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Uzoma Okoro, Athanasios Kolios, Lin Cui

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Multi-criteria risk assessment approach for components risk ranking– The case study of an offshore Wave Energy Converter

Uzoma Okoro*, Athanasios Kolios^{1*}, Lin Cui[†]

*Centre for Offshore Renewable Energy Engineering, School of Energy, Environment and Agrifood, Cranfield University, Cranfield, MK43 0AL, UK

[†]National Ocean Technology Centre, Tianjin, China

Abstract

Experts' judgement is employed in offshore risk assessment because reliable failure data for quantitative risk analysis are scarce. The challenges with this practice lies with knowledge-based uncertainties which renders risk expression and estimation, hence components' risk-based prioritisation, subjective to the assessor – even for the same case study. In this paper, a new risk assessment framework is developed to improve the fidelity and consistency of prioritisation of components of complex offshore engineering systems based on expert judgement. Unlike other frameworks, such as the Failure Mode and Effect Criticality Analysis, it introduces two additional dimensions: variables and parameters, to allow more effective scoring. These additional dimensions provide the much needed and uniform information that will assist experts with the estimation of probability of occurrence, severity of consequence and safeguards, herein referred to as 3-D methodology. In so doing, it achieves a more systematic approach to risk description and estimation compared to the conventional Risk Priority Number (RPN) of FMECA. Finally, the framework is demonstrated on a real case study of a wave energy converter (WEC) and conclusions of the assessment proved well in comparison and prioritization.

Keywords: Condition-based risk assessment, risk estimation, multi-criteria risk assessment, wave energy converter.

¹ Corresponding author. Tel.: +44 (0) 1234 754631; E-mail address: a.kolios@cranfield.ac.uk

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