eBook

FUNCTIONAL MOCK-UP INTERFACE: THE STANDARD FOR COLLABORATION IN MODELING AND SIMULATION

Four benefits of incorporating the FMI standard into your workflow

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WHAT IS FMI?

The Functional Mock-up Interface (FMI) is a tool independent standard for exchanging dynamic simulation models across different platforms or tools. The FMI standard specifies an open format for exporting and importing simulation models. This means that you can select the tool best suited for each type of analysis while keeping the same model. You can also share your model with colleagues who can reuse it for other applications and within tools that better match their needs, skills, and preferences.

The value of model-based development and investment in a simulation model portfolio increases tremendously when models can be reused and repurposed for different applications. Today there are more than 150 tools that support the FMI standard – enabling engineers to transfer simulation models from one tool to another. The true benefit is not only the ability to transfer models between tools, but rather transferring and exchanging models between engineers, teams, and companies – people!

Utilizing the FMI standard allows engineers to package advanced simulation models into a jigsaw puzzle piece, hiding internal complexity and exposing a limited interface.

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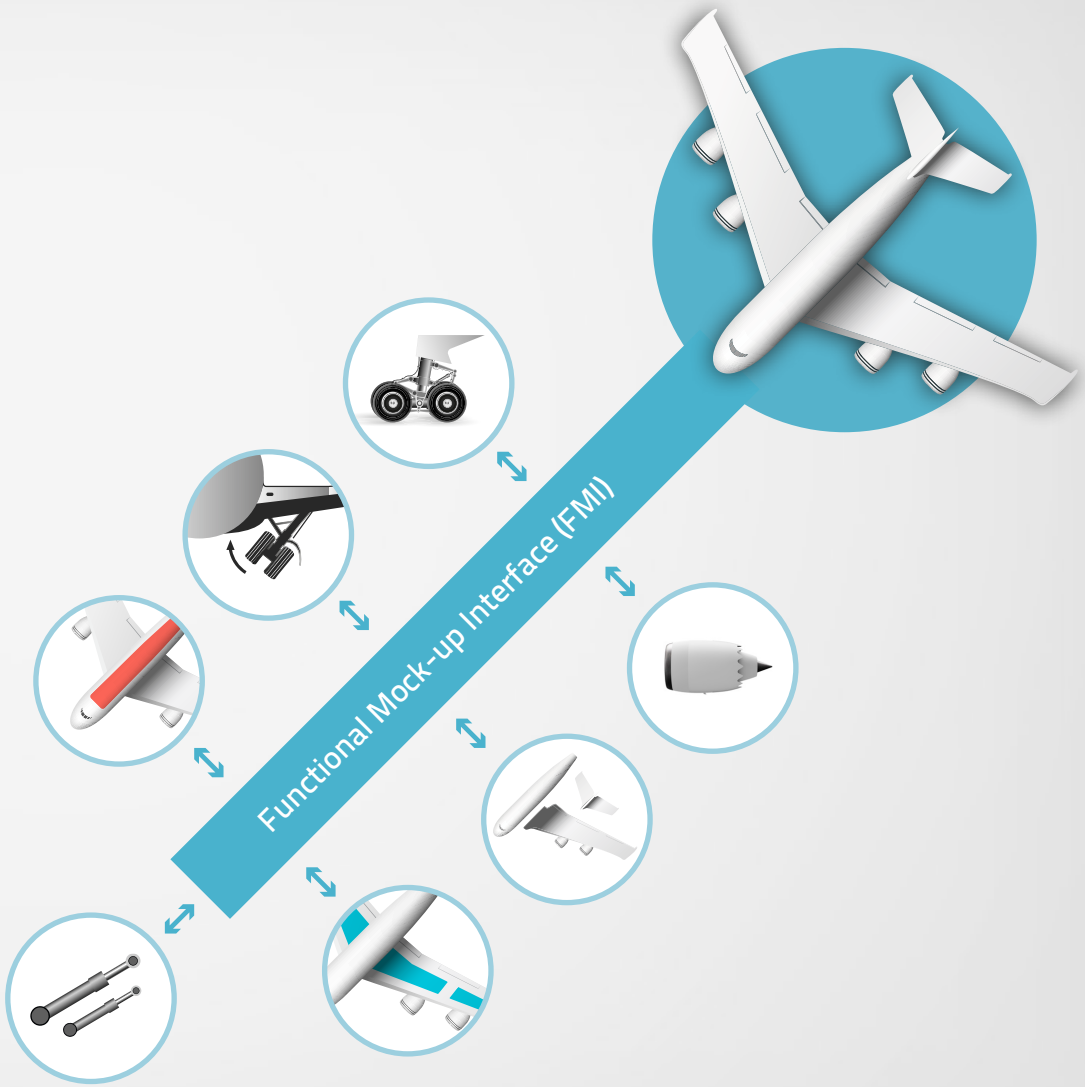
WHY FMI?

In the world of virtual engineering, system engineers have a variety of tools to design the products of the future. Advanced engineering and innovative technologies require modeling and simulation technology that can be:

1) customized to adapt to changing needs, and
2) deployed easily across a broad range of stakeholders – making collaboration between teams easy and efficient.

This eBook introduces the Functional Mock-up Interface as an enabler for advanced engineering and covers the benefits of incorporating the innovative standard into your current workflow.



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HOW DOES IT WORK?

The Functional Mock-up Interface (FMI) standard supports two Functional Mock-up Unit (FMU) types - a file (with extension .fmu) which contains a simulation model that adheres to the FMI standard - including: Co-Simulation (CS) and Model Exchange (ME).

Co-Simulation (CS) – The numerical solver is embedded and supplied by the exporting tool. The importing tool will set the inputs, tell the FMU to step forward at a given time, and then read the outputs.

Model Exchange (ME) – The numerical solver is supplied by the importing tool. The FMU provides functions to set the state and inputs, and to compute the state derivatives (i.e., the left-hand side of the equation). The solver in the importing tool will determine what time steps to use, and how to compute the state at the next time step.

To learn which type of FMU you need, check with your vendor regarding your intended tool chain to see available options.

Co-Simulation (CS)

Model Exchange (ME)

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✔ FMI BENEFIT

IMPROVED INTERNAL COLLABORATION

Most engineering groups at large industrial or manufacturing organizations are split into multiple teams, with each team specializing in a specific domain. Typically, these teams use different tools to accomplish their goals. When it is time to work cross-functionally, engineers can struggle to share their work with other teams, and vice versa. This ultimately causes product development inefficiency, siloed teams, and significant lost opportunity.

Using the Functional Mock-up Interface standard, models can be shared across teams and throughout their supply chain, regardless of what tool the model came from. Multi-disciplinary teams gain the flexibility of working from the same page and can more easily combine their sub-system models into a full system. The FMI standard is also careful to bring models to the same level of communication, while not compromising quality. Models with different levels of abstraction, such as FEA, CFD, 1-D and block diagram controls models, can all be exported as FMUs regardless of their underlying numerical methods.

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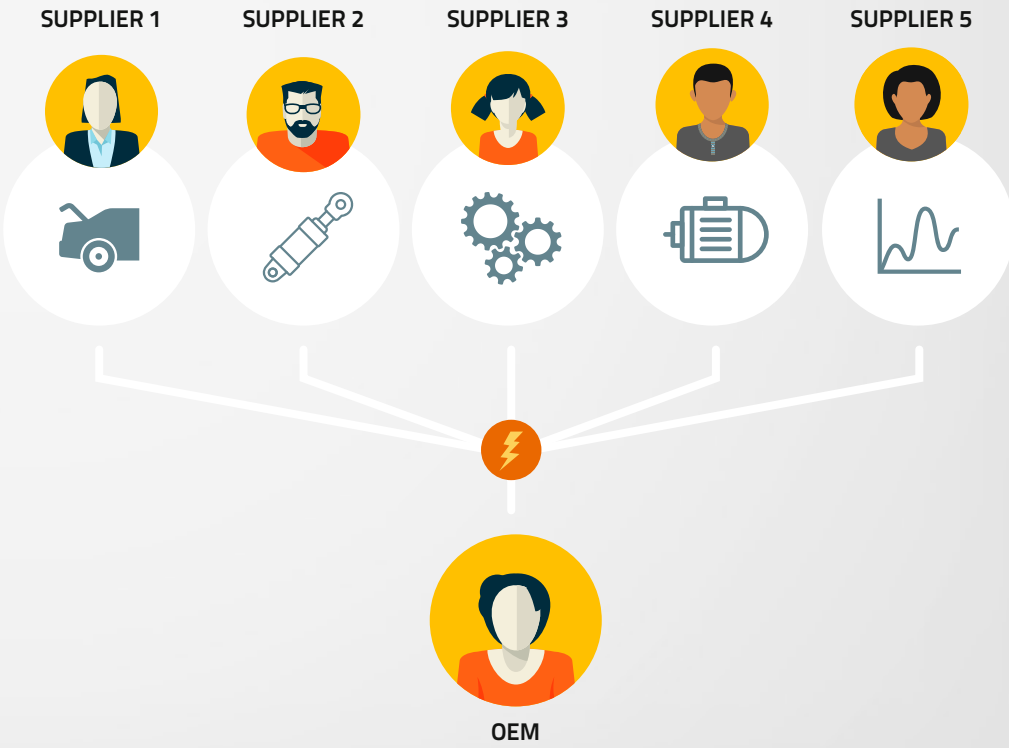
✔ FMI BENEFIT

EFFICIENT EXTERNAL COLLABORATION

Engineers spend countless hours building, calibrating, and optimizing component and system models, but often hit major roadblocks when the time comes to share these models outside their organization. In addition, security around engineering IP is a high-profile issue everywhere, and can introduce major concerns when an engineering team wants to share their results. The Functional Mock-up Interface standard was created to support collaboration with partners and outside stakeholders. FMI enables custom IP protection during model export, helping organizations keep their data secured. Sharing models regardless of the complexity of the model, can be as simple as emailing from person to person.



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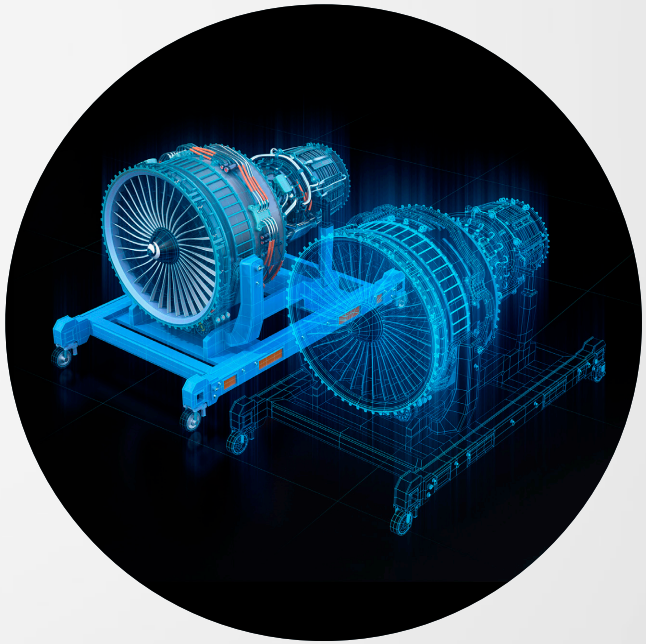
✔ FMI BENEFIT

INTEGRATING SOFTWARE AND HARDWARE

The ability to connect the virtual world and physical world is enabled by the Functional Mock-up Interface. FMI technology seamlessly connects software components with hardware components, whether it be for real-time simulation, predictive simulation, or both. Today, major hardware-in-the-loop vendors such as dSPACE, National Instruments™, Concurrent Real-Time, IPG Automotive, and Speedgoat fully support the FMI standard, making controller design testing more accessible than ever. Additionally, FMI supports digital twin simulations by providing a platform with a suitable interface for channeling data from a physical object to its simulation twin model. Therefore, models can be calibrated to return more accurate results, or differences between the expected and actual behavior can lead to actionable insights, like the detection of failures.



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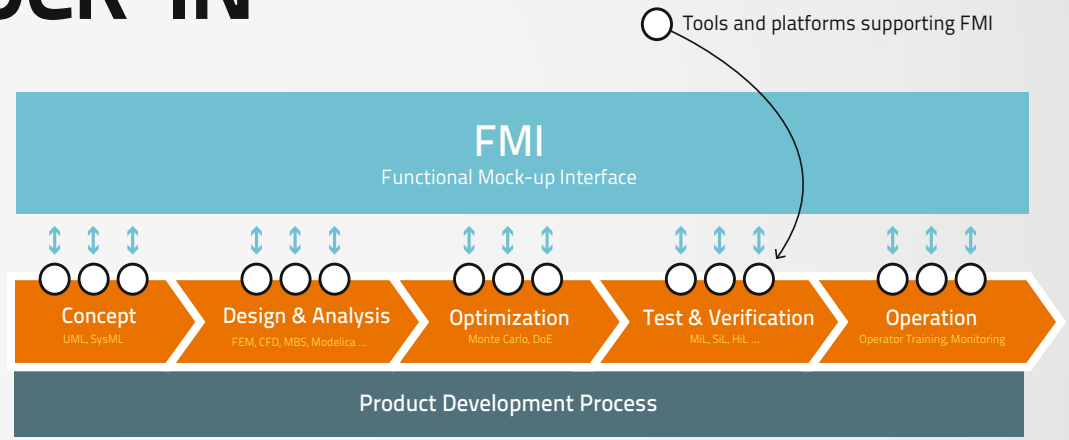
✔ FMI BENEFIT

AVOIDING VENDOR LOCK-IN

Using software platforms and tools that support the Functional Mock-up Interface standard can reduce organizational concerns around vendor lock-in. Companies researching or developing advanced technologies continue to invest in model-based systems engineering, placing more and more emphasis (and budget) on virtual engineering, and software tools.



The FMI standard workflow allows teams to utilize multiple tools efficiently – separating the model authoring tool from the model execution tool. Therefore, as workflows and knowledge evolve, the fear of switching costs can be reduced. A high investment in switching costs can be enough to prevent organizations from deploying better tools that serve their present and future needs, and in the worst case, can chain engineering organizations to increasingly outdated solutions.
By adopting FMI-based workflows, organizations can significantly reduce switching costs with the assurance that their FMI-based workflows will transfer seamlessly into a new tool.

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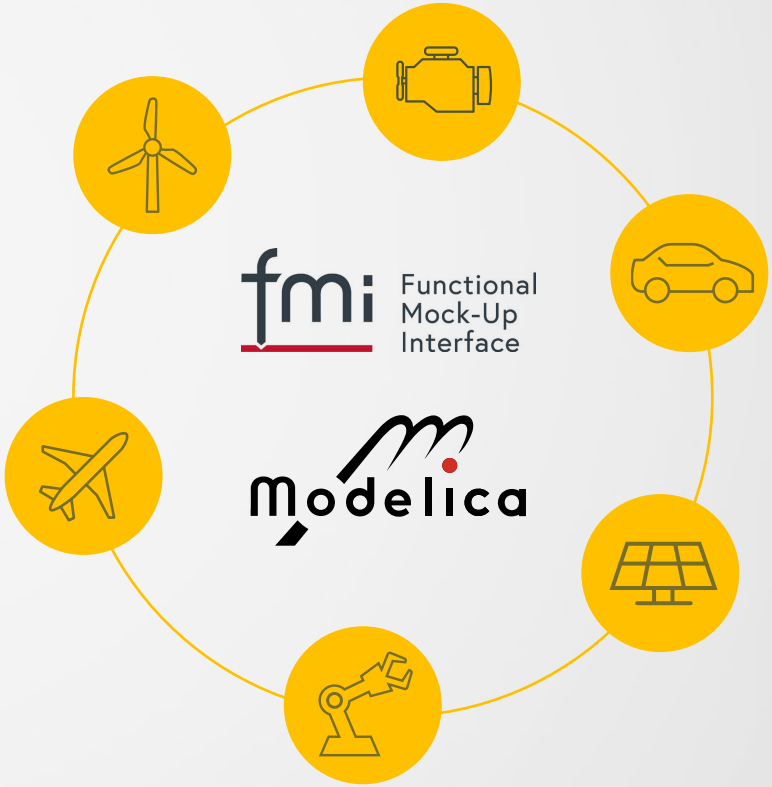
MODELON'S FMI EXPERTISE

Modelon is an industry leader in model-based systems engineering with a focus on leveraging open standard technologies – Modelica and Functional Mock-up Interface. Our leading solutions enable users to share models efficiently and effectively throughout the product development cycle.

Would you like to discuss how FMI can benefit your organization? Our modeling and simulation experts specialize in utilizing and implementing open standards for systems simulation and modeling workflows.

Get in touch with us today.



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