

An Axiomatic Model for Development of the Allocated Architecture in Systems Engineering Process

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Abstract : The final step to complete the "Analytical Systems Engineering Process" is the "Allocated Architecture" in which all Functional Requirements (FRs) of an engineering system must be allocated into their corresponding Physical Components (PCs). At this step, any design for developing the system's allocated architecture in which no clear pattern of assigning the exclusive "responsibility" of each PC for fulfilling the allocated FR(s) can be found is considered a poor design that may cause difficulties in determining the specific PC(s) which has (have) failed to satisfy a given FR successfully. The present study utilizes the Axiomatic Design method principles to mathematically address this problem and establishes an "Axiomatic Model" as a solution for reaching good alternatives for developing the allocated architecture. This study proposes a "loss Function", as a quantitative criterion to monetarily compare non-ideal designs for developing the allocated architecture and choose the one which imposes relatively lower cost to the system's stakeholders. For the case-study, we use the existing design of U. S. electricity marketing subsystem, based on data provided by the U.S. Energy Information Administration (EIA). The result for 2012 shows the symptoms of a poor design and ineffectiveness due to coupling among the FRs of this subsystem.

Keywords : allocated architecture, analytical systems engineering process, functional requirements (FRs), physical components (PCs), responsibility of a physical component, system's stakeholders

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