



# PROGRAMS

## **PROGnostics based Reliability Analysis for Maintenance Scheduling**

In this issue: introduction to PROGRAMS; the Consortium; the Pilot Cases; the first 6 months activities and next steps.

### **Introduction to PROGRAMS**

The European research project PROGRAMS (coordinated by the Italian company FIDIA) started on October 1st 2018 with a term of three years. The project aims at exploiting all pieces of information available at every factory level (controllers and sensors data, maintenance reports, operators experience, physical characteristics of the equipment components, production line specifications) to determine the optimal (1) scheduling of maintenance activities and (2) resources management. PROGRAMS will develop prognostic methods and technologies that will allow to minimize the impact of maintenance activities on the production plan, thus increasing the overall plant availability.

The main hardware tool deployed at shop floor level, the Smart Control System, will allow to retrieve information from sensors connected to its I/O boards and from equipment controllers. This information will be exploited immediately, to adapt the equipment processing parameters to its health status, and moved on a cloud repository for further analysis. Reliable information about the remaining lifetime of equipment components will be achieved by combining different techniques, such as trend analysis, components modelling and simulation. The computation of equipment reliability will take into account both the components models and the information extracted from maintenance reports and simulations. The determination of the best maintenance schedule will rely on the simulation of machine behavior and be based on the assessment of the impact that each component has on the whole system. Finally the maintenance schedule will be integrated with users' production schedule thanks to smart interfacing with legacy ERPs.

PROGRAMS expected developments:

- An integrated, easy to install tool to gather data from sensors and controllers and to securely move these data on a cloud repository.
- Several model-based prognostics approaches for the evaluation of equipment condition.
- A Maintenance Decision Support System capable of extracting equipment reliability information from different sources and to exploit this information to determine optimal maintenance activities scheduling.
- A smart tool to merge maintenance schedule with production activities without disrupting either, supporting integration with legacy ERPs.
- A Maintenance Service Platform to share maintenance information among involved personnel.

### **The Consortium**

PROGRAMS consortium consists of 13 European organizations from 5 different EU Countries. The consortium combines relevant industrial participation, with significant participation of SMEs that represent more than half of the partners.

- FIDIA S.p.A. (IT), Machine Tool/CNC producer, Large enterprise

- CeSI (IT), Technical consulting company, SME
- Budapesti Muszaki es Gazdasagtudomanyi Egyetem (HU), Manufacturing, Research Institute
- CASP (GR), ERP solutions developer, SME
- SAVVY-DS (ES), Technology provider, SME
- IK4-IDEKO (ES), ICT/Manufacturing, Research Institute
- RWTH Aachen WZL (DE), Manufacturing, Research Institute
- Lab for Manufacturing Systems and Automation, University of Patras (GR), ICT/Manufacturing, Research Institute
- AURRENAK S. Coop (ES), End user for milling machines tools, SME
- GIZELIS ROBOTICS (GR), Robots technology provider, SME
- We Plus S.r.l. (IT), Software solutions developer, SME
- CALPAK (GR), End user for pick/place and welding robots, SME
- Università degli Studi di Brescia (IT), Manufacturing, Research Institute



### The Pilot Cases

**AURRENAK** business focuses on the design and manufacture of moulds and tooling for the mass production casting industry, both in iron and aluminium, specialising in pressure injection, low pressure, gravity and green sand casting technologies. Its major customers are vehicle manufacturers and the suppliers of mass produced iron and aluminium parts for these manufacturers.



**CALPAK** covers all parts of solar thermal energy systems, producing a complete range of solar collectors, hot storage tanks, complete central solar systems and thermosiphonic systems. Its selling points are both the residential market as well as the industrial market



### **The first 6 months activities and next steps**

The activities of the first 6 months were devoted to investigate the end users' current maintenance practices (the so called "as is" scenario) to create a typical image of today's processes. The end users maintenance requirements were collected and, with the help of the consortium, several theoretical points of improvement to end users' pilot lines were proposed and became the project major challenges. Based upon the points of improvement, the PROGRAMS use cases (representing all the functionalities of the project solutions) have been designed, including the proposal for several KPIs to evaluate their performances. Finally, the software and hardware requirements for the project solutions have been identified. It is worth noting that PROGRAMS joins the H2020 pilot action on open access to research data. For this purpose a preliminary DMP has been prepared and shared.

In the next months the pilot lines will be enhanced with hardware and software solutions for collecting maintenance relevant data from the production equipment. In parallel the development of prognostic solutions for the maintenance scheduling and for the production equipment health status evaluation will begin, with the objective to have first working versions within the first half of the project length. Finally the platform for secure data and messages transmission will be implemented.