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VISMA: A Method for System Analysis in Early Lifecycle Phases

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Abstract : The choice of applicable analysis methods in safety or systems engineering depends on the depth of knowledge about a system, and on the respective lifecycle phase. However, the analysis method chain still shows gaps as it should support system analysis during the lifecycle of a system from a rough concept in pre-project phase until end-of-life. This paper’s goal is to discuss an analysis method, the VISSE Shell Model Analysis (VISMA) method, which aims at closing the gap in the early system lifecycle phases, like the conceptual or pre-project phase, or the project start phase. It was originally developed to aid in the definition of the system boundary of electronic system parts, like e.g. a control unit for a pump motor. Furthermore, it can be also applied to non-electronic system parts. The VISMA method is a graphical sketch-like method that stratifies a system and its parts in inner and outer shells, like the layers of an onion. It analyses a system in a two-step approach, from the innermost to the outermost components followed by the reverse direction. To ensure a complete view of a system and its environment, the VISMA should be performed by (multifunctional) development teams. To introduce the method, a set of rules and guidelines has been defined in order to enable a proper shell build-up. In the first step, the innermost system, named system under consideration (SUC), is selected, which is the focus of the subsequent analysis. Then, its directly adjacent components, responsible for providing input to and receiving output from the SUC, are identified. These components are the content of the first shell around the SUC. Next, the input and output components to the components in the first shell are identified and form the second shell around the first one. Continuing this way, shell by shell is added with its respective parts until the border of the complete system (external border) is reached. Last, two external shells are added to complete the system view, the environment and the use case shell. This system view is also stored for future use. In the second step, the shells are examined in the reverse direction (outside to inside) in order to remove superfluous components or subsystems. Input chains to the SUC, as well as output chains from the SUC are described graphically via arrows, to highlight functional chains through the system. As a result, this method offers a clear and graphical description and overview of a system, its main parts and environment; however, the focus still remains on a specific SUC. It helps to identify the interfaces and interfacing components of the SUC, as well as important external interfaces of the overall system. It supports the identification of the first internal and external hazard causes and causal chains. Additionally, the method promotes a holistic picture and cross-functional understanding of a system, its contributing parts, internal relationships and possible dangers within a multidisciplinary development team.

Keywords : analysis methods, functional safety, hazard identification, system and safety engineering, system boundary definition, system safety
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