Guest Editorial

Prognostics and Health Management (PHM) is an engineering discipline that aims at assessing the current status and predicting the future condition of components and systems. PHM provides information for effective condition-based and predictive maintenance for increasing productivity, optimizing operating performance, reducing lifecycle costs, extending operating periods between maintenance and reducing downtimes, frequency and severity of unanticipated failures. Research in PHM has significantly advanced over the last years, providing new methods as well as realworld applications. The Journal of Risk and Reliability has contributed strongly to the dissemination of the knowledge and findings in the field. This Special Issue collects six papers, which are extended and revised versions of selected works presented at the International Prognostics and System Health Management Conference (PHM 2013). The conference was the 4th edition of the Prognostics and System Health Management Conference Series and took place at the Politecnico di Milano, Milan, Italy, on 8– 11 September 2013. The conference offered a stimulating platform for addressing the technical issues related to PHM and its development and application in various industrial sectors. Participation counted 250 attendees including all interested stakeholders, such as industrialists, regulators, managers, decision makers, universities, research organizations and government bodies. The unifying motivation behind the selection of these works is that of reporting on the international advancements in PHM techniques, highlighting their capabilities, reliability and cost-effectiveness in diverse practical applications. The works tackle different problems typically encountered in the development of PHM systems, including the identification of the sensors to be used for monitoring the degrading component and predicting its remaining useful life (RUL), the preprocessing of the data for the selection of the most useful features, the development of methods for the detection of failures, the classification of their causes and the prediction of equipment's RUL with its uncertainty. Applications come from different industrial sectors, such as energy production, nuclear, oil and gas, maritime and aviation. The first paper by Sharp et al. considers that during the lifecycle of an industrial system, the information available for prognostics changes. Typically, only historical time-to-failure data are available before the beginning of operation; stressors data and knowledge about operation conditions are collected during early operation, whereas direct or indirect measurements of the component degradation become available during the component lifecycle. The paper presents a Bayesian framework that allows updating the prediction of the RUL as a component proceeds in its lifecycle and new information becomes available. The proposed framework is applied with success to the prediction of the RUL of a nuclear power plant heat exchanger. The second paper by Yan et al. concerns the condition monitoring of marine diesel engines. The authors consider online tribological data acquired by monitoring the oil conditions through ferrographic, oil moisture and viscosity sensors. They extract nine features from the sensor measurements and by observing the correlation between the feature values and the component degradation they select the index of particle covered area (IPCA) as the best feature for the detection of failures in the motor. Experimental tests performed in laboratory and data obtained from a diesel engine of a real ship confirm the feasibility of using a fault detection system based on the tracking of IPCA for condition monitoring of industrial marine diesel engines. The third paper by Shumaker et al. addresses the problem of estimating the RUL of instrument and control cables used in nuclear power plants. Since it is not a priori known which measured features should be used to predict cable's RUL, for their selection, the authors define an objective function to be optimized, which measures the monotonicity, the trendability and the prognosticability of the candidate features. Once the most effective feature for prognostic has been selected, the general path model (GPM) technique is applied for the estimation of the cable's RUL. The method has been verified considering (1) the measurements performed during destructive tests and (2) the frequency domain reflectometry data, which can be online measured during cable operation. The results obtained are satisfactory in both cases. Also, the fourth paper by Yu et al. focuses on a component of a nuclear power plant. The authors investigate the effect of air temperature on the reliability of a passive containment system in an AP1000 nuclear reactor. Monte Carlo simulation is used for predicting the physical process

failure probability, and fault tree analysis is employed for the prediction of the whole system reliability. The results of the analysis allow concluding that air temperature is an important factor influencing the system operation and failure probability. Hence, climate should be considered in the system design phase in order to increase the system reliability. The fifth paper by Droguett et al. deals with the problem of identifying the degradation state of components used in oil wells. The authors focus on the formation of inorganic scale depositions, which, under pre-salt oil well conditions, can reduce the well's production rate by blocking valves, tubing and flow lines. An approach based on the combined use of bootstrap, particle swarm optimization and support vector regression is proposed for modelling the influence of environmental parameters on scale growth rate. The empirical model is trained using data collected on laboratory tests carried out on coupons that simulate realistic downhole conditions. The proposed approach is shown able to provide satisfactory prediction of the scale growth rate and related confidence intervals. The last paper by Colace et al. presents a practical implementation in a real industrial environment of an E-maintenance tool integrated within an existing information and communication technology infrastructure. The authors discuss all the phases necessary for the deployment of a condition monitoring system on an electric arc furnace in a steelmaking company, from the HAZOP analysis, to the development of the condition monitoring method and its implementation. The system allows detecting incipient failures before they cause downtimes that may lead to disastrous consequences on people safety, integrity of assets and production cycle. The results achieved by the E-Maintenance tool are very satisfactory: it provides a limited number of false positive and no false negative advices. The paper by Cromie et al. (already published in June issue, 229(3) 266–274) proposes a novel approach for integrating human and organizational factor (HOF) training with risk management. A three-phase blended learning programme is designed to address identified human and organizational hazards within the operation to enhance knowledge and application of risk management strategies and to build a stronger safety culture within the operation. The organizational context in which the approach is developed is an aviation maintenance company, whose objective is to employ HOF training as a targeted risk management intervention rather than as a regulatory requirement. As a final remark, we would like to thank all the authors for their contributions and the reviewers for their hard, timely and professional work; we also wish to acknowledge Professor John Andrews, Editor-inChief of the journal, for giving us the opportunity and the assistance necessary to put together such a collection of interesting works.

Piero Baraldi and Enrico Zio