INCOSE-LA Speaker Meeting

September 17, 2024

Welcome New Members

Adam	Young	Leidos/Loyola Marymount University
Adrian	Avila-Arceo	Loyola Marymount University
Alma	Saiya	Northrop Grumman Corporation
Charles	Kim	Loyola Marymount University
Diem Quyen	Tran	Loyola Marymount University
Hiroki	Kogure	Ministry of Defense, Japan/USC
Lauren	Ochoa	Loyola Marymount University
Leroy	Hanneman	INCOSE Foundation
Miray	Hepguler	Purdue University
Philipp	Kalenda	LieberLieber Software GmbH
Sebastian	Medina	Loyola Marymount University
Shaan	Sharma	Loyola Marymount University
Tyrique	Harris	Loyola Marymount University

INCOSE-LA Chapter

- INCOSE = INternational COuncil of Systems Engineering
  - Online systems engineering documents (35+) available
  - Current job board/listings
  - Great career, mentoring & professional development resources
  - Training for systems engineering certifications (ESEP/CSEP/ASEP)
- Very active LA chapter
  - 480+ members
  - Website: www.incose-la.org

Upcoming INCOSE-LA Events (1/2)

To register, visit Chapter Events at http://incose-la.org

Saturday, 21 Sep 2024 - LMU

11th Annual Mars Rover & Society Expo

15+ Exhibitors, STEM talks, lab demos, and space raffle

Tuesday, 8 Oct 2024 – Online and The Aerospace Corporation

Bridging the Transition Gap: A Framework for Systems Engineering in Early-Stage R&D

Ann Hodges, Sandia National Laboratories (retired)

Saturday, 19 Oct 2024 - California Institute of Technology, Pasadena, California

MBSE Tutorial and Workshop

Dassault Systèmes and Rick Hefner

Upcoming INCOSE-LA Events (2/2)

To register, visit Chapter Events at http://incose-la.org

Saturday & Sunday, 9-10 Nov 2024 - UCI

Joint INCOSE-LA & SD Systems Engineering Mini-Conference

Registration will open at the end of September

Tuesday, 12 Nov, 2024 – Online and The Aerospace Corporation, El Segundo, CA

International Boehm COCOMO Forum on Systems and Software Cost Modeling

Saturday, 16 Nov 2024 – Online and California Institute of Technology, Pasadena, California

INCOSE LA Q4 Strategic Planning Meeting (SPM)

Saturday, 7 Dec 2024 –California Institute of Technology, Pasadena, California

INCOSE LA Holiday Party

NAFEMS-INCOSE Systems Modeling & Simulation WG

Frank Popielas, SMS_ThinkTank, LLC

- Entrepreneur, engineer, coach and consultant with broad experience and detailed knowledge in engineering (virtual and physical), engineering and business management
- Co-chair of the working group (https://www.incose.org/communities/working-groups-initiatives/incose-nafems-collaboration)

www.incose.org

www.nafems.org

NAFEMS-INCOSE Systems Modeling & Simulation Working Group (SMSWG)

"Bridging the worlds of Systems Engineering and Engineering Simulation"

MBSE:	*Systems Modeling and Simulation:*	*Engineering Simulation:*
The formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.	*The use of interdisciplinary functional, architectural, and behavioral models (with physical, mathematical, and logical representations) in performing MBSE to specify, conceptualize, design, analyze, verify and validate an organized set of components, subsystems, systems, and processes.*	*The use of physics-based mathematical (numerical) models and/or logical models, including relevant data derived from their physical model counterparts, as representations of a conceptual or real-world system, phenomenon, or process in studying its technical requirements and operational behaviour.*

SMSWG – Terms & Definitions: https://www.nafems.org/community/working-groups/systems-modeling-simulation/smstermsdefinitions/s-u/

V9 update

Systems Modeling & Simulation WG supporting INCOSE – NAFEMS collaboration

History & Governance

- Following 2011 agreement to develop a collaborative relationship, 1st Joint MoU signed at INCOSE Symposium in 2012 with announcement to form the NAFEMS-INCOSE SMSWG
- SMSWG launched in 2013 with founding steering committee to promote membership
- Joint MoU renewed at INCOSE Symposium in 2015 and NAFEMS World Congress in 2019
- Common INCOSE Charter & NAFEMS Terms of Reference established 2020 & updated end of 2021
- **10th Anniversary of collaboration and renewal of Joint MoU in June 2022**
- **2023 updates on MoU addendum A (joint activities) and B (certification)**

Collaboration

- Promotion of jointly developed products and opportunities for members to participate in each organisation’s activities
- Mutual recognition of certifications offered by each organisation & reduced certification costs
- Mutual support for specific key events of each organisation
  - E.g. NAFEMS sponsorship at INCOSE IS 2021 and INCOSE sponsorship at NWC 2021
  - E.g. NWC19 special panel session “Systems Engineering meets Engineering Simulation”
  - E.g. NWC21 special panel session “Connecting Two Worlds Through Leadership” (inc SE vision & grand challenges)

MEMORANDUM OF UNDERSTANDING
Between
NAFEMS and International Council on Systems Engineering

THIS MEMORANDUM OF UNDERSTANDING ("MOU") is made this 19th day of June, 2019, by and between NAFEMS, an independent organization representing the engineering simulation community with offices at 46 Campbell Street, Hamilton ML3 6AS, United Kingdom, and the International Council on Systems Engineering (INCOSE), with offices at 7670 Opportunity Road, Suite 220, San Diego, CA 92111, henceforth known as the “Parties.” It sets forth the relationship and obligations for NAFEMS and INCOSE relating to mutual participation and collaboration.

1. PURPOSE: This MOU is intended to promote a collaborative relationship in related professional areas that are of mutual interest and benefit to INCOSE and NAFEMS. INCOSE and NAFEMS wish to develop and promote best practice processes and guidance, training, and supporting materials that can be used in projects and organizations in the field of "Systems Modeling and Simulation." This agreement is intended to formalize the working relationship and arrangements.

2. BACKGROUND:

NAFEMS is the International Association for the Engineering Modelling, Analysis and Simulation Community. It is a not-for-profit organization which was established in 1983.

INCOSE is a non-profit membership organization, dedicated to advancing interdisciplinary principles and practices that enable the realization of successful systems.

It is the express purpose of the signatory organizations to support processes that provide customers with systems that perform optimally and are affordable. By joining efforts, the signatory organizations facilitate the exchange and further development of their knowledge and best practices towards comprehensive integration into the design and operation of successful systems.

3. SCOPE AND OBJECTIVES: The Parties will each appoint personnel to explore collaboration opportunities and propose specific objectives on what each party will pursue and how the collaborative efforts will be handled. The *potential* scope for partnering includes, but is not limited to:

a. Promotion opportunities at one another’s annual meetings and symposia.
b. Adoption of a policy permitting one organization’s members to join and participate in the technical or working groups of the other organization for a nominal annual fee, without requiring dual society-level membership; thereby facilitating opportunities for cross-talk among practitioners of the two organizations. This may include preferential access to the other organization’s products or other IP.
c. Facilitation of opportunities for joint collaborative publications, tutorials, presentations, and development/improvement of processes, methods, guidance and tools; plus co-marketing of any joint products, public relations and communications about the nature of the relationship, and sharing of initiatives or projects of potential interest to the Parties’ members.

All joint and collaborative opportunities and products will meet the necessary reviews of each of the Parties as prescribed by their respective policies. The embodiment of the cooperative relationship will comprise the specific recommendations in Addendum A, which will be kept up to date as the partnership and its objectives evolve.

4. OWNERSHIP: The Parties agree and acknowledge that NAFEMS is the exclusive owner of all rights, title and interest throughout the world to the name NAFEMS; and that INCOSE is the exclusive owner of all rights, title and interest throughout the world to the name INCOSE: including, and without being limited to, all rights in the

INCOSE NAFEMS

SMSWG Purpose & Mission

Purpose

- **Systems Engineering** has recognized the importance of models in a wide range of roles. Early in the development of a system, models may be used to understand the user domain, to define functions and concepts, and to capture system requirements across the levels of a system architecture. Such models may specify functional, interface, performance, and physical requirements, as well as other non-functional requirements such as reliability, maintainability, safety, and security.
- **Engineering Simulation** has been an essential part of product development engineering across many industries and disciplines for decades. This work is typically performed by technical specialists with deep knowledge in their respective domains, and with expertise in specialized mathematical and analytical tools.
- **Combining the Modelling and Simulation perspectives of both Systems Engineering and Engineering Simulation can improve communications and coordination across the product development life cycle.**

Mission & Goal

- To develop a **vendor-neutral, end-user driven** consortium that not only promotes the advancement of the technology and practices associated with **integration of engineering simulation and systems engineering**, but also acts as the advisory body to drive strategic direction for **technology development and international standards** in the space of complex engineering.
- **The SMSWG supports activities that bridge engineering simulation and systems engineering to optimize the integration of Systems Engineering and Engineering Simulation solutions for both OEM and supplier. This includes education, communication, promotion of international standards, and development of requirements that will have general benefits to the Engineering Simulation and Systems Engineering communities.**

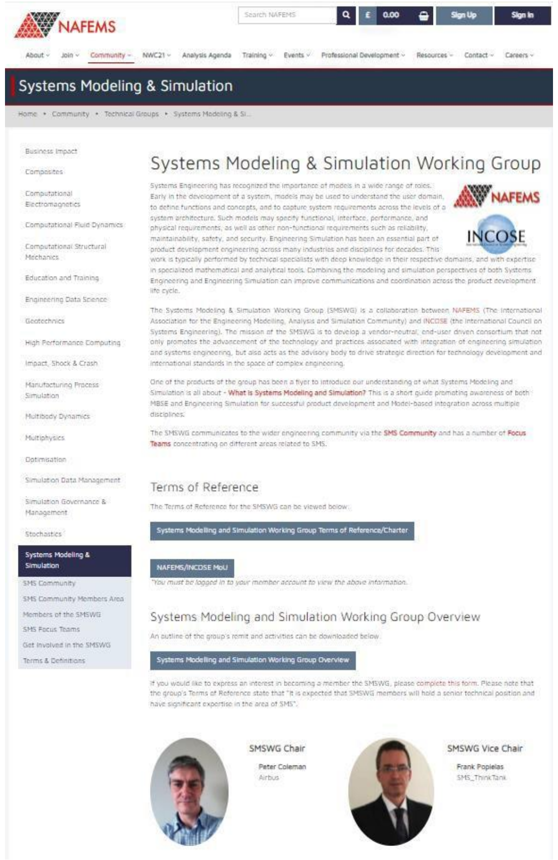
INCOSE

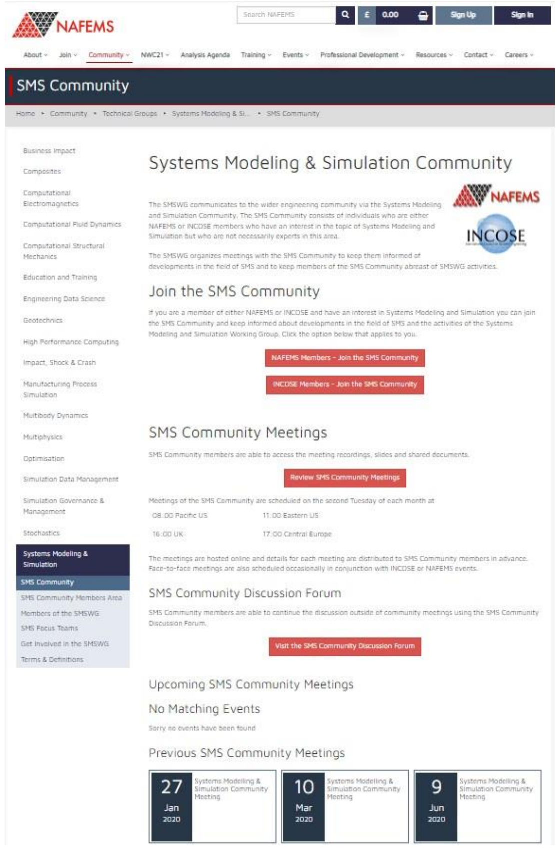
NAFEMS

V9 update

SMSWG Web Pages + SMS Community shared material

Ensure you are signed up to the SMS Community via the NAFEMS website in order to access the SMS Community Members' Area and to receive future event notifications and SMS Community correspondence





https://www.nafems.org/community/working-groups/systems-modeling-simulation/

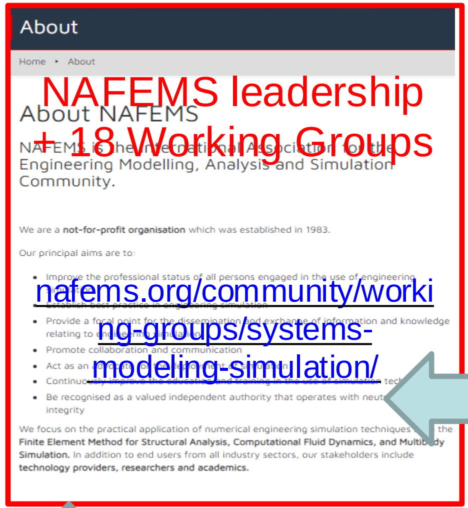
New SMSWG pages for INCOSE launched at IW2023

https://www.incose.org/incose-member-resources/working-groups/transformational/incose-nafems-collaboration

V9 update

SMS WG organisation (2024)

Contact nafems-incose@incose.net if interest to join any Focus Team

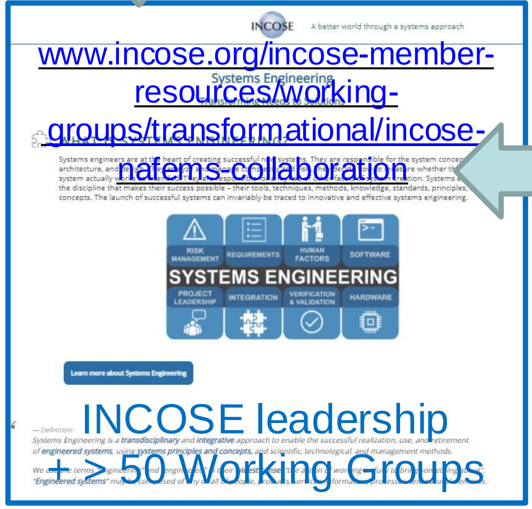


NAFEMS leadership
+ 18 Working Groups

nafems.org/community/working-groups/systems-modeling-simulation/

Collaboration MoU

+ SMSWG Charter / ToR



www.incose.org/incose-member-resources/working-groups/transformational/incose-nafems-collaboration

INCOSE leadership
+ >50 Working Groups

15 SMSWG Members

- Roger Burkhart | Thematix
- Alexander Busch | Ansys
- Peter Coleman | Airbus (Chair)
- Hans Peter de Koning | DEKonsult
- Rodney Dreisbach | NAFEMS Technical Fellow
- Greg Garstecki | Garstecki Modeling Solutions
- Alexander Karl | Rolls-Royce & INCOSE relationship manager for NAFEMS
- Eric Landel | IRT SystemX / ELC
- Phyllis Marbach | INCOSE Assistant Director Transformational Enablers
- Sandeepak Natu | CIMData
- Frank Popielas | SMS_Thinktank (Co Chair)
- Ian Symington | NAFEMS Technical Officer
- Hubertus Tummescheit | Modelon Inc
- Mark Williams | PDES-LOTAR
- Kelly Zimmermann | Boeing

+

- NAFEMS TWG manager

Focus Team - **ACTIVE**
Roadmap & Best Practices
Frank Popielas

Focus Team - ***NEW***
Refining understanding of SMS
Alexander Busch

Focus Team - **restarting June'23**
SMS Standards Ecosystem
HP de Koning

Focus Team - **ACTIVE**
Terms & Definitions
Greg Garstecki

Focus Team - **completed**
SE Handbook 5E MA&S
HP de Koning

Focus Team - **on-hold**
SMS Models & Metadata
P Coleman

Affiliated
AFIS-NAFEMS SMSWG
Eric Landel

SMS Community

Open to all INCOSE or NAFEMS

631 registered (Jul'24)

* 547 NAFEMS

* 113 INCOSE

* 29 both NAFEMS & INCOSE

From >300 different organisations

37 different countries

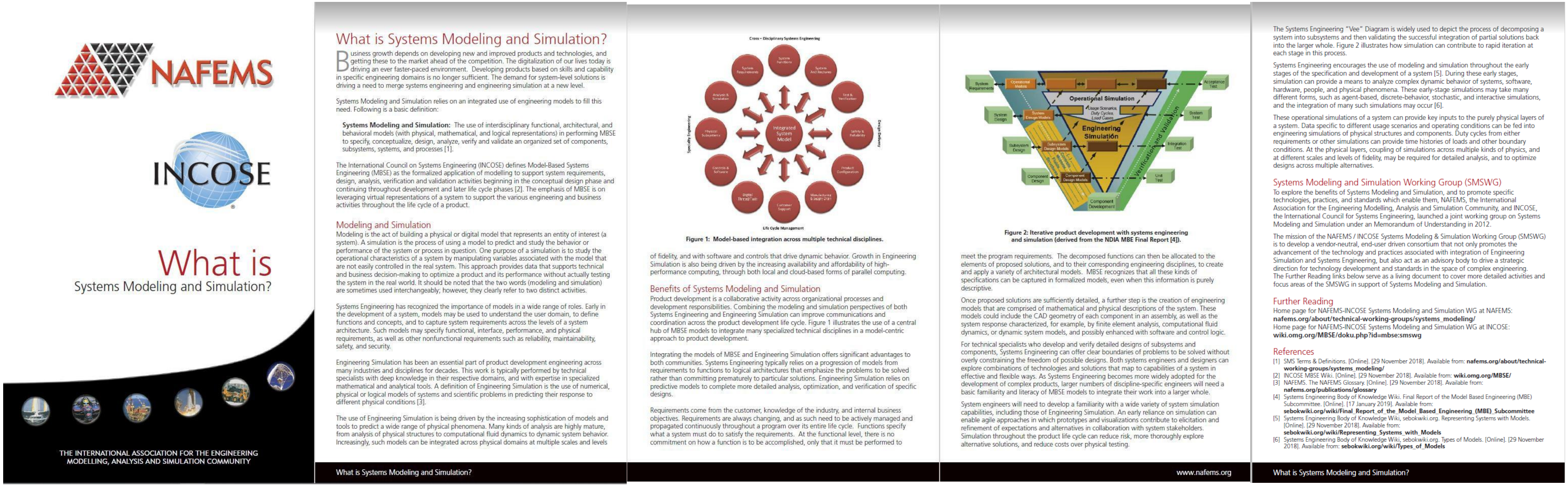
- US & Canada = 40%
- Europe = 43%
- Asia = 14%
- Rest of the world = 2%

69 meetings from 2013 to 2024

Avg 30 participants (since Mar 2020)

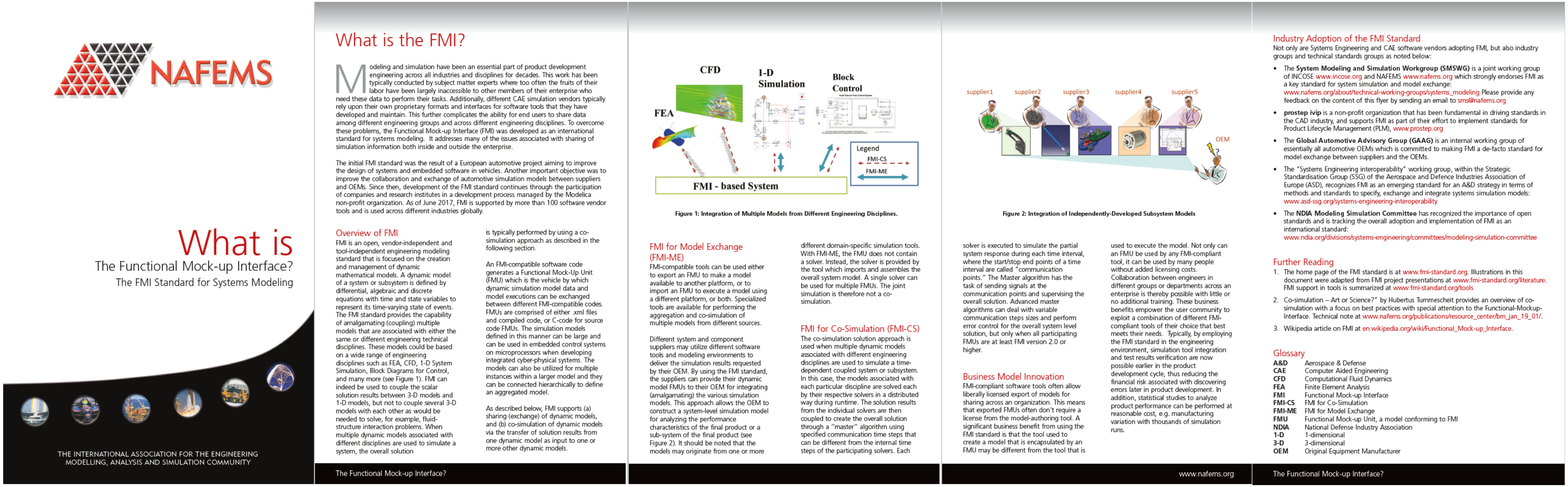
SMSWG “What is SMS?” publication 2019

- Short guide promoting awareness of both MBSE and Engineering Simulation for successful product development and Model-based integration across multiple disciplines
- First co-branded product available for INCOSE or NAFEMS members via:
- https://connect.incose.org/Pages/Product-Details.aspx?ProductCode=what_is_sms
- https://www.nafems.org/publications/resource_center/bm_apr_19_11/



SMSWG “What is FMI?” publication 2018

- Short guide promoting awareness on the Modelica FMI standard for Model Exchange and Co-simulation
- NAFEMS branded product freely available via: https://www.nafems.org/publications/resource_center/wt06/



NAFEMS

What is
The Functional Mock-up Interface?
The FMI Standard for Systems Modeling

THE INTERNATIONAL ASSOCIATION FOR THE ENGINEERING MODELLING, ANALYSIS AND SIMULATION COMMUNITY

What is the FMI?

Modeling and simulation have been an essential part of product development engineering across all industries and disciplines for decades. This work has been typically conducted by subject matter experts where too often the fruits of their labor have been largely inaccessible to other members of their enterprise who need these data to perform their tasks. Additionally, different CAE simulation vendors typically rely upon their own proprietary formats and interfaces for software tools that they have developed and maintain. This further complicates the ability for end users to share data among different engineering groups and across different engineering disciplines. To overcome these problems, the Functional Mock-up Interface (FMI) was developed as an international standard for systems modeling. It addresses many of the issues associated with sharing of simulation information both inside and outside the enterprise.

The initial FMI standard was the result of a European automotive project aiming to improve the design of systems and embedded software in vehicles. Another important objective was to improve the collaboration and exchange of automotive simulation models between suppliers and OEMs. Since then, development of the FMI standard continues through the participation of companies and research institutes in a development process managed by the Modelica non-profit organization. As of June 2017, FMI is supported by more than 100 software vendor tools and is used across different industries globally.

Overview of FMI

FMI is an open, vendor-independent and tool-independent engineering modeling standard that is focused on the creation and management of dynamic mathematical models. A dynamic model of a system or subsystem is defined by differential, algebraic and discrete equations with time and state variables to represent its time-varying state of events. The FMI standard provides the capability of amalgamating (coupling) multiple models that are associated with either the same or different engineering technical disciplines. These models could be based on a wide range of engineering disciplines such as FEA, CFD, 1-D System Simulation, Block Diagrams for Control, and many more (see Figure 1). FMI can indeed be used to couple the scalar solution results between 3-D models and 1-D models, but not to couple several 3-D models with each other as would be needed to solve, for example, fluid-structure interaction problems. When multiple dynamic models associated with different disciplines are used to simulate a system, the overall solution is typically performed by using a co-simulation approach as described in the following section.

An FMI-compatible software code generates a Functional Mock-Up Unit (FMU) which is the vehicle by which dynamic simulation model data and model executions can be exchanged between different FMI-compatible codes. FMUs are comprised of either .xml files and compiled code, or C-code for source code FMUs. The simulation models defined in this manner can be large and can be used in embedded control systems on microprocessors when developing integrated cyber-physical systems. The models can also be utilized for multiple instances within a larger model and they can be connected hierarchically to define an aggregated model.

As described below, FMI supports (a) sharing (exchange) of dynamic models, and (b) co-simulation of dynamic models via the transfer of solution results from one dynamic model as input to one or more other dynamic models.

The Functional Mock-up Interface?

CFD
1-D Simulation
Block Control
FEA
Legend
FMI-CS
FMI-ME
FMI - based System

Figure 1: Integration of Multiple Models from Different Engineering Disciplines.

FMI for Model Exchange (FMI-ME)

FMI-compatible tools can be used either to export an FMU to make a model available to another platform, or to import an FMU to execute a model using a different platform, or both. Specialized tools are available for performing the aggregation and co-simulation of multiple models from different sources.

Different system and component suppliers may utilize different software tools and modeling environments to deliver the simulation results requested by their OEM. By using the FMI standard, the suppliers can provide their dynamic model FMUs to their OEM for integrating (amalgamating) the various simulation models. This approach allows the OEM to construct a system-level simulation model for analyzing the performance characteristics of the final product or a sub-system of the final product (see Figure 2). It should be noted that the models may originate from one or more different domain-specific simulation tools. With FMI-ME, the FMU does not contain a solver. Instead, the solver is provided by the tool which imports and assembles the overall system model. A single solver can be used for multiple FMUs. The joint simulation is therefore not a co-simulation.

FMI for Co-Simulation (FMI-CS)

The co-simulation solution approach is used when multiple dynamic models associated with different engineering disciplines are used to simulate a time-dependent coupled system or subsystem. In this case, the models associated with each particular discipline are solved each by their respective solvers in a distributed way during runtime. The solution results from the individual solvers are then coupled to create the overall solution through a “master” algorithm using specified communication time steps that can be different from the internal time steps of the participating solvers. Each

supplier1
supplier2
supplier3
supplier4
supplier5
OEM

Figure 2: Integration of Independently-Developed Subsystem Models

solver is executed to simulate the partial system response during each time interval, where the start/stop end points of a time interval are called “communication points.” The Master algorithm has the task of sending signals at the communication points and supervising the overall solution. Advanced master algorithms can deal with variable communication steps sizes and perform error control for the overall system level solution, but only when all participating FMUs are at least FMI version 2.0 or higher.

Business Model Innovation

FMI-compliant software tools often allow liberally licensed export of models for sharing across an organization. This means that exported FMUs often don’t require a license from the model-authoring tool. A significant business benefit from using the FMI standard is that the tool used to create a model that is encapsulated by an FMU may be different from the tool that is used to execute the model. Not only can an FMU be used by any FMI-compliant tool, it can be used by many people without added licensing costs. Collaboration between engineers in different groups or departments across an enterprise is thereby possible with little or no additional training. These business benefits empower the user community to exploit a combination of different FMI-compliant tools of their choice that best meets their needs. Typically, by employing the FMI standard in the engineering environment, simulation tool integration and test results verification are now possible earlier in the product development cycle, thus reducing the financial risk associated with discovering errors later in product development. In addition, statistical studies to analyze product performance can be performed at reasonable cost, e.g. manufacturing variation with thousands of simulation runs.

www.nafems.org

Industry Adoption of the FMI Standard

Not only are Systems Engineering and CAE software vendors adopting FMI, but also industry groups and technical standards groups as noted below:

- The **System Modeling and Simulation Workgroup (SMSWG)** is a joint working group of INCOSE www.incose.org and NAFEMS www.nafems.org which strongly endorses FMI as a key standard for system simulation and model exchange: www.nafems.org/about/technical-working-groups/systems_modeling Please provide any feedback on the content of this flyer by sending an email to sms@nafems.org
- **prostep ivip** is a non-profit organization that has been fundamental in driving standards in the CAD industry, and supports FMI as part of their effort to implement standards for Product Lifecycle Management (PLM), www.prostep.org
- The **Global Automotive Advisory Group (GAAG)** is an internal working group of essentially all automotive OEMs which is committed to making FMI a de-facto standard for model exchange between suppliers and the OEMs.
- The “Systems Engineering interoperability” working group, within the Strategic Standardisation Group (SSG) of the Aerospace and Defence Industries Association of Europe (ASD), recognizes FMI as an emerging standard for an A&D strategy in terms of methods and standards to specify, exchange and integrate systems simulation models: www.asd-ssg.org/systems-engineering-interoperability
- The **NDIA Modeling Simulation Committee** has recognized the importance of open standards and is tracking the overall adoption and implementation of FMI as an international standard: www.ndia.org/divisions/systems-engineering/committees/modeling-simulation-committee

Further Reading

1. The home page of the FMI standard is at www.fmi-standard.org. Illustrations in this document were adapted from FMI project presentations at www.fmi-standard.org/literature. FMI support in tools is summarized at www.fmi-standard.org/tools
2. Co-simulation – Art or Science?” by Hubertus Tummescheit provides an overview of co-simulation with a focus on best practices with special attention to the Functional-Mockup-Interface. Technical note at www.nafems.org/publications/resource_center/bm_jan_19_01/.
3. Wikipedia article on FMI at en.wikipedia.org/wiki/Functional_Mock-up_Interface.

Glossary

A&D	Aerospace & Defense
CAE	Computer Aided Engineering
CFD	Computational Fluid Dynamics
FEA	Finite Element Analysis
FMI	Functional Mock-up Interface
FMI-CS	FMI for Co-Simulation
FMI-ME	FMI for Model Exchange
FMU	Functional Mock-up Unit, a model conforming to FMI
NDIA	National Defense Industry Association
1-D	1-dimensional
3-D	3-dimensional
OEM	Original Equipment Manufacturer

The Functional Mock-up Interface?

SMSWG focus team - SMS Terms & Definitions

ACTIVE

V8 update

- First published 2016 with regular updates on dedicated pages hosted via NAFEMS website:
  - https://www.nafems.org/community/working-groups/systems-modeling-simulation/smstermsdefinitions/
  - 173 terms in total at end of 2023
- 12 additions in 2020:
  - Democratization of Simulation / Digital Twin / Engineering Simulation / Generative Design
  - Model-Based Definition (MBDef) / Model-Based Design (MBD) / Model Based Development (MBDev) / Model-Based Engineering (MBEng) /Model-Based Enterprise (MBEnt) / Model-Based Safety Analysis (MBSA) / Model-Based Systems Engineering (MBSE)
  - Simulation Governance
- Additions in 2022
  - Hardware, Software, Model, Human, Processor … “in the loop”
- Terms under review in 2023
  - Types of model e.g. logical, behavioural, physical, descriptive, executable, …
- Review T&D’s from NAFEMS SDMWG
  - Definitions related to existing terms within ISO 10303
  - Simulation model, simulation state, and simulation step

Home • Community • Working Groups • Systems Modeling & Si... • Terms & Definitions • M-O

Systems Modeling & Simulation Working Group

The following was compiled by members of the Systems Modeling & Simulation Working Group to provide the model-based systems engineering community with a common set of shared terms and definitions.

A-C | D-F | G-I | J-L | M-O | P-R | S-U | V-X | Y-Z

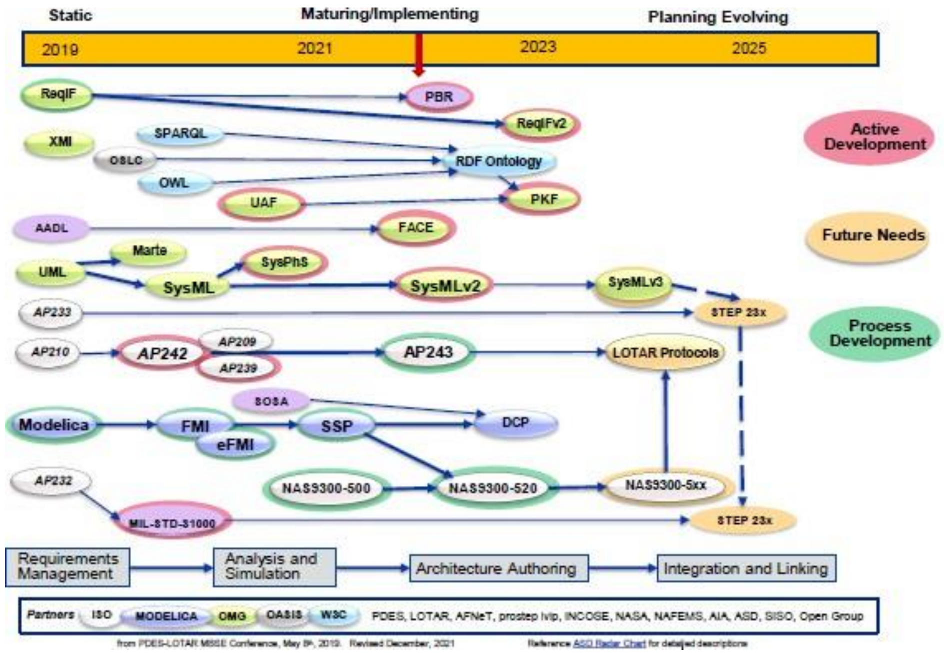
Terms & Definitions (M-O)

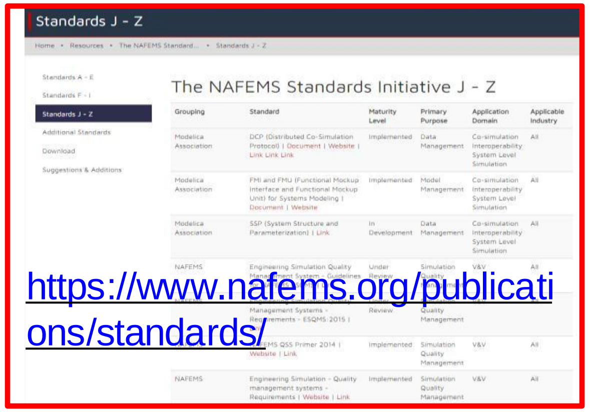
Term	Definition	Source	Comments
Mathematical Model	A symbolic model whose properties are expressed in mathematical symbols and relationships. (IEEE 610.3-1989)	Modeling & Simulation Coordination Office	
Measure Of Effectiveness (MOE)	A metric used to quantify the performance of a system, product or process in terms that describe a measure to what degree the real objective is achieved.	Modeling & Simulation Coordination Office	
Measure Of Outcome (MOO)	A qualitative or quantitative measure that defines how operational requirements contribute to end results at higher levels, such as campaign or national strategic outcomes.	Modeling & Simulation Coordination Office	
Measure Of Performance (MOP)	A qualitative or quantitative measure of how the system/individual performs its functions in a given environment (i.e., number of targets detected, reaction time, number of targets nominated, susceptibility of deception, task completion time). It is closely related to inherent parameters (physical and structural) but measures attributes of system behavior.	Modeling & Simulation Coordination Office	
Measures of Effectiveness Data	Data provided to quantify Measures of Effectiveness.	INCOSE	
Measures of Effectiveness Needs	The "operational" measures of success that are closely related to the achievement of the mission or operational objective being evaluated, in the intended operational environment under a specified set of conditions (i.e., how well the solution achieves the intended purpose).	INCOSE	
Measures of Performance Data	Data provided to quantify the Measures of Performance.	INCOSE	
Measures of Performance Needs	Key performance characteristics the system should have when fielded and operated in its intended operating environment.	INCOSE	
Metadata	Information describing the characteristics of data; data or information about data; descriptive information about an organization's data, data activities, systems, and holdings. For example, discovery metadata is a type of metadata that allows data assets to be found using enterprise search capabilities. (DoDD 8320.02)	Modeling & Simulation Coordination Office	
Metamodel	A model of a model or simulation. Metamodels are abstractions which use functional decomposition to show relationships, paths of data and algorithms, ordering, and interactions between model components and subcomponents. Metamodels allow the developer to abstract details to a level that subject matter experts can validate.	Modeling & Simulation Coordination Office	

SMSWG focus team - SMS related standards

Restarted June'23

- SMSWG aim to identify and promote the maturity and industry adoption of relevant international standards that enable Systems M&S and the integration of MBSE with engineering simulation
- “Unknown or no standards” identified as major gap in survey from MBSE workshop at 2018 GPDIS
- Need for improved model/data interoperability and cross-domain engineering collaboration
- Connect with industry groups working on developing or promoting adoption of standards for MBSE and Engineering Simulation
- Ongoing liaison with NAFEMS Standards Initiative
- Examples:
  - Modelica Assoc. standards e.g. FMI/FMU, SSP …
  - ISO STEP standards e.g. AP209ed2, AP243 (MoSSEC), link with LOTAR
  - Web standards e.g. OSLC, RDF, XML/XMI, UML
  - OMG standards e.g. ReqIF, SysML v2, UAF





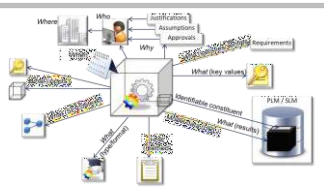
https://www.nafems.org/publications/standards/

on-hold

SMSWG focus team - SMS model characterization & metadata

- Focus team launched in 2021, from discussions initiated at IW 2020
- Ten meetings up to May 2022
- How to characterise SE (systems engineering) and ES (engineering simulation) models together?
- How to harmonise on common and specific categories and types of metadata across types of models?
- Metadata compared to metamodels?
- How to join-up common interests and initiatives?
- Supporting comparison and mapping of model characterisation categories and metadata from multiple sources
  – UMC4ES (ASSESS), NAS9300-5xx (LOTAR), MIC, OAIS, MCP, MoSSEC
- Interface with NAFEMS SDMWG

MoSSEC



- **Modelling and Simulation in a collaborative Systems Engineering Context**
- **ISO 10303-243:2021**
- Business objects covering Study management; Models management; Methodology; Architecture & interfaces; Optimisation; Requirements & quality; Value generation; Actors & organisation; Security & trust

ASSESS

- **UMC4ES** - Unified Model Characterization for Engineering Simulation
- Feature Groups - Model Identity and Focus; Model Scope of Content; Model Representation; Model Utility; Model Confidence/Credibility; Model Lifecycle Management

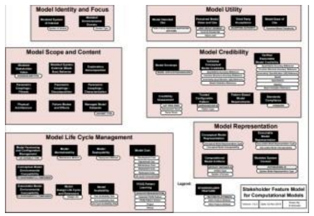
Model Identity Card (MIC)

- General Information; Integration; Content and computation; Ports, internal variable and parameters; Verification and validation

LOTAR MBSE

- NAS9300-520 - analytical models
- Categories - PLM General Info; Model Development-Execution; Physics; Model Variables; V&V;

Model Characterization Pattern (MCP)



- INCOSE MBSE Patterns WG
- Feature groups - Model identity & focus; Model utility; Model scope & content; Model credibility; Model life cycle management; Model representation

Completed

SMSWG focus team – INCOSE Systems Engineering Handbook 5th Edition

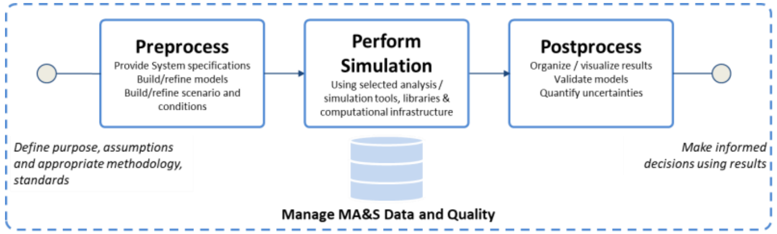
- SMSWG & Community team contributing to SEH5E revision:
  - Hans Peter de Koning + Peter Coleman, Alexander Karl, Maurice Theobald, Hubertus Tummescheit, Rod Dreisbach
- Adapted chapter title => Modeling, Analysis and Simulation
  - Modeling - the conception, creation and refinement of models
  - Analysis - the process of systematic, reproducible examination to gain insight
  - Simulation - the process of using a model to predict and study the behavior or performance of the system-of-interest
- Dec’20 to Apr’21 - Major re-write:
  - Streamlining content & narrative
  - Reference to "What is SMS" flyer
  - Proposed additional terms & definitions
  - Reviews & feedback with Editorial team
  - Overall prototype draft issued to reviewers
- Jan’22 to Mar’22 - Restructured SEH5E and MA&S revisions in response to reviewers comments for final draft submission
- Oct/Nov’22 and Jan’23 - Review significant reduction of text by Editorial team + Further revisions of System Development “vee” figure for final publisher ready version.

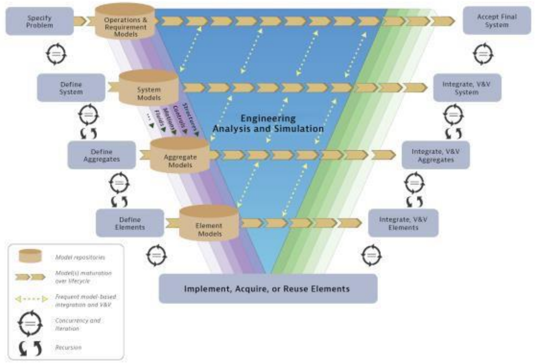
SEH5E - Part III - Life Cycle Analyses and Methods

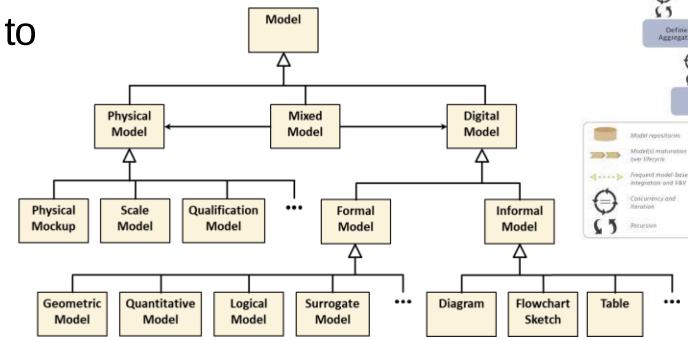
2. – Systems Engineering Analysis and Methods

1. – Modeling, Analysis and Simulation

- Overview and Purpose
- Benefits
- Classifying and Characterizing Models
- Model Interoperability
- Tools
- Modeling Quality and Metrics
- MA&S Industrial Practice







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V8 update

SMSWG outlook for 2024 - work in progress

- Maintain & update SMS WG content on NAFEMS and INCOSE webpages
- SMS WG management meetings - Usually 1st Monday each month, 17.00 CET / 11.00 ET
  - Support INCOSE SE / NAFEMS PSE competencies alignment
- SMS Community meetings - 5 planned in 2024, usually 17.00 CET / 11.00 ET
  - Jan at IW24 + April, June, October and November online
- SMS Roadmap focus team - Usually 3rd Tuesday each month =>
  - Plan SMS community sessions and SMS WG participation at events
  - Identify & support emerging products e.g. MBSE “cheat sheet” for managers
- SMS T&D's focus team meetings - Usually 3rd Tuesday each month
  - Continue to identify relevant SMS Terms & Definitions and integrate in next releases of T&D’s website
- SMS Standards focus team - regular meetings TBA => Potential for primer “How to develop effective engineering digitalisation standards?”
- Refining understanding SMS focus team (NEW) - regular meetings TBA => Potential output revision of “What is SMS” product
- Support key events
  - INCOSE Symposium July 2-6 => Panel session with INCOSE & NAFEMS - theme "Building the digital bridge between MBSE and Engineering Simulation"
  - NAFEMS Americas July 9-11 => SMS track and/or Panel => proposals welcome
- Other potential topics
  - INCOSE, NAFEMS & ASME collaboration with Prostep SmartSE initiative for "Simulation Quality/Credibility" standard
  - NAFEMS ESQMS (Engineering Simulation Quality Management Standard)

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Interested to join the SMSWG or SMS Community?

Get Involved in the Systems Modeling & Simulation Working Group

If you are an expert in the area of SMS and would like to get involved in the **Systems Modeling & Simulation Working Group** activities, please complete the form below.

First Name

First Name

Last Name

Last Name

Company

Company

Email

Email

My organisation is a NAFEMS member

Please Select

I am a member of INCOSE

Please select

If your organisation is not already a member of NAFEMS, would you be interested in receiving information on membership?

Please Select

If you are not already a member of INCOSE, would you be interested in receiving information on membership?

Please select

www.nafems.org/community/working-groups/systems-modeling-simulation/get_involved/

Join the SMS Community

If you are an INCOSE member please complete the form below in order to join the SMS Community.

If you are a NAFEMS member and wish to join the SMS Community please visit the Technical Communities tab in the "My NAFEMS" section of the website.

Visit the SMS Community page to find out about SMS Community events.

First Name

First Name

Last Name

Last Name

Company

Company

Email

Email

Are you a member of INCOSE?

Please select

Submit

By clicking submit and providing us with your contact details, you are giving NAFEMS your explicit consent to contact you using these details regarding your enquiry and our related products and services. You can view our privacy policy here

www.nafems.org/community/working-groups/systems-modeling-simulation/get_involved_sms_community/

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Orbit Regime Analysis, Simulation, and MBSE Modeling

Kyle Gallaher, Ansys Government Initiatives (AGI)

- Bachelors in Aerospace and Ocean Engineering at Virginia Tech
- Joined Ansys in June 2023 as a Technical Support Engineer supporting Digital Mission Engineering tools such as Systems Tool Kit (STK) and Orbit Determination Tool Kit (ODTK)
- Specializes in space-based system simulation:
  - Planning satellite maneuvers for attitude adjustments, orbit transfers, and station keeping
  - Optimization of network communication through large satellite constellations
  - Coverage analysis of communication/optics over an area of interest