



CIRP-2014- “CM”-4 (STC A, Dn and O)

Collaborative Working-Group on Continuous Maintenance

Meeting held on August 28th, 2014
in Nantes, France

Minutes

Present:

Roy, Rajkumar; Stark, Rainer; Tracht, Kirsten; Abramovici, Michael; Alves, Catia; Antoniomaria, Diilio; Aranzabe, Ana; Butala, Peter; Ceglarek, Derek; Deuse, Jochen; Erkoguren, John; Frabolot, Marc; Galdos, Lander; Ganiyusufoglu, Ö. Sahin; Gao, Robert; Hedlind, Mikael; Heyer, Steffen; Ihlenfeldt, Steffen; Iung, Benoit; Jedrzejewski, Jerzy; Kim, Chang-Yu; Kumara, Soundar; Lanza, Gisela; Lee, Dong Yoon; Li, Weidong; Liang, Shuo Peng; Majstorovic, Viadosav; Makris, Sotiris; Matyas, Kurt; Mehnen, Jörn; Mei, Hsiao-Chen; Michalos, George; Nee, Andrew YC; Ong., Soh Khim; Putnik, Goran; Sáenz de Argantona, Eneko; Satish, Bukkapatnam; Schönsleben, Paul; Schützer, Klaus; Shimomura, Yoshiki; Sihn, Wilfried; Teti, Roberto; Tomiyama, Tetsuo; Urgo, Marcello; van Houten, Fred; Vancza, Jozsef; Wang, Lihui; Yin, Yue Hong (48)

1. Welcome to the CWG session

Prof. Roy welcomed all members and invited guests to the fifth meeting of the CWG continuous maintenance and opened the session.

2.1 Technical Presentation - Development of optimized Maintenance Strategies by linking various Data, Kurt Matyas (see Annex 1)

The presented research idea aims at minimizing the impact of wear within the production process by applying appropriate maintenance measures at the best point in time. Current condition-oriented maintenance strategies oftentimes cope with fractional perspectives only. They are not capable to anticipate holistic strategies, such as Total Productive Maintenance (TPM). To solve this, a methodology which is able to illustrate production facilities on component level and to allocate registered load-data to specific components should be developed.

The new research approach is to develop anticipative maintenance strategies in a holistic view. The input is a combined real-time data collection with wear & failure effects, consistent documentation of load-data (load spectrum), condition monitoring data and historical data. With methods of data mining it should be possible to develop wear forecasts and to form the basis for the optimization of maintenance strategies.

2.2 Technical Presentation - Expert Systems for Diagnosis and Maintenance: State of the Art, Vidosav Majstorovic (see Annex 2)

The diagnosis and maintenance of complex mechanical systems represents a very complex interdisciplinary engineering task. This particularly relates to mechatronics system in manufacturing, which are the subject of analysis in this paper, i.e. expert systems for such purpose. The state of the art and application of expert systems are analyzed in the paper from different aspects, namely: (i) knowledge engineering for maintenance ES; (ii) basic hypotheses for the development of ES for maintenance; (iii) the level of development and application of ES in the domain of maintenance; and (iv) the analysis of developed ES for maintenance. At the end, an example of an ES developed for diagnosis and maintenance of working stations in advanced manufacturing systems is presented.

2.3 Technical Presentation - Robots for Maintenance, Tetsuo Tomiyama (see Annex 3)

The development of robots in many fields has reached outstanding competencies, e.g. in space. Nevertheless, maintenance tasks have unique requirements and classical robot solutions do not match these. An overview on these requirements has been given and the question of reasonability of the use of robots in maintenance has been raised.

2.4 Technical Presentation - Augmented Reality for Maintenance of Complex Engineering Systems, Andrew YC Nee (see Annex 4)

Augmented reality (AR) has been developed since the late 1980s and in the last 30 years, there are many applications spanning fields from medical, gaming, learning, advertising, movie making to engineering. AR has recently been applied to maintenance of complex engineering systems such as aerospace engines, military vehicles, chemical plants, etc. Instead of using heavy head-mounted devices (HMDs), tablets, mobiles and Google glasses have been popularly used. Information such as text, video, animation, voice, etc. can be overlaid on real scenes providing instructions and guidelines for maintenance tasks. Laboratory prototypes have shown that AR can provide intuitive and satisfactory results for the maintenance operators, reducing their cognitive load, head movements for referencing manuals, and offers a more intuitive environment. Several applications have been reported on aircraft maintenance operations, e.g. aircraft engines. Service technicians can also consult remote experts for providing necessary advice. Speech-enabled AR is even more exciting as components and devices can be made to communicate with the technicians, providing them with their state-of-health. Psychomotor studies can help reduce operator fatigue and provide the best posture to reduce the physical strain while operating on complex maintenance tasks. A prototype AR-assisted maintenance system developed at the National University of Singapore provides a bi-directional authoring system between a technician and an expert. Both text and graphics information, including video and animation can be used to instruct the technician. Future research issues include ergonomic studies of the maintenance process such as the estimation of cognition load and fatigue of operators, measurement of comfort and safety, reliability and risk assessment, etc. Cost and time analysis and comparison with traditional practices is important to justify the use of AR. Real-time data capture and updating using cloud technology is another potential area to be addressed.

2.5 Technical Presentation - No Fault Found: Challenges and Research Directions, Derek Ceglarek (see Annex 5)

No Fault Found is a major research area for maintenance tasks. In the presentation the ongoing research has been outlined and an overview about the challenges of no-fault-found has been given.

3 Continuous Maintenance CIRP Keynote 2016: Update and discussion: Professor Rajkumar Roy(see Annex 6)

Prof. Roy gave an overview on the actual status of the keynote structure and again invited all volunteers to provide papers.

5. Closing

Prof. Roy thanked all presenters and all participants, invited everyone to the next meeting in Paris and closed the session.