil-structure interaction for helicopter impact, angular location of the impact on composite structure using single rosette, Stepping Piezo Actuators (SPA) and a conceptual study of a pneumatic adaptive absorber for mechanical energy dissipation.

Complete presentations from the first day of the Workshop can be found on the website http://smart.ippt.gov.pl/index.php?id=events_aia15agenda.

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Second day of the Workshop – SMART-NEST Project

The second day of the Workshop was dedicated to the results of the SMART-NEST Project.

'Smart Technologies for Transport Safety -Innovation Cluster Nesting' Project has started on 1st January 2012 and lasts 48 months. The main objective of the project is to establish a vibrant European-level network of three SMEs and three Academic partners in a new and rapidly emerging research field at the crossroads of the structural engineering and smart technologies. The participants link up their cross-sectoral expertise to support their researchers in pursuing an interdisciplinary career and to provide them a cohesive training environment.

The SME partners are:

- **Adaptronica Sp. z o.o.** (Warsaw, Poland)

ADAPTRONICA is a spin-out SME, having its roots in the Institute of Fundamental Technological Research of the Polish Academy of Sciences (IPPT PAN) in Warsaw. The majority of its staff are young and highly-qualified engineers, strongly motivated to implement their technological ideas for the benefit of various industries. ADAPTRONICA is an SME of R&D profile, providing consulting services, offering products and doing research related to the field of smart technologies.

- **I-Deal Technologies** (Saarbrücken, Germany)

I-Deal Technologies is a Spin-Off company of Fraunhofer Society with scientific background. It is located in Saarbrucken in Germany. It has developed a novel UT technology. They are introducing a new quality of ultrasonic testing. I-Deal Technologies GmbH is considered to be a technological leader in the UT market.

- **Cedrat Technologies** (Grenoble, France)

CEDRAT TECHNOLOGIES is a SME located in Meylan, Inovallée, the French Innovation Valley near Grenoble. It is recognized as a highly innovative company and has received several awards. CEDRAT TECHNOLOGIES offers off

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the shelve mechatronics products including piezoelectric & magnetic actuators, motors, mechanisms, transducers and sensors with corresponding drivers & controllers. These mechatronics products are used for scientific and industrial applications requiring features such as: micro & nano positioning, generation of vibrations, micro-scanning, fast & precise motion control, active control of vibrations, energy harvesting.

The Academic partners are:

- **Institute for Fundamental Technological Research (Poland)**

The Institute of Fundamental Technological Research (IPPT PAN) has been founded in 1953. The Institute, with its staff of about 120 highly qualified researchers, is one of the biggest research institution within the structure of the Polish Academy of Sciences. The main mission of the Institute is to pursue high quality, up-to-date research activities. As its names suggests, the Institute is oriented towards basic theoretical and experimental engineering research. Over the years the Institute has established itself as a leading research institution, making significant contributions to many science and engineering areas, promoting successfully novel research directions and enjoying high reputation both in and out of Poland. IPPT PAN is the Coordinator of the SMART-NEST Project.

- **Saarland University (Germany)**

Saarland University is a modern university within the Saar-Lor-Lux region – a dynamic part of Europe defined by the shared borders between Germany, France and Luxembourg. It was founded in 1948 in Homburg in co-operation with France and is organized in eight faculties that cover all major fields of science. The university is particularly well known for research and education in computer science, computational linguistics and materials science, consistently ranking among the top in the country in those fields. The university campus and the surrounding area is home to several specialized research institutes, affiliated with various high-profile independent research societies and private companies, focused on primary and applied research.

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- **Ecole Centrale de Lyon (France)**

The École centrale de Lyon, founded in 1857, is one of the oldest graduate schools in France. It is considered as one of the most prestigious French grandes écoles of engineering continuously ranking as one of the top six French engineering research institutions for the post bachelor study. The university is one of the six members of the Centrale Graduate School (Lille, Paris, Marseilles, Nantes, Beijing). The school is well-reputed for educating and training highly skilled engineers with a minimum degree of BSc through many specialized postgraduate programs. Ecole centrale de Lyon is a founding member of University of Lyon, Pole Research and Higher Education (PRES) established as a public establishment of scientific cooperation. The school excels in the research attached to acoustics, biosciences and nanotechnology.

Administrative presentations – Session 1

Coordinator and representatives of the Project Partners summarized the 4-year cooperation (2012–2015) in the field of connecting science and business. Referring to statistics, 30 secondments took place during the Project and 23 researchers had the opportunity to gain new experiences during intersectoral (Academia – Industry) secondments/exchanges. The shortest secondment lasted 2 months and the longest – 16 months. The median duration of the exchange amounted to 4 months. Research topics that were developed within the Project are among others:

- defect monitoring in piping systems,
- nonparametric monitoring of structures,
- semi-rigid joints of SHM of skeletal structures,
- modeling and monitoring of prestressed fibre composites,
- SHM of large CFRP composite plates using Lamb waves excited by piezoelectric patches (PWAS),
- supervisory platform for LWDS45-2 (pulse-echo) device intended for ultrasonic SHM based on piezoelectric patches,
- virtual supports for substructural health monitoring,
- railway weigh-in-motion systems,

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- vibroacoustics of linear stepping piezo-actuators,
- controlled snap-through effects for fast pneumatic valves,
- orientation/position tracking with intertial measurements units,
- on-off methods for semi-active vibration control,
- eddy current damping techniques for space applications,
- data fusion and hybrid sensing system.

In addition, the Weigh-in-Motion demonstrator for Copernicus Science Centre in Warsaw, the most popular interactive educational science museum in Poland, was presented.

Figure 1. Educational interface of the demonstrator in the Copernicus Science Centre. Vistula river in the background. The instrumented railway bridge is nearby, to the right (no seen on the photo)

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Presentations of the fellows – Sessions 1 and 2

The last presentation in the first session and the second session of this day were devoted to the experiences and accomplishments gained during the secondments. Selected fellows gave the following presentations:

- Mr. Grzegorz Mikulowski 'Smart Hybrid Semi-Active Dampers'
- Mr. Olivier Bareille *'Long-range SHM in structured media'*
- Mr. Marek Kokot *'Sensor fusion for AIA applications'*
- Mr. Alexandr Lozak *'Development of novel termography technique for ultrasonic examination of weld joints'*
- Mr. Cezary Graczykowski '*The concept of smart prestressed composites. Numerical modeling and experimental evaluation'*
- Mr. Georg Seiler *'Assesment of steel bridge using magnetic methods'*
- Mr. Tomasz G. Zieliński *'Vibroacustic analyses and strategies for the noise attenuation of Linear Stepping Piezoelectric Actuators'*
- Mr. Krzysztof Sekuła *'Experimental development of the portable WIM detector'.*

The presentations are summarized below. Complete presentations can be found on the website http://smart.ippt.gov.pl/index.php?id=events_aia15agenda.

Mr. Grzegorz Mikulowski *'Smart Hybrid Semi-Active Dampers'*

New applications are emerging requiring damping of critical vibrations. Those new applications require a large number of dampers in different locations, meaning that a low-cost and self-sustained solution is required. Passive damping solutions could be considered to solve the problem, but the main drawback of those solutions is the low efficiency and the narrow bandwidth. Active solutions offer the best performance in damping, however those solutions consume energy, require controllers and sensors, and they are not cost-effective. Semi-active solutions appear as a good candidate for the applications, with a wider band than passive solutions, and perspectives of self-sustainability. The objective of the study is to establish a State Of the Art of existing semi-active damping technologies. Among the identified

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solutions, the most promising solutions was studied in more details to select the best candidate.

Mr. Olivier Bareille 'Long-range SHM in structured media'

Structural health monitoring aims to ensure a reliable, long-term surveillance in order to detect fatigue cracks in operational conditions. The damage characterization must be extracted from measured signals. The wave propagation in structural components is here considered as the information phenomenological support for structural health monitoring. Traveling waves necessarily interact with singularities along their path. Singularities are, in the case of Structural Health Monitoring, elements to be identified. Numerical simulation can necessarily help to forecast the interaction of propagating wave with singularities. These singularities are geometrical or material discontinuities in accordance with the initial design but they can also be the result of the evolution of critical damages. For such a purpose, the Wave Finite Element Method (WFEM) is particularly adapted. It uses Bloch's theorem to provide significant reduction of the modeling effort. Wave dispersion characteristics of a waveguide whose crosssection is modeled with FEM can be derived by solving a small quadratic eigenvalue problem. The wave propagation and scattering in a structured composite component is studied using time-response analysis and compared to the Wave Finite Element Methods' predictions. These waves are generated by pulse excitations of the medium. Guided waves occurrence is not limited to structures whose shape exhibits a significant elongation in one direction. Indeed, guided waves can be generated in other structures with specific inner-structure settings. The Wave Finite Element have been therefore applied to propagative characteristic evaluation on specific pipe elements. These structural component are, by design, natural waveguides. The main aim was to extract reflection and transmission coefficients that could reveal specific interaction with local singularities. The numerical results are used to not only validate the monitoring protocol but they also establish a baseline, like a mapping of the likeliness of a defect occurrence. High-order waves' propagation with low spatial attenuation in broadband frequency range happen to be an alternative to some structural health monitoring techniques based on first-order wave propagation. It may encompass some of the drawbacks encountered when

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dealing with boundary conditions in 2D-waveguides or provide accurate wave-based inspection techniques for heterogeneous or composite beams. Their efficiency is shown on a sandwich plate made of transverse isotropic honeycomb core surrounded by fiber-reinforced skins.

Mr. Marek Kokot 'Sensor fusion for AIA applications'

Optimal control strategies in adaptive absorption systems depend strongly on impact conditions. Identification of velocity, mass or kinetic energy of impacting body can be however a difficult task – it is usually done through non-direct measurements of other quantities, with the following signal and data processing. Sensor quality, noise, methodological and numerical errors all determine the ultimate accuracy of estimation of impact conditions. Sensor fusion is a technique which allows to combine various sensoric data and use their synergy to increase accuracy, range or robustness of parameter estimator. The presented case study shows the enhancements obtained in the AVI system for touchdown velocity identification in adaptive landing gear. In its original design, the device determines velocity from ultrasonic distance measurements. The method is subject to intrinsic inaccuracy, high noise and limited range of operation. The proposed enhancement combines mathematical model of the phenomenon (equations of motion supported by measurements of acceleration) with height measurements by ultrasonic distance meter and barometric altimeter. The efficiency of the approach was shown in the results of numerical simulations and laboratory prototype testing.

Mr. Alexandr Lozak 'Development of novel termography technique for ultrasonic examination of weld joints'

The ultrasonic in-production and in-service examination of tubes and pipelines is a relevant technical task in different industrial branches, such as power generation, oil and gas transportation, chemical production, municipal water supplying et.al. Typically, the most relevant aspect of the quality assurance aspect hereby is the non-destructive testing of weld joints. Due to their configuration (reinforcing bead or "cap") the ultrasound coupling during the inspection procedure is performed by means of two transducers from both sides of the weld for providing 100% coverage of the weld seam volume. However, even by using of two ultrasonic transducers

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uninspected areas, so-called dead zones, limit the inspectability of the joints and, thus, the reliability of ultrasonic testing (UT). The second aspect, causing complications in applying UT is the limited access to the inspected weld due to insufficient place pipe sockets and elbows.

The possible technical solution for overcoming this limitation is local immersion coupling directly on the weld cap, which allows 100% weld inspection and requires minimal space for introducing ultrasound into the material. However, the irregular cap shape makes the insonification of the weld and following signal processing a challenging task. The refraction phenomena for both falling and reflecting waves must be taken into account while reconstruction of the inspected volume.

Three tasks must be solved for correct spatial representation of the material flaws due scanning of the weld seam through the cap:

- accurate reinforcing bead profile capturing by means of optical or ultrasonic measurement
- simulation of “forth and back” sound propagation through the irregular weld surface by means of ray-tracing technique
- implementation of tomofraphic volume reconstruction algorithms on the base of graphic processor units for real-time representation of inspection results by means of dedicated inspection system for industrial pipeline condition monitoring

Mr. Cezary Graczykowski ‘The concept of smart prestressed composites. Numerical modeling and experimental evaluation’

The presentation introduced the concept of prestressing selected layers of laminated composite in order to increase its stiffness and to improve its overall mechanical response to static and dynamic loading. Initially, several analytical and numerical models of prestressed composites will be proposed and utilized for optimization of applied prestressing forces. Further, a dedicated laboratory stand and developed methodology for experimental evaluation of prestressed composites was presented. The final part of the presentation focused on prospective applications of prestressed composites including prestress-induced snap-through effect.

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Mr. Georg Seiler 'Assesment of steel bridge using magnetic methods'

Ageing of civil structures is becoming an increasing challenge for industrial societies. Many essential structures that were designed for a finite lifetime are reaching the end of their safe life but cannot be replaced economically. In order to extend the service time of critical structures such as bridges, a damage tolerant lifetime approach has to be implemented. This requires a profound assessment of the structures in terms of the loads applied and the resulting degree of damage. Non-destructive testing methods are one important experimental technique in this assessment.

This presentation provided an idea and a first concept on how this can be applied on steel structures. Electromagnetic measurements were used for stress characterization of an aged steel truss railway bridge in different locations. The results were correlated to FEM stress analysis results. A few conceptual notions was given on how life cycle management and residual fatigue life evaluation was pursued.

Mr. Tomasz G. Zieliński 'Vibroacustic analyses and strategies for the noise attenuation of Linear Stepping Piezoelectric Actuators'

Linear Stepping Piezoelectric Actuators (LSPAs) are inertial piezoelectric motors able to reach a long stroke with high resolution and precision. On the other hand, LSPAs are rather noisy which may become a serious problem in some applications. To investigate this problem vibraocoustic analyses were accomplished for some relevant parts of an LSPA produced by CEDRAT Technologies, as well as some experimental test were carried out in order to identify the noise origin and level. A few strategies were proposed for attenuating the noise of LSPA, namely: a re-design concept, vibration decoupling, acoustic isolation, and new actuation signals.

Mr. Krzysztof Sekuła 'Experimental development of the portable WIM detector'

This contribution reported on experimental development of a portable Weight in Motion (WIM) detector dedicated for railway transport. The portability relies on a proposed special type of the clamping system for mounting of the strain transducer to typical rails, which has been designed and manufactured in the framework of the Smart-Nest project. The proposed WIM technology was verified in numerical analyses and in laboratory experimental investigations.

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Selected photos

Figure 2. Dr. Dariusz Wiącek (Adaptronica) gives a presentation on the demonstrator installed in the Copernicus Science Centre (main screen). In the background (right-hand side screen) a live feed from the demonstrator can be seen

Figure 3. Mr. Stephane Sage (Cedrat Technologies) gives a presentation on his company participation in the Smart-Nest project (main screen). In the background (right-hand side screen) a live feed from the demonstrator in the Copernicus Science Centre can be seen

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Figure 4. Professor John Mottershead (University of Liverpool, editor-in-chief of *Mechnical Systems and Signal Processing*) and professor David Wagg (The University of Sheffield) take part in the Final Open Workshop

Figure 5. The Final Open Workshop of the Project

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Figure 6. The Final Open Workshop of the Project

Figure 7. The Final Open Workshop of the Project

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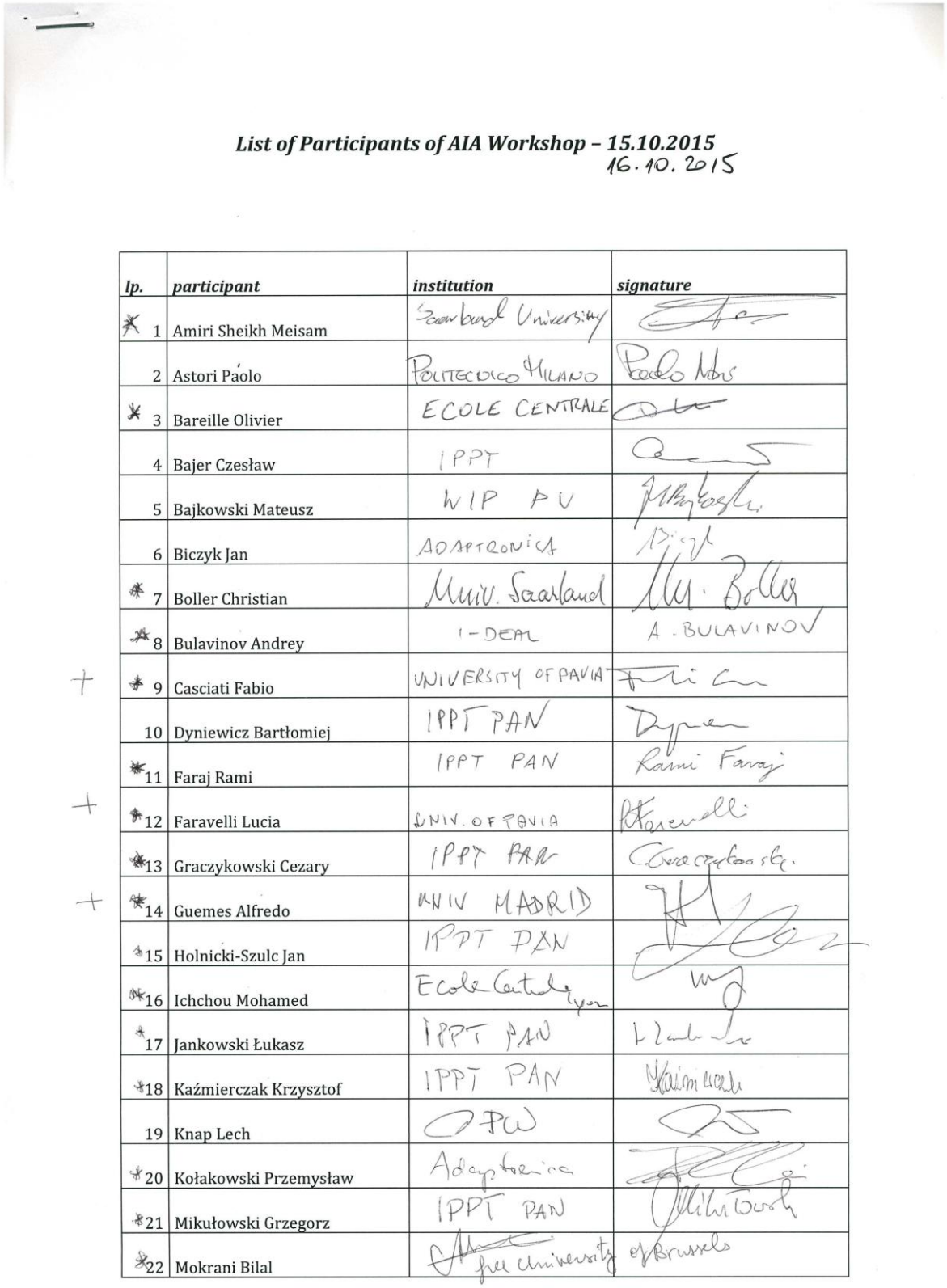
Annex A: List of participants



List of Participants of AIA Workshop – 15.10.2015
16.10.2015

lp.	participant	institution	signature
1	Amiri Sheikh Meisam	Saarland University	
2	Astori Paolo	Politecnico Milano	Paolo Astori
3	Bareille Olivier	ECOLE CENTRALE	
4	Bajer Czesław	IPPT	
5	Bajkowski Mateusz	WIP PW	
6	Biczyk Jan	ADAPTRONICA	
7	Boller Christian	Univ. Saarland	Ch. Boller
8	Bulavinov Andrey	I-DEAL	A. BULAVINOV
9	Casciati Fabio	UNIVERSITY OF PAVIA	
10	Dyniewicz Bartłomiej	IPPT PAN	
11	Faraj Rami	IPPT PAN	Rami Faraj
12	Faravelli Lucia	UNIV. OF PAVIA	
13	Graczykowski Cezary	IPPT PAN	
14	Guemes Alfredo	UNIV MADRID	
15	Holnicki-Szulc Jan	IPPT PAN	
16	Ichchou Mohamed	Ecole Centrale Lyon	
17	Jankowski Łukasz	IPPT PAN	
18	Kaźmierczak Krzysztof	IPPT PAN	
19	Knap Lech	IPW	
20	Kołakowski Przemysław	Adaptronica	
21	Mikułowski Grzegorz	IPPT PAN	
22	Mokrani Bilal	free university of Brussels	

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23	Mottershead John	Univ Liverpool.	
24	Mróz Arkadiusz	Adaptronica	Arkadiusz
25	Neil Sims	NEIL SIMS	NEIL SIMS
26	Opoka Szymon	IMP PAN	
27	Ostachowicz Wiesław	IMP PAN	
28	Ostrowski Marian	IPPT	
29	Osuch-Rak Ewa (organisation)	IPPT	
30	Pawłowski Piotr	—	—
31	Perlikowski Przemysław	Politechnika Łódzka	
32	Pisarski Dominik	—	—
33	Rojek Jerzy	IPPT	
34	Sage Stephan	Sidrat Technologies	
35	Seiler Georg	UdS	Georg Seiler
36	Sekuła Krzysztof	Adaptronica. sp.zoo	Krzysztof Sekuła
37	Szmidt Tomasz	IPPT PAN	
38	Wagg David	U of Sheffield	D. Wagg
39	Wiącek Dariusz		
40	Wiszowaty Rafał	IPPT PAN	Rafał Wiszowaty
41	Wolska Magdalena (organisation)	IPPT PAN	M Wolska
42	Wołejsza Zbigniew	IPPT PAN	
43	Brzeski Piotr	Politechnika Łódzka	
44	Lazarek Mateusz	Politechnika Łódzka	
45	Brzezetskyi Serhii	Politechnika Łódzka	
46	Dmytro Wmelnyy	IPPT PAN	

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47	Elżbieta Jonbowska		
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Annex B: Programme of the Workshop

Workshop on Adaptive Impact Absorption AIA'15
(mitigation of impact-born vibrations)

Institute of Fundamental Technological Research (IPPT PAN), Warsaw, Poland
October 15-16, 2015

Thursday, Oct 15th		
	Session 1	***Chairman: David Wagg***
9:00 – 9:10	Welcome	*Jan Holnicki-Szulc*
9:10 – 9:45	An introduction to the tuned-inerter-damper for vibration suppression	*David Wagg (invited)*
9:45 – 10:20	Prestress Accumulation–Release (PAR) for damping of free vibrations in frame structures. Experimental study of a lab-scale demonstrator structure equipped with piezo-actuated semi-active nodes	*Arkadiusz Mróz, Jan Biczyk, Jan Holnicki-Szulc, (invited)*
10:20 – 10:40	A preliminary study of helicopter crashworthy stages adapted to different impact conditions	*Paolo Astori, Alessandro Airoldi*
Coffee break		
	Session 2	***Chairman: Fabio Casciati***
11:00 – 11:35	Modelling and experimental validation for low and high energy impacts on composite aircraft structures	*Alfredo Güemes (invited)*
11:35 – 12:10	Active Damping of Suspension Bridges	*André Preumont (invited), David Alaluf*
12:10 – 12:30	Selected studies on adaptive control for crash and impact	*Marian Ostrowski*
12:30 – 12:50	Vibration control in smart buildings subjected to earthquake excitation	*Dominik Pisarski, Mateusz Bajkowski, Czesław Bajer, Bartłomiej Dyniewicz, Tomasz Szmidt*
12:50 – 13:10	SPINMAN device for inertial impact absorption	*Rami Faraj, Jan Holnicki-Szulc, Krzysztof Kaźmierczak, Lech Knap, Jarosław Seńko*
Lunch break		
	Session 3	***Chairman: Alfredo Güemes***
14:00 – 14:35	Pole Placement and Active Vibration Control in Structures	*John E Mottershead (invited), Xiaojun Wei, Shakir Jiffri, Sebastiano Fichera*
14:35 – 15:10	Observer-based linearised semi-active control	*Neil D Sims (invited), Mehmet Eroglu*
15:10 – 15:30	Novel type of tuned mass damper with inerter which enables changes of inertance	*Piotr Brzeski, Tomasz Kapitaniak, Przemysław Perlikowski*
15:30 – 15:50	High Performance Valves for Adaptive Pneumatic Impact Absorbing Systems	*Piotr Pawłowski, Cezary Graczykowski, Marian Ostrowski, Krzysztof Sekuła, Arkadiusz Mróz*
Coffee break		
	Session 4	***Chairman: John E Mottershead***
16:10 – 16:45	Soil-structure interaction for helicopter impact	*Fabio Casciati (invited), Sara Casciati, Lucia Faravelli*

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Workshop on Adaptive Impact Absorption AIA'15
(mitigation of impact-born vibrations)

Institute of Fundamental Technological Research (IPPT PAN), Warsaw, Poland
October 15-16, 2015

16:45 – 17:20	Angular location of the impact on composite structure using single rosette	*Szymon Opoka, Katarzyna Majewska, Pawel Kudela, Wiesław Ostachowicz (invited)*
17:20 – 17:40	Stepping Piezo Actuators (SPA) : a solution for image stabilisation?	*Stéphane Sage*
17:40 – 18:00	A Conceptual Study of a Pneumatic Adaptive Absorber for Mechanical Energy Dissipation	*Rafał Wiszowaty, Grzegorz Mikułowski, Jan Holnicki-Szulc*
Friday, Oct 16th	Smart-Nest Project	
	Session 5	***Chairman: Christian Boller***
9:00 – 9:10	Welcome by a REA representative	
9:10 – 9:30	The Smart-Nest Project	*Jan Holnicki-Szulc*
9:30 – 9:50	Weigh-in-Motion demonstrator for Copernicus Science Centre	*Damian Sala, Dariusz Wiącek, Krzysztof Sekuła, Przemysław Kołakowski*
9:50 – 10:00	A short summary from ECL	*Mohamed Ichchou*
10:00 – 10:10	A short summary from UdS	*Christian Boller*
10:10 – 10:20	A short summary from I-Deal Technologies	*Andrey Bulavinov*
10:20 – 10:30	A short summary from Cedrat Technologies	*Stéphane Sage*
10:30 – 10:40	A short summary from Adaptronica	*Przemysław Kołakowski*
10:40 – 10:50	A short summary from IPPT PAN	*Łukasz Jankowski*
10:50 – 11:10	Smart Hybrid Semi-Active Dampers	*Grzegorz Mikułowski*
Coffee break		
	Session 6	***Chairman: Mohamed Ichchou***
11:30 – 11:50	Long-range SHM in structured media	*Olivier Bareille*
11:50 – 12:10	Sensor fusion for AIA applications	*Marek Kokot*
12:10 – 12:30	Development of novel tomography technique for ultrasonic examination of weld joints	*Alexandr Lozak, Roman Pinchuk, Andrey Bulavinov, Olivier Bareille, Grzegorz Mikułowski, Piotr Pawłowski*
12:30 – 12:50	The concept of smart prestressed composites. Numerical modelling and experimental evaluation	*Cezary Graczykowski, Ramanan Sridaran Venkat, Anita Orłowska*
12:50 – 13:10	Assessment of a steel bridge using magnetic methods	*Georg Seiler, Meisam Sheikh Amiri, Peter Starke, Christian Boller, Przemysław Kołakowski, Jan Holnicki-Szulc*
13:10 – 13:30	Vibroacoustic analyses and strategies for the noise attenuation of Linear Stepping Piezoelectric Actuators	*Tomasz G Zieliński, Fabien Dubois, Krzysztof Sekuła*
13:30 – 13:50	Experimental development of the portable WIM detector	*Krzysztof Sekuła*
Lunch break		

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Contact to Organizers

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