Welcome to the third edition of Impact, the newsletter from the European Factories of the Future Research Association (EFFRA) focusing on the work of projects launched under the EU's research and innovation programme for advanced manufacturing – 'Factories of the Future'.

In this edition EFFRA is pleased to report that the inaugural 'Factories of the Future Conference' was a great success drawing eighty speakers and five hundred participants. Opened by Gunther Oettinger, European Commissioner of Digital Economy and Society, the conference explored key topics at the centre of the ongoing transformation of manufacturing in Europe and showcased the achievements of 'Factories of the Future' projects.

This edition brings you news of two more 'Factories of the Future'-centred events and news from the Fortissimo 2, Use-It-Wisely, ADALAM, FineSol, JOIN'EM and MiRoR projects.

The aim of this newsletter continues to be to bring news from these projects and related activities to a European audience. The newsletter is free and readers are welcome to share it with their networks.

If you have project news you wish to share you can submit it to: info@effra.eu.

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Subscribing to Impact

Impact is available to anyone with an interest in factories of the future and is registered on the EFFRA Innovation Portal.

If you have colleagues/contacts who are interested in receiving this newsletter direct them to the EFFRA Innovation Portal and they will receive our next edition direct into their mailbox.

Access to the EFFRA Innovation Portal and subscription to this newsletter is free.

Innovation Portal

Factories of the Future Conference 2016: A Major Success

The inaugural Factories of the Future Conference (15 and 16 September) was a major success. With a participation rate of nearly five hundred people it is the largest event of its kind to focus on 'Factories of the Future'. In particular, it is the first to place the achievements of the 'Factories of the Future' projects at the very centre of thematic discussions.

Over eighty speakers discussed major industry 4.0 themes, illustrating these discussions with key examples from 'Factories of the Future' projects and made use of the unique pitch sessions to pitch results to potential business and innovation partners.

Opening the conference, Commissioner Gunther Oettinger (Commissioner for Digital Economy and Society) expressed his support for the 'Factories of the Future' partnership and congratulated the community on the achievements of its projects. He also underlined the important role the partnership is playing in the transformation of European industry.

During his address to participants, EFFRA Chairman Maurizio Gattiglio unveiled the 'Factories 4.0 and Beyond' strategic working document. Complementing the existing 'Factories of the Future 2020', this document is at the centre of EFFRA's discussions with the European Commission 'Factories of the Future' work programme 2018/2019/2020. Dispatched to all participant on the eve of the conference it can be downloaded via the link below.

Factories 4.0 & Beyond Working Document

Plenary Speaker Interviews | Images from the Conference

Reminder: Register for Information Day on Factories of the Future

The annual PPP Info Day takes place at the Charlemagne Building (Brussels) on 14 October. This full day event centres on the 2017 call topics. Representatives of the European Commission will present, and answer questions about, each topic. In addition, EFFRA will co-host a brokerage session for participants seeking to join potential proposals or seeking potential project partners.

It is recommended that persons wishing to participate should register early due to the high level of interest.

Online Brokerage & Brokerage on the Day

Online brokerage is already open on the EFFRA Innovation Portal, enabling interested organisations to already identify potential proposals to join or potential partners.

If you are interested in presenting an expression of interest during the PPP Info Day brokerage day you must upload this on the EFFRA Innovation Portal. If you do not plan on participating in the PPP Info Day, you may also upload your expression of interest and make use of this online brokerage.

Uploading a presentation does not count as registration. Participants must register through the link below. Please contact EFFRA if you have questions concerning the brokerage session. Please contact the Commission if you have questions regarding registration (via the 'contact' link below.

All participants must register via the link below.

Registration | Agenda & Location | 2017 Call Topics | Contact

(*Please direct all questions regarding registration to the European Commission. EFFRA is not responsible for registration)

Registration Open: Factories of the Future for Aerospace Workshop

On 22 & 23 November EFFRA (supported through the FoF-Impact coordination action) and Aerospace Valley in a collaboration with CAPPADOCIA European project and Regional Council Nouvelle Aquitaine, will hold a workshop under the theme "Factories of the Future for Aerospace". This event will take place in Bordeaux (France).

The aim of the workshop is to stimulate the take up of results of pre-competitive projects in Aerospace industry and present the actual and future innovative trends and emerging technologies. This event will include four parallel pitch sessions which are focused on providing short and to-the-point presentations ('pitches') about innovative manufacturing technologies and approaches. Presentations will be approx. 10 minutes long.

The sessions will cover the following themes:

- Pitch Session 1: Product and process Simulation
- Pitch Session 2: Factory automation
- Pitch Session 3: Advanced Material processing
- Pitch Session 4: Collaborative supply chain

Invitation to Present

Should you be interested in giving a 'pitch' presentation in one of these session, promoting concrete exploitable technologies and approaches, preferable resulting from an FoF project, then please let us know and contact: chris.decubber@effra.eu.

Draft Agenda | Registration

Registration Open: Factories of the Future – Making Innovation Happen

The FoF-Impact project will hold its concluding event on 1 December at the Diamant Building (Brussels). This event will focus on the successful industrial exploitation of FoF project results is organised by EFFRA through the FoF-Impact Coordination Action in cooperation with the Co-FACTOR, EFFECTIVE, FOCUS and FOFAM Coordination Actions.

Event Aims:

- Show the tangible outcome of the FoF-7-2014 CSAs, in particular in terms of services that stimulate industrial exploitation.
- Promote services offered by other service providers.
- Promote exploitable results.

By addressing the three points, the event will not only discuss services, but will also be a service to the projects.

Pitch Sessions & Exhibition

This event will include 'Pitch' sessions which will focus on providing short and to-the-point presentations ('pitches') about innovative manufacturing technologies and approaches. Presentations will most likely be 10 minutes long. Participants interested in giving a 'pitch' presentation in one of these session, promoting concrete exploitable technologies and approaches should contact: chris.decubber@effra.eu.

The workshop will also host an exhibition area in which projects will promote their achievements.

Agenda | Registration

Call: Service Offers in Support of Exploitation & Up-take of 'Factories of the Future' Project Results

A small subcontracting budget within the FoF-Impact coordination action (up to €10,000) has been allocated to the financing of services to projects or project participants. These services would help the project or project participants in increasing the potential of exploitation of project results.

Two requests for services have been identified and an anonymous description of the services can be found via the link below.

EFFRA is now looking for services providers that are interested in providing the requested services. Interested service providers are invited to contact EFFRA by 15 October with a brief description of their offer in relation to the requested services.

The services would have to be carried out before 15 December.

More Information

Fortissimo 2 Project Opens Call Two

The Fortissimo 2 call for proposals targets the augmentation of the application experiments currently being carried out within projects Fortissimo and Fortissimo 2 focusing on modelling and simulation of coupled physical processes and high-performance data analytics (HPDA) and in all cases targeting benefits for engineering and manufacturing SMEs and Mid-caps.

The expectations for the proposed experiments are that they should:

- be complementary to those already included in Fortissimo 2, and to those from the original Fortissimo project;
- contain all those actors in the value chain necessary for the realisation of services meeting the end-users' engineering and manufacturing needs;
- use the (distributed) HPC resources already offered within the Fortissimo infrastructure to solve real world problems involving high performance data analytics or coupled simulation of physical phenomena.

The new application experiments should provide business relevant investigations and demonstrations of coupled simulation services or Big Data analytics in the Fortissimo HPC Cloud that have the potential to create business benefits for manufacturing SMEs. Priority will be given to experiments that are driven by the requirements of first-time HPC users and to those that involve SMEs and Mid-caps. End-user companies already involved in Fortissimo or Fortissimo 2 are not eligible to participate in new experiments in Fortissimo 2 and proposals involving such companies will be rejected.

Fortissimo is a collaborative 'Factories of the Future' project that enables European SMEs to be more competitive globally through the use of simulation services running on a High Performance Computing cloud infrastructure.

More Information

Use-It-Wisely Dissemination Event

The 'Factories of the Future' project Use-It-Wisely will hold its final dissemination event on 18 October in Brussels.

During the "Sustainable Upgrades for Competitive Industry of Tomorrow" event project's results, innovations and breakthroughs to key influencers and decisions makers across policy, industry and research will be presented. Industry experts will present innovations in re-manufacturing, circular economy and collaboration technologies. The presentations will be interactive to promote open discussions on the implications of the project results on the future of remanufacturing in Europe.

Use-It-Wisely aims to enable European manufacturers to produce products and services capable of adapting to rapidly changing markets, the changing business environment, and customer goals. The project's results will demonstrate a state-of-the-art business model and platform, which will enable life-long adaptation of high investment products and services.

More Information

ADALAM: Developing an Adaptive Laser Micromachining System

Miniaturization, advanced high performance materials and functional surface structures are all drivers behind key enabling technologies in high added value production. It is in such areas that ultrashort pulse lasers have enabled completely new machining concepts, where the big advantages of laser machining are combined with a quasi-non-thermal and therefore mild process, which can be used to machine any material with high precision.

However, an important obstacle that hinders the full exploitation of the unique process characteristics is the lack of a smart/adaptive machining technology. The laser process in principle is very accurate, but small deviations - e.g. in the materials to be processed - can compromise the accuracy to a very large extend. Therefore, feedback systems are needed in order to keep the process accurate

For that reasons, ADALAM is developing an adaptive laser micromachining system, based on ultrashort pulsed laser ablation and a novel depth measurement sensor, together with advanced data analysis software and automated system calibration routines.

The technology developed in ADALAM generates completely new solutions for manufacturing of high-quality and innovative products, enabled by the flexibility of adaptive laser micromachining. Indeed, this higher degree of adaptation in the machining process will reduce the effort needed to obtain stable fabrication of components and enable new applications in diverse markets, by adding accuracy, flexibility and control.

The availability of an adaptive machining process associated to an inline distance measurement system in ADALAM is aimed at industrial application and can also serve as a development tool for future smart laser based manufacturing systems. The calibration of the measurement system as well as the complete solution (machine architecture, inline measurement system) regarding aspects as traceability and certification will be a central part of the objective.

The ADALAM project is designed to deliver convincing evidence to the industry of the benefits of the use of adaptive ultra-short pulsed laser based manufacturing systems and its monitoring and control with in-line dimensional metrology as well as final quality assurance for a considerably enhancement of the exploitation and usage of material and resources and the consequent generation of high quality final products. So, in order to evaluate the impact in the market and the benefits of the ADALAM approach for the industry, within the project three industrial representative applications will be developed:

1. Adapting a micromachining process to process deviations
2. Adapting a micromachining process to defect detection and removal present on a workpiece
3. Steering and adapting a texturing process regarding deviations in shape and position of complex 3D shapes

ADALAM is developing a new approach for zero defect manufacturing that is based on three main innovations:

1. In line topography sensor: The integration of this interferometric sensor (based on low frequency coherence) with ultrashort pulse laser process in feedback controlled systems has not be done so far. But there are also, some innovative developments that contribute to increase the impact of this solution: optimized scanning objective with enhance numerical aperture, active alignment unit for beam coupling, sensor integration based on adaptive optics and automatic point cloud analysis software for feature detection and characterization for the generation of qualified information.
2. Adaptive laser micromachining system: Enabled by the integration of the inline topography sensor in the laser machining system. Also, the automation of the information extraction from the data acquired and the customization of the delivery information to the control system, allow ADALAM to face many different application scenarios where this kind of adaptive process represent an advance beyond the state of the art.
3. Evaluation and calibration methodology; enabling the characterization of the main error sources and the fulfilment of the performance in both systems in terms of accuracy and repeatability.

Concerning the project impact, there are three main topics addressed in the project, summarized in the following paragraphs.

Reinforced capacity to manufacture high-quality and innovative products and to penetrate new application areas. The integration of all the elements being developed in the project will allow the generation of a high quality and flexible laser based machine enabling the zero failure manufacturing.

Strengthened market position of European producers of laser-based manufacturing equipment, their suppliers and of the users of the equipment. ADALAM partners are developing a solution by the integration of the knowledge coming from all the value chain, end-users, technology providers and machine producers. Also, the implementation of innovative approaches such as the integration of topography sensor and software analysis for monitoring and drive the adaptive process is help to improve the European laser-related market.

Increased capability for better and faster reaction to market changes by being able to use holistic global and local optimization algorithms in a collaborative value chain.

The proposed solution in the ADALAM project is highly customizable depending on the case: the laser source depending on the material and action to be developed, the data acquisition and pointcloud analysis software, large working volume for different part sizes etc. Furthermore, the adaptive process enables the monitoring of the laser-based process, enabling any reaction in case of deviation from expected results.

More Information

FineSol: Electronics Assembly of Miniaturized PCBs Using Low Cost Hyper-Fine Solder Powders

To sustain its growth, retain its competitive edge, improve upon its already high standards of efficiency and reduce the impact from waste of electrical and electronic equipment (WEEE directive), the European electronics industry is looking to innovate in key areas. One such area is the drive for ultra-miniaturisation/ultra-functionality of equipment, namely by increasing the component density on the printed circuit board (PCB). The FineSol project is aiming at just that, by looking at the key show-stopper for miniaturisation of electronics in mass production – the size limits for reducing the solder joint sizes due to the solder paste particle size.

On a first stage, FineSol will deliver an integrated production line for hyper-fine lead free solder particles and to formulate solder pastes containing these particles that, by proper printing methods (e.g. screen and jet printing) will reach the targeted miniaturization of solder joints in mass production. The industry-wide impact of this can be easily perceived by considering the possibility of more than doubling the functions available in electronic devices per volume, such as cell phones, satellite navigation systems, health devices and the increasing need for Internet of Things.

The project puts together the most recent advancements in technological fields such as mechanical and chemical engineering as well as of automated control systems and nano science, in order to successfully achieve miniaturization of PCBs via the delivery of functional, low cost, hyper-fine solder powders of type 8-9 (particle size less or equal to 10 µm). The consortium partners are leading entities responsible for contract manufacturing of electronics components as well as for the production of relevant materials.

The trend in miniaturization in electronics and its potential impact was coined in 1965 by Gordon Moore, co-founder of Intel, who has predicted in his famous Moore's Law that the number of transistors on an integrated circuit for minimum component cost would double every two years.

Consumer electronics, as exemplified by the cell phone, have continuously decreased in size whilst offering more and more functions with future cell phones aiming to offer phone/video/TV/medical-diagnostics/computer power, not to forget the ongoing and recent trend on embedded electronics, only made possible by this miniaturisation.

The total EU electronics industry employs approx. 20.5 million people, with sales exceeding €1 trillion and encompassing a total of 396,000 SMEs. It is a major contributor to EU GDP and its size continues to grow fuelled by demand from consumers to many industries. Despite its many positive impacts, as previously highlighted, the industry also faces some sustainability challenges connected with the

enormous quantity of raw materials that it needs, the huge quantity of waste from electrical and electronic equipment (WEEE) generated and the threat of competition from Asia. Moreover, the already-existing energy issue has become even more important after the transition from tin-lead solders to lead-free solders one decade ago, which require soldering temperatures 50°C higher relative to older tin-lead solders. This increase in processing temperature has meant not only higher energy consumption for manufacturing, but also increased risk of heat damage to electronics components on the PCB.

More Information

JOIN'EM Project Addresses Increasing Requirements of Industrial Enterprises to Weld Dissimilar Materials

The manufacturing sector is faced with new challenges to remain ahead of the competition and abreast of regulatory requirements. This comes need to seek innovative approaches including the development of new materials and the ability to use different materials together in one component or structure. These challenges are part of a trend to manufacture lighter, safer, more environmentally-friendly, high-performance and cheaper products. Scientific research as well as successful industrial case studies has shown that the performance requirements of innovative products can only be met if the material properties are ideally adapted to the requirements, the load profile, and the function of each individual component.

The JOIN'EM project addresses current short comings of more traditional welding technologies when joining dissimilar metal combinations and it aims to create a cost-effective and practical way of joining aluminium and copper. Joining by electromagnetic forming (EMF), also called electromagnetic pulse welding, is a promising innovative technology which can be used for welding of similar and dissimilar material combinations, including multiple combinations, which are difficult or impossible to join using conventional processes. The joint is formed without heat, but due to the impact of the joining parts. This process needs no fluxes or shielding gases and produces no harmful smoke, fumes or slag, thus reducing the overall negative impact on environment while improving working conditions for factory staff.

The implementation of electromagnetic pulse welding will allow designers to combine metals or to integrate new metals. This, in turn, will allow a steep increase in production performance and will pave the way for several new application areas in the fields of electric devices, heating and cooling, automotive and transport, white goods, air-conditioning, and more recent fields such as high power electronics and energy storage, enabling these industries to follow new trends in product design and manufacture components and products at a top level.

The new joining solutions will also help to implement improved lightweight designs with further weight reduction and better performance. This will decrease energy consumption and greenhouse gas emissions, an increasingly significant requirement for industries such as car manufacturing, where a weight reduction of 100 kg can result in fuel savings of about 300 to 800 litres over the vehicle lifetime, as well as reducing CO2emissions by 9 grams per kilometre.

The JOIN'EM project will optimise usage of a finite resource –copper –for industry's benefits

Due to its excellent thermal and electrical properties, copper is the third most frequently used raw material in the world. JOIN'EM directly aims at decreasing the consumption of this high-cost material by partially substituting it with aluminium. At the current level of known reserves and expected consumption, it is expected that copper will become ever more expensive and difficult to obtain, creating an additional cost issue for manufacturers. So, even if the replacement of copper with aluminium can only happen partially, it will have a lasting impact on the targeted industries.

JOIN'EM will:

- Develop innovative methods for joining dissimilar metals, which will allow improved manufacturing of new products. These innovations will also deliver increased product reliability, longer lifetime of the components and welds, combined with a reduction of maintenance costs;
- Facilitate an increased use of dissimilar metal combinations;
- Increase productivity and reduce costs for realising hybrid components using electromagnetic pulse welding: joining operations are performed faster, more efficiently and robustly, with a less expensive production process and better-quality final products;
- Achieve lower product life cycle costs;
- Enable the use of the environmentally-friendly electromagnetic pulse welding process. This process needs no fluxes or shielding gases and produces no harmful smoke, fumes or slag, thus reducing the overall environmental impact.
- Investigate joint performance with conventional as well as novel testing methods.

Looking ahead: The Future of Electromagnetic Welding

Beyond this application, project partners will also look into the transferability of project results to other material combinations of relevance for industrial sectors that deal with multi-material joints. JOIN'EM will develop and demonstrate flexible and cost-effective joining processes for dissimilar metal combinations, for which currently available conventional welding technologies have proved inadequate.

More Information

MiRoR Project: Revolutionising In-Situ Maintenance & Repair

Once the stuff of science fiction, robots are today a common sight in many industry sectors. EU-funded researchers have significantly advanced the technology, developing a robotic system for in-situ repair and maintenance that makes work in hazardous environments easier and safer. It could be on the market in three to five years.

MiRoR can put two major innovations to its name: a novel walking hexapod robot and a flexible robot arm, also known as a 'continuum robot'. The team of researchers built both elements with specific areas of application in mind: the system is uniquely suited to maintenance and repair tasks, including machining, in tight, difficult or dangerous-to-access spaces in power plants, construction and aero-engines, or on offshore platforms.

But thanks to its autonomy, versatility and manoeuvrability, the MiRoR robot is not limited to these fields. For instance, the medical sector has already shown interest, seeing its potential for minimally invasive surgery.

The team behind the robot was coordinated by Dragos Axinte from the University of Nottingham and including academia/research organisations (IK4-Tekniker, IPA Fraunhofer and ETH Zurich) as well as experts from the aerospace, civil engineering and energy industries (Rolls-Royce and Acciona).

Walk & Snake

The hexapod robot – which gets its name from its six legs and was developed by the Spanish technological innovation centre IK4-Tekniker in collaboration with University of Nottingham – consists of a flat platform with the legs attached to it. Each leg boasts a special articulation system, which means it can be steered individually in any direction.

While the researchers had already developed the initial concept for the hexapod before the project started, early versions had to be placed manually. The intelligent control developed by IPA allowed them to make the robot more autonomous; equipped with a camera and sensors to help detect defects and facilitate direction, it can now either be guided by an operator or navigate itself to the location where maintenance or repair works are needed.

"There is a sensor attached to the front of the robot that works like a scanner and can detect objects in its surroundings, so that it can avoid obstacles and find the best way to the target," explains Aitor Olarra from Tekniker, who was tasked with the design of the hexapod robot.

Controlling Stiffness

Mounted on the walking hexapod is the continuum arm robot that has been developed by the researchers from the University of Nottingham. With an outer minimum diameter of 15 mm and 1200 mm in length, its snake-like flexibility lets the robot bend and reach inside confined spaces such as a jet engine, for example. But its outstanding feature is that the arm has two states of stiffness.

“Imagine the compressor is damaged. Conventional robots cannot do the proper repairs because they require the robot to have sufficient degrees of freedom to reach the location by passing through the ‘compressor forest’ and also very good stiffness when repairing,” explains Xin Dong of the University of Nottingham.

He and his colleagues used twin-pivot compliant joints, which help avoid having to twist the arm when bending into convoluted shapes. Each link of the arm can be articulated individually. A through-hole inside the arm allows for a selection of machining tools to be passed through to the tip, so that – once in place – the arm can be made completely stiff and inflexible with the help of thermal plastics to carry out whatever repair task is required.

Following successful system testing in a mock-up environment as well as under real-world conditions at project partner Rolls-Royce’s aerospace branch, Dong is hopeful that the MiRoR system will soon be ready for application in the real world. He predicts that the first robots may be employed for in-situ repair of aircraft in large airports within the next three to five years.

More Information

Contact

If you have suggestions, questions or comments concerning this newsletter, contact info@effra.eu.

Disclaimer

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