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Forensic Engineering and Management

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Editorial

"The analysis of problems - ranging from serviceability to catastrophic - which may lead to legal activity, including both civil and criminal," is how forensic engineering is defined. It entails looking into substances, items, buildings, or other parts that malfunction, do not perform or function as intended, and result in harm to people or property or financial loss. Failure may result in legal action under civil or criminal law, including but not limited to health and safety regulations, contract and/or product liability laws, and tort laws. Retracing processes and procedures that result in accidents when operating machines or vehicles is another aspect of the field. A forensic engineering study typically aims to identify the cause or causes of failure in order to increase a component's performance or life or to help a court determine the circumstances surrounding an accident. Investigation of intellectual property rights, particularly patents, may also be involved. Forensic engineers in the US are required to hold a professional engineering licence from every state [1].

Forensic engineering has advanced alongside engineering as a discipline over time. Investigations into bridge failures like the Tay rail bridge tragedy in 1879 and the Dee bridge disaster in 1847 are early examples. Tensile testing of samples and fractography of defective components were both developed as a result of numerous early train accidents [2].

In the broader framework of safety engineering, the fault tree analysis (FTA) and failure mode and effects analysis (FMEA) methodologies similarly evaluate product or process failure in an organised and methodical manner. All of these methods, however, depend on precise identification of the failure types and accurate reporting of failure rates. There are various areas where forensic science and forensic engineering overlap, such as the investigation of crime and accident scenes, the reliability of the evidence, and court appearances. For instance, optical and scanning electron microscopes are widely used in both disciplines. Additionally, they both investigate crucial evidence using spectroscopy (infrared, ultraviolet, and nuclear magnetic resonance). Before attempting a destructive investigation, radiography employing neutrons or X-rays (such as X-ray computed tomography) can be very helpful in examining thick items for interior flaws. But frequently, a straightforward hand lens can point to the root of a certain issue [3].

In order to increase quality or efficiency, the majority of manufacturing models will incorporate a forensic component that tracks early failures. Forensic engineers are used by insurance firms to demonstrate liability or lack thereof. Engineers knowledgeable in forensic investigation techniques are called upon to conduct forensic investigations into the majority of engineering catastrophes (structural failures such as bridge and building collapses). When a component failure is suspected, forensic engineers focus their investigations on rail crashes, aviation accidents, and some auto accidents. Furthermore, accidents resulting in harm or property damage can be caused by appliances, consumer goods, medical equipment, buildings, industrial gear, or even simple hand tools like hammers or chisels. Reporting and analysing malfunctions of medical devices is especially crucial because they are frequently safety-critical for the user. Implants must endure the complex environment of the body while also avoiding leaching any potentially hazardous contaminants. For instance, there have been issues with catheters, heart valves, and breast implants [4].

Early-stage failures of a new product provide crucial information to the maker for product improvement. Defects may arise during a product's early life, but new product development seeks to remove them by testing in the factory before introduction. Testing products to mimic how they would behave in the real world is a challenging expertise that could require, for instance, accelerated life testing. The worst type of defect that can happen after launch is a safety-critical defect, which puts human life or limb in danger. When they are discovered, the product is frequently recalled or even completely removed from the market. A common pattern for product defects is the bathtub curve, with high initial failure rates, a reduced rate during normal use, and then a subsequent spike owing to wear-out. The designer can increase product integrity by using national standards like those of ASTM and the British Standards Institute as well as international standards [5].

Conflict of Interest

None.

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