RISK-INFORMED INSPECTION OF INDUSTRIAL EQUIPMENT

Ayyub, Bilal
Center for Technology and System Management
University of Maryland
College Park, Maryland, USA

Abstract. The paper describes the development and demonstration of a practical methodology and procedures for using a risk approach in the decision making process for structural inspection of industrial equipment. A systems approach has been developed for risk-based optimal inspection management of structures of industrial equipment. This approach consists of the synergistic combination of decision models, advanced probabilistic reliability analysis and risk algorithms, and conventional mechanistic residual strength assessment methodologies that have been demonstrated in the marine vessel industry for structural integrity evaluation. This approach realistically accounts for the various types/sources of uncertainties involved in the decision-making process including uncertainties in the defect data gathered from inspections, materials types, loads, parameters of repair method, as well as the engineering strength models that are employed. Furthermore, the probabilistic approach is capable of taking direct advantage of previously verified residual strength assessment models and engineering experience that has been compiled over the years from the operation of these vessel systems. The proposed methodology could lead to the provision of a capability for quantitatively assessing reliability and risk levels to ensure the safe operation of existing vessels. The capability could also provide a rational framework and basis for extending the life of current vessels, as well as the re-qualification of such vessels using quantitative risk-based methodologies. The application of such a capability could lead to improved reliability levels, and significantly reduce incidents/accidents that cause damage to property, personnel and the environment. The application of the technology is also believed to have substantial potential to realize cost savings in the inspection, maintenance, and repair of aging vessel systems.