made
decisions better MADe...

MADe - Model-based Fault Tree Analysis (FTA)

Automatically generate Fault Tree diagrams for safety analysis.

Key benefits

- Automated generation of Fault Tree diagrams based on the design configuration
- Consistency of analysis process (use of standardised taxonomy and FTA symbols)
- Usability – rapidly identify and navigate between different Top-Effects
- Traceability – configuration management of analysis based on design configuration

Key features

- Model-based creation of analyses (automation)
- Flexibility of analysis (fault tree generation across multiple hierarchies)
- Developed from a central modelling repository
- Dynamic, iterative process (cf: static documentation derived from traditional methodologies)

The Problem: Fault Tree Analysis (FTA) is a vital part of safety assessment in the design process, identifying the engineering risks in a specific system configuration. With the increasing use of model-based engineering analysis for complex systems design, traditional tools and methods that rely on manual input prove impractical for FTA. Without integration between model-based engineering analysis and the FTA generation process, design schedules are extended and configuration management of the analysis is problematic.

The Solution: MADe uses a simulation model to represent a system and can automatically generate a range of analyses, including both hardware and functional FTAs. FTAs derived from a MADe model are based on the relationships between faults and failure modes in the system model. Tracking failures from initiating event to end effect on the system, through each level of the system hierarchy (system, subsystem, component, parts). Automating the process of FTA generation allows the user to focus on prioritising and addressing issues during the design process, rather than attempting retrospective engineering changes.

Fault Tree Analyses: identifying the contributors to system failure

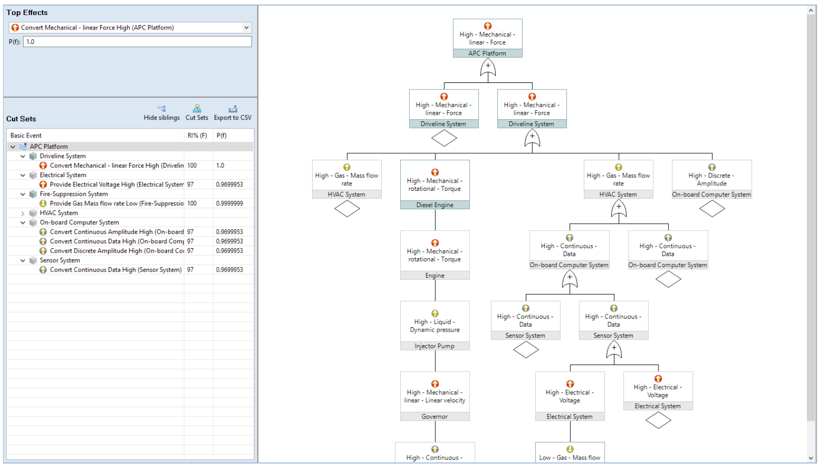

Figure 1: Functional FTA generated from a MADe model

How does MADe Fault Tree Analysis work?

From a MADe model, the user nominates the target hierarchy (system, subsystems, etc.) and then selects the fault tree type (functional/hardware). MADe assimilates model data including failure diagrams/concepts, functional failure modes and the system hierarchy to construct the layout of the fault tree (including gates and event symbols) with the relative importance of failure modes and their probability of occurrence output.

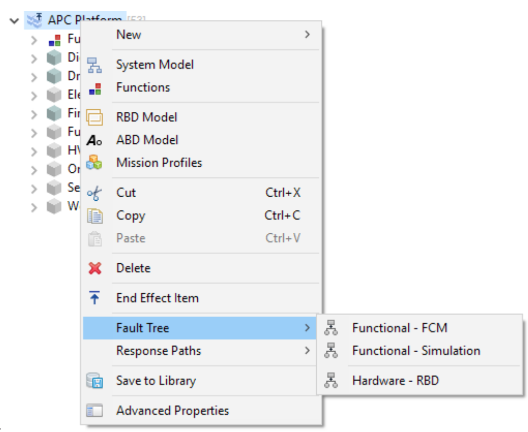

Figure 2: Selecting the FTA type in MADe

Why is Fault Tree Analysis important?

The ability to generate FTA on-demand is crucial to ensuring the safe operation of complex systems. Additional benefits include:

- Objective identification and documentation of potential causes of failure
- Identification & classification of potential issues in complex systems
- Quantification of failure probability and contributors

What benefits does MADe Fault Tree Analysis over standard Fault Tree Analysis tools?

MADe Fault Tree Analysis is constructed based on a model-based structure, which is developed using a consistent and comprehensive function, flow and failure taxonomy. This means that the user can maximise the consistency and effectiveness of the failure analysis process.

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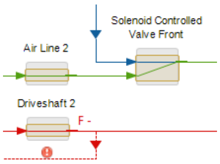
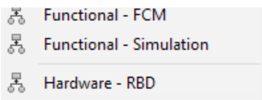
How MADe performs model-based Fault Tree Analysis

What is required to conduct MADe FTA?

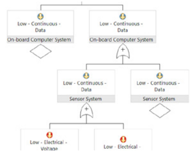
Functional Model



FTA Type



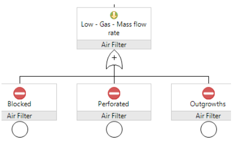
FTA Generated



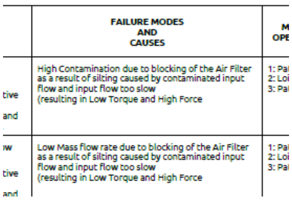
1) Functional Model of the system is created in MADe.
2) User selects the FTA type (Functional or Hardware).
3) MADe automatically generates the FTA for the system.

What does MADe FTA provide?

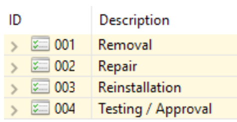
Fault Tree Analyses



FMECA/FMEA



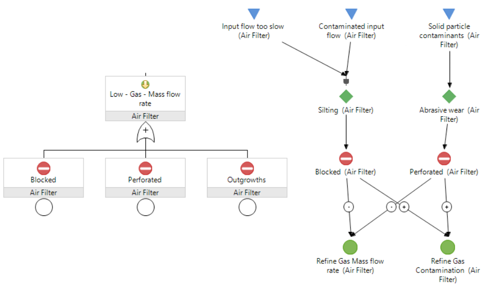
Safety Assessment/
Corrective Action



1) FTA facilitates root cause analysis – identifies causes of a given event.
2) FMECA/FMEA – Identifies and assess each failure path.
3) Safety/Corrective Action – Items identified as critical.

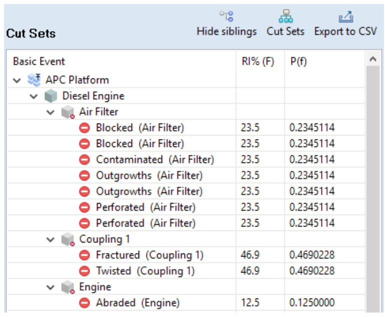
What is the role of model-based Fault Tree Analyses in System Safety Analysis?

Resolve causes of system failure



Identify physical root cause of system failures

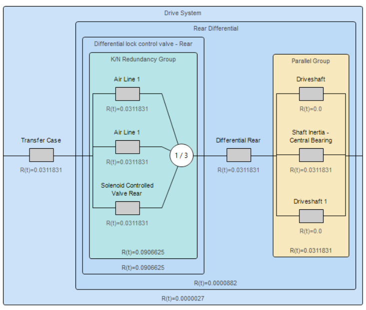
Quantify system failure probability



Basic Event	RI% (F)	P(f)
APC Platform		
Diesel Engine		
Air Filter		
Blocked (Air Filter)	23.5	0.2345114
Blocked (Air Filter)	23.5	0.2345114
Contaminated (Air Filter)	23.5	0.2345114
Outgrowths (Air Filter)	23.5	0.2345114
Outgrowths (Air Filter)	23.5	0.2345114
Perforated (Air Filter)	23.5	0.2345114
Perforated (Air Filter)	23.5	0.2345114
Coupling 1		
Fractured (Coupling 1)	46.9	0.4690228
Twisted (Coupling 1)	46.9	0.4690228
Engine		
Abraded (Engine)	12.5	0.1250000

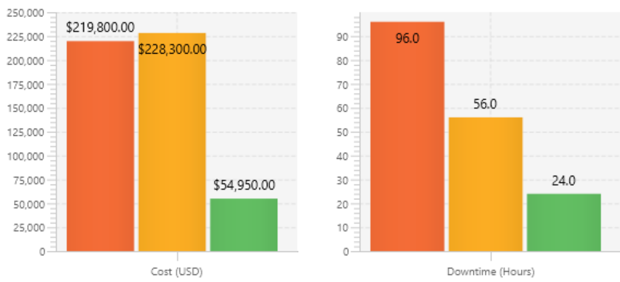
Analyse system reliability and failure mode probability

Identify potential system upgrades



System critical poor performing items identified for re-design

Optimize resources – assure system safety



Develop maintenance actions for critical failure modes

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