Objective assessment of “Controllability” rankings during Hazard Analysis and Risk Assessment Process

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In recent years ISO 26262:2018 Road vehicles- Functional Safety became very popular in automotive electronic domain as it establishes a standard process at each stage of product development. “Hazard Analysis and Risk Assessment” (HARA) is one of the first steps and is the most important step in functional safety process for any item integrated in the vehicle because determining “Automotive Safety Integrity Level” (ASIL) is one of the outputs of HARA and determined ASIL decides rigour of the product development activities for the item under consideration. ASIL determination for a hazardous event is based on analysing each hazardous event’s consequence during a driving scenario and then estimating three parameters: Severity (S), Exposure (E) and Controllability (C). The estimation of ASIL is based on the functional behaviour of the item and therefore a detailed design is not necessary. In most of the cases, injury level and probability of exposure can be assessed subjectively based on different injury scales (for e.g.:- Abbreviated Injury Scale), item behaviour and environmental conditions. But assessing controllability based on driver response towards each hazardous event is always a difficult process wherein subjective assessment is difficult to justify.

In this presentation, we present and discuss the concept of HARA in product development, determination of Severity & Exposure parameters and a very detailed discussion on objective assessment of controllability rankings for different items with examples. As controllability determines the extent to which the driver of the vehicle can control the vehicle in case of failure or malfunctioning of automotive component under evaluation, controllability factor, most of the times, is analysed subjectively and often remains a debatable parameter. The major portion of this presentation covers the objective way of calculating controllability parameter through statistical analysis of publicly available accident data and driver response times for different actions such as steering, braking and acceleration. We also cover how driver response times affect the controllability parameter for different severity levels of a hazard. We will cover the topic with two real examples of controllability assessment, one hazard from vehicle longitudinal motion and other hazard from high voltage battery.