MADe – model-based FMEA

made
decisions better MADe...

Objective FMEA process that leverages automation.

Key benefits

- Automation of failure identification (significant cost / schedule reductions).
- Consistency of failure analysis process (objective , easily verified / validated).
- Traceability - knowledge of domain experts captured and leveraged in the model.
- Extensibility of system (configuration management across platform lifecycle).

Key features

- Visual representation of failure propagation.
- Usability – intuitive graphical interfaces enable rapid knowledge transfer.

The Problem: The systems-driven approach to design and increasing complexity of equipment (combining electronic, hydraulic, mechanical and pneumatic systems) makes the traditional manual approach to failure identification and analysis difficult to conduct or validate – which in turn makes it difficult to accurately and consistently perform a Failure Mode Effects Analysis (FMEA) using the traditional 'brainstorming' process (with the outputs recorded in spreadsheets). These problems are compounded by the requirement to update the FMEA as engineering changes are proposed during the design lifecycle.

The Solution: the model-based FMEA available in MADe introduces automation (e.g. dependency mapping of failure propagation), objectivity (results are derived from the model attributes) and consistency (standardised taxonomies of functions / failure concepts). MADe FMEAs use a structured approach that is consistent with international standards and guidelines (MIL, SAE, ISO) to generate a consistent and repeatable FMEA analysis directly from a system model. A key benefit of this model-based approach is that the FMEA analysis is generated 'on-demand', enabling the user to analyse the impact of potential changes rather than simply document the design state.

Simulate the effects of failure throughout the system.

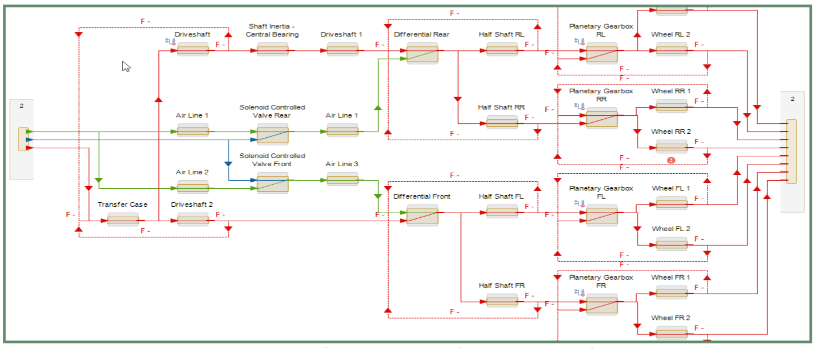


Figure 1: A simulated failure propagation for a driveline transfer case.

How does MADe generate a FMEA Report?

MADe generates the FMEA reports directly from the FBD (system model) – the functional definitions of each element in the system and their connections to other model elements are used to identify the causal relationships and the propagation of failure effects in the system. Once the core failure modes are identified MADe uses a Failure Diagram to add extra detail to determine failure causes, detection methods or compensating provisions.

Where in the system lifecycle Environmental Scaling be applied?

Understanding the the impact of Operating Environments of maintenance costs will inform engineering and management decisions throught a system's lifecycle:

- Consistency of analysis using engineering taxonomies to guide the construction of FBDs and Failure Diagrams.
- Graphical interfaces and simulations to provide a seamless process for FMEA.
- Rapid, on-demand FMEA reporting, that can be performed iteratively as the design changes during the system lifecycle.

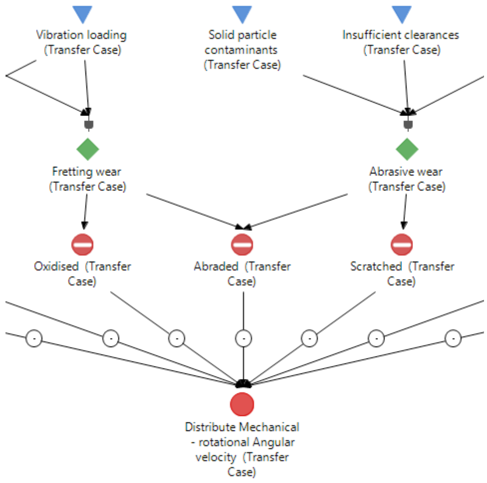


Figure 2: Failure Diagram in a Transfer Case Component.

What benefits does model-based FMEA have over traditional FMEA?

MADe model-based FMEA means that the user can maximize the consistency and effectiveness of the failure analysis process. Since the failure analysis information is consistent and current, the FMEA information can be used to drive additional future analyses (e.g. Fault Tree Analysis, Classic RCM, PHM Analysis and Sensor Set Design).

PHMTechnology
www.phmtechnology.com

To arrange for a demonstration, please contact us at info@phmtechnology.com

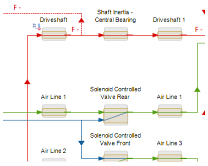
made
decisions better MADe...

How MADe performs FMEA

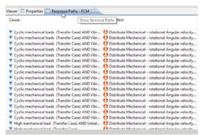
Establish FMEA Framework

1) Define Mission Profile

2) Define System Model



3) Generate Failures



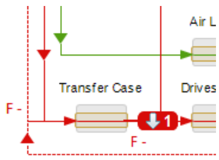
1) Define the usage profiles and environment of operation.

2) Define the system framework using a FBD modelling approach.

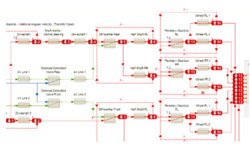
3) Generate functional failures from the system model (failure propagation table) for review.

Simulating failure and generating response outputs

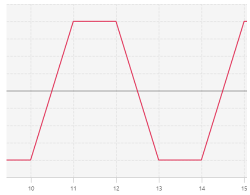
1) Inject Failure



2) Simulate Failure



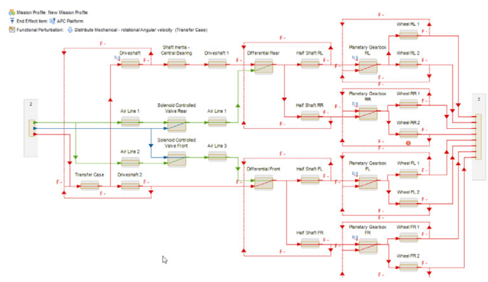
3) Chart Failure Responses



1) Inject failure modes into the system model for use in simulation.
2) Simulate the effects of failures step-by-step, including all steps between local, next and end effect.
3) Graph the results of the response at the local, next and end effect of a failure.

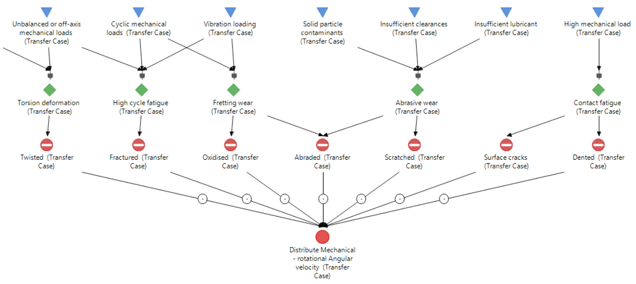
Generate Key FMEA Outputs

Functional Flow Block Diagrams (FFBDs)



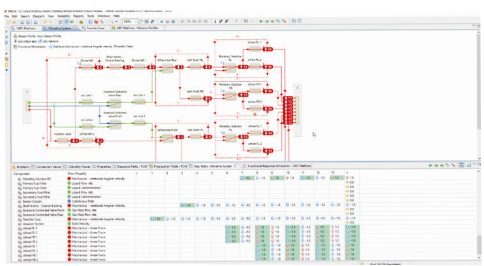
MADe FBDs show the system model, including items (logical or physical), functions and interfaces.

Failure Diagrams (FDs)



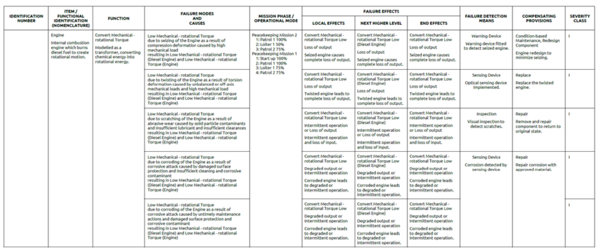
MADe Failure Diagrams show failure causes, mechanisms, and faults that lead to functional failure modes.

Failure Effect Simulations (FES)



Failure Effect Simulations show the progression (propagation) of failures through the system (model).

FMEA Report



FMEA reports can be generated in a variety of formats, and are generated directly from the system model.

PHMTechnology
www.phmtechnology.com

To arrange for a demonstration, please contact us at info@phmtechnology.com

MADe is a registered trademark of PHM Technology.