MADe Models & CAD Integration

Importing CAD models into MADe to highlight critical items.

Key benefits

- Ease of use – automated import of a CAD structure into a system model
- Consistency of model structure (matching CAD items to subsystems, components and parts)
- Reconfigurable – quickly reconfigure different CAD items into alternate system model hierarchy
- Traceability – critical Items from system model highlighted in CAD export

Key features

- Importing from a CAD model
- Analysis flexibility (criticality analyses across multiple system model hierarchies)
- Dynamic, iterative process (vs. static documentation using traditional methodologies)

The Problem: The increasing challenge of engineering complex systems necessitates understanding the likelihood of failure and how it can be reduced early in the design stages. For CAD models, users require extensibility in terms of simulating structural, finite element, data management analyses, etc. An aspect of early design that is rarely captured is the effect of failure mode criticality and reliability. Without a way to flag how one or more items in a CAD model have surpassed a criticality or reliability threshold, it becomes increasingly difficult to assess the safety performance of a complex system.

The Solution: MADe has been developed with a built-in import capability to access a CAD model, convert it into a MADe model for analyses, then highlight critical or unreliable items in an exported CAD model. This feature allows the user to use heuristic analyses coupled with historical data to determine whether a design needs further refinement. MADe models are generated automatically with options for the user to select specific items and the ability to allocate these items to the required model hierarchy.

CAD Integration: Highlighting critical items in a CAD model

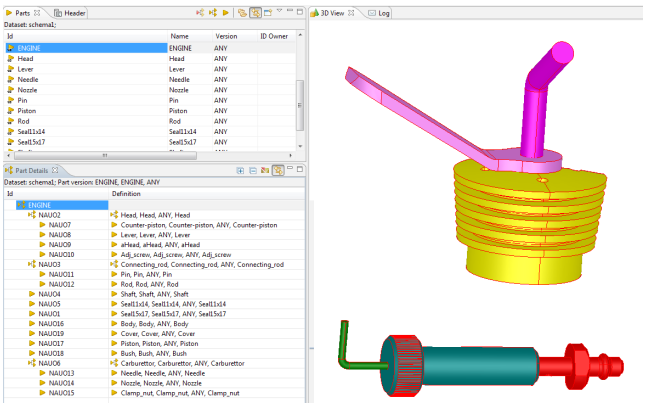

Figure 1: A critical item in a CAD model flagged as a result of MADe critical item analysis

How does CAD integration work in MADe?

The user opens a MADe project and selects the import wizard. From this wizard, the user selects a compatible CAD model (in STEP file format), and then selects the CAD items to include in the import process. Next, the user can attempt to match CAD items with the palette or existing item library in MADe. The final step is the user selecting hierarchy in the model in which the imported items will be allocated.

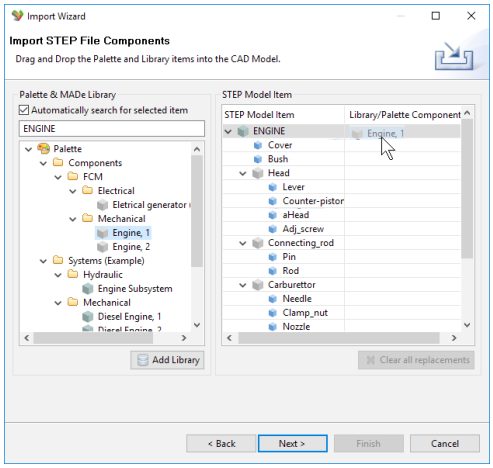

Figure 2: Matching CAD items with MADe Palette items

Why is CAD integration important?

The ability to perform a criticality analysis for a CAD model on-demand is crucial to improving the design of a complex system. Additional benefits include:

- Comprehensive identification and documentation of failure causes
- Identifying & classifying weaknesses in a complex system
- Quantify failure probability and contributors
- Provide system optimisation through testing and maintenance

What benefits does MADe CAD integration have over standard integration solutions?

MADe models are constructed using a model-based functional block diagram with built-in criticality and reliability analyses. This means that the user can capture critical items in MADe and reflect this criticality in an exported CAD model.

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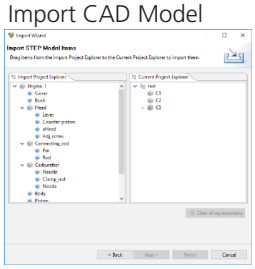
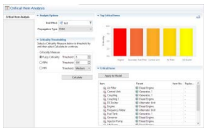
How MADe Performs CAD Integration

What is required to integrate CAD models?

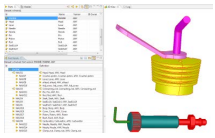
Import CAD Model



Perform Criticality Analysis



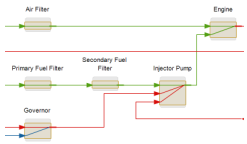
Export updated model



1) User imports CAD model in STEP format into MADe
2) User performs criticality analysis to determine critical items
3) When CAD model is exported, opening the drawing will show items that are considered 'critical'

What does MADe CAD integration provide?

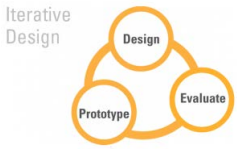
System Structure



Criticality Analysis

CRITICALITY			
O	S	D	RPN
10.0	10.0	10.0	1000.0

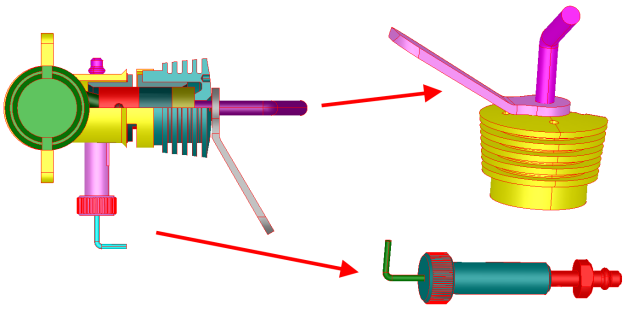
Design Loop (FRACAS)



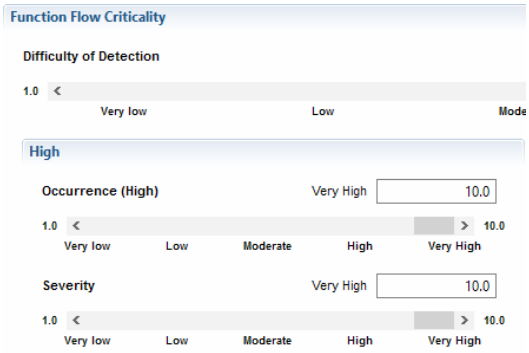
1) User can translate a CAD structure into a functional model
2) User can perform criticality analyses/trade-offs with model
3) Analysis results fed back into the model promotes iterative design

How are the results of CAD Integration used?

Highlight design deficiencies



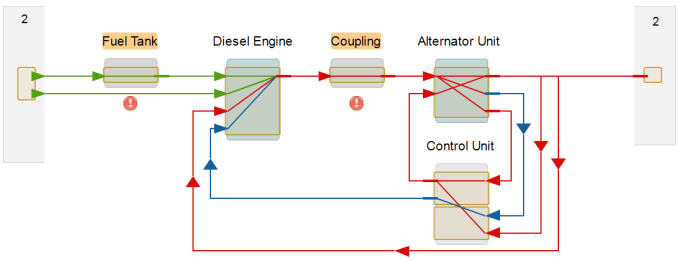
Heuristics/field data used to influence design decisions



Identify potential lifecycle upgrades in design

- Baseline Actions
  - Failure-Finding
  - **Redesign**
  - Repair
  - Replace
- Proactive Maintenance Tasks
  - Scheduled Repair
  - Scheduled Replace
  - On Condition

Design validation from a MBSE perspective



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