

Integrating Assurance and Risk Management of Complex Systems

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Abstract : This paper explores the relationship between assurance, risk, and risk management in the context of complex safety-related systems. It introduces a nuanced understanding of assurance and argues that the foundation for grounds for justified confidence in claims made about a complex system is related to the system behaviour. It emphasises the importance of knowledge as the cornerstone of assurance. The paper addresses the challenges of epistemic and aleatory uncertainties inherent in safety-critical systems. A systems approach is proposed to model emergent properties and complexity using the composition, environment, structure, mechanisms (CESM) metamodel, offering a structured framework for analysing system behaviour. The interplay between assurance and risk management is conceptualised through two models: the domain model and the control model. Assurance and risk management are mutually dependent on each other to reduce uncertainty and control risk levels. This work highlights the dual roles of assurance in risk management, acting as an epistemic actuator on the one side and providing feedback about the strength of the justification on the other. Assurance and risk management have inseparable roles in ensuring safety in complex systems.

Keywords : assurance, CESM metamodel, confidence, emergent properties, knowledge, objectivity, risk, system behaviour, system safety

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