



# SPSysML questionnaire

24 lip 2024

Welcome to the assessment of the breaking solution in the Systems Engineering domain! This will take about 20 minutes.

## Your experience questions

1

How long do you develop robotic or other Cyber-Physical Systems? (months)

Wartość musi być liczbą

2

How long do you manage technology development teams? (months)

Wartość musi być liczbą

3

What is/are your technology domain? Choose one or more from:

- ☐ Robotics
- ☐ Automotive
- ☐ Avionics
- ☐ Another cyber-physical system
- ☐ Production automation
- ☐ Information systems
- ☐ Artificial Intelligence
- ☐ Inne

4

How many setups had the most complicated system you developed, or how big was the product family of the system?

Wprowadź liczbę większą lub równą 1

5

Were you familiar with the Digital Twin concept before the presentation?

- ☐ Yes
- ☐ No

6

In which phase of the system life cycle have you utilized simulation technology, including digital twin?

Choose one or more from:

- ☐ Analysis
- ☐ Design
- ☐ Development
- ☐ Testing
- ☐ Implementation
- ☐ Maintenance
- ☐ Evaluation
- ☐ None

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Are you a member of a science or engineering organisation?

Choose one or more from:

- ☐ Institute of Electrical and Electronics Engineers (IEEE)
- ☐ International Council on Systems Engineering (INCOSE)
- ☐ Institute of Industrial and Systems Engineers (IISE)
- ☐ None

8

Did you receive a certificate or graduate a university in the field of systems engineering, robotics, applied information technology or related?

- ☐ Yes
- ☐ No

9

Briefly describe your biggest success in the systems engineering domain.

How valuable is it for you to join simulation and physical models?

1	2	3	4	5
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## Assessment of Simulation-Physical Modelling Language (SPSysML)

11

Is the requirement-based decomposition applicable to your technology domain? Answer Yes/No and briefly why.

12

How sure are you that the requirement-based decomposition strengthens traceability between system components and the requirements?

Wprowadź liczbę mniejszą lub równą 100

13

How sure are you that the requirement-based decomposition would help you in comprehensiveness analysis and verification?

Wprowadź liczbę mniejszą lub równą 100

## SPSysML applicability

**If you would be developing a cyber-physical system including simulation components**, which of the following parts of the methodology would you apply? Write why or why not.

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Would you apply **SPSys Modelling Language as a modelling language** to specify and share the system design? Write why, or why not.

15

Would you apply **the requirement-based decomposition**? Write why, or why not.

16

Would you apply **the agent-based architecture**? Write why, or why not.

17

Would you apply **the simulation-physical integrity factors evaluation for the design evaluation**? Write why, or why not.

18

Would you apply **the systematic procedure (based on the simulation-implementation factor)** to plan and analyse the development order of components? Write why or why not.

Do you agree that:

- ☐ **Controller integrity factor** is a significant evaluation factor for simulation-physical systems
- ☐ **Driver generalisation factor** is a significant evaluation factor for simulation-physical systems
- ☐ **Digital Twin coverage** is a significant evaluation factor for simulation-physical systems
- ☐ **Mirror integrity factor** is a significant evaluation factor for simulation-physical systems

## SPSysML Profits

If you were a designer of a complex cyber-physical system project, how profitable would it be to you to measure:

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the **Controller integrity factor** and change the system design to control it (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

21

the **Driver generalisation factor** and change the system design to control it (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

22

the **Digital Twin coverage** and control it while developing the system (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

23

the **Mirror integrity factor** and control it while developing the system (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100



24

How clear (1-5) are the rules for improving the system based on the proposed design evaluation factors? Expand on the answer using the next question answer. Clarity scale:

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments.
- ☐ 4 – I feel confident to comment on most of it.
- ☐ 5 – I feel confident giving precise comments on all its aspects.

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Expand on the previous answer. Please tell us what aspects:

- a) are clear (for answer 1), **or**  
b) what was not deep enough presented (for answer 2), **or**  
c) what is fuzzy to you (for answer 3), **or**  
d) what is not clear (for answer 5)

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Do you have any other comments on the SPSysML/SPSysDP performance?

## The performance of SPSysML

Based on your experience and knowledge, **assess the probability of the integrity improvement between simulation and physical embodiments in subsequent design iterations** by applying the methodology and controlling:

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the **Controller integrity factor** while modifying the system design (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

28

the **Driver generalisation factor** while modifying the system design (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

29

the **Digital Twin coverage** while modifying the system design (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

30

the **Mirror integrity factor** while modifying the system design (enter your probability 0-100%)

Wprowadź liczbę mniejszą lub równą 100

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Do you see profits in joining simulation and physical models as SPSysML proposes?

☐ Yes

☐ No

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What profits do you see?

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If you were a complex cyber-physical system project designer, how would SPSysML and SPSysDP help you in change analysis? Choose one or more from:

- ☐ component change propagation analysis,
- ☐ promote wider simulation-based change verification,
- ☐ promote wider simulation-based change validation,
- ☐ tracing change from a requirement to the system components' attributes,
- ☐ communicating change impact,
- ☐ Inne

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If you were a complex cyber-physical system project designer, what features of SPSysML would help you maintain the system?

- ☐ SPSys Modelling Language as a modelling language to specify changes and share the system design
- ☐ requirement-based decomposition
- ☐ none
- ☐ Inne

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If you were a complex cyber-physical system project designer, how sure are you that SPSysML would help you maintain the system

Wprowadź liczbę mniejszą lub równą 100

36

What difficulties do you see in the application of:  
**SPSysML as a language for system specification and presentation**

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Based on your experience and knowledge, **does the method comply with the V model?**

- ☐ Yes
- ☐ No
- ☐ I don't know the V model
- ☐ Inne

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What difficulties do you see in the application of:  
**SPSysDP as a development procedure**

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What difficulties do you see in the application of:  
**The proposed design evaluation factors as design assessment markers**

40

What difficulties do you see in the application of:  
**The requirement-based decomposition in finding systems' setups, their components and simulation-physical classes of these components**

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What difficulties do you see in the application of:

**The proposed requirement model in tracing component requirements**

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Do you have any other comments on the aims of SPSysML/SPSysDP?

## The compatibility of SPSysML

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If Yes/No, justify your previous answer.

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To which Zachman Framework cells SPSysML applies, and to which it does not. Please write:  
**APPLIES WELL:** 1-A, 1-B ...; **APPLIES:** 1-A, 1-B ...; **NOT APPLIES:** 1-A, 1-B

ZFI Zachman Framework						
The Zachman Framework	a DATA What	b FUNCTION How	c NETWORK Where	d PEOPLE Who	e TIME When	f MOTIVATION Why
<b>1</b> SCOPE (Contextual) Planner	Things Important to the Business 	Processes the Business Performs 	Locations in which the Business Operates 	Organizations Important to the Business 	Events/Cycles Significant to the Business 	Business Goals/Strategies 
<b>2</b> BUSINESS MODEL (Conceptual) Owner	Conceptual Data Model 	Business Process Model 	Business Logistics 	Work Flow Model 	Master Schedule 	Business Plan 
<b>3</b> SYSTEM MODEL (Logical) Designer	Logical Data Model 	Application Architecture 	Distributed System Architecture 	Human Interface Architecture 	Processing Structure 	Business Rule Model 
<b>4</b> TECHNOLOGY MODEL (Physical) Builder	Physical Data Model 	System Design 	Technology Architecture 	Presentation Architecture 	Control Structure 	Rule Design 
<b>5</b> DETAILED REPRESENTATIONS Sub-Contractor	Data Definition 	Program 	Network Architecture 	Security Architecture 	Timing Definition 	Rule Specification 
<b>6</b> FUNCTIONING ENTERPRISE	Data 	Function 	Network 	Organization Units 	Schedule 	Strategy 

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Do you have any other comments on the compatibility of SPSysML/SPSysDP?

## Qualities of great models

Assess against the following qualities of great models how SPSysML and SPSysDP affect the quality of the resulting models (1: decrease significantly, 2: seem to decrease, 3: not affect, 4: seem to increase, 5: increase significantly):

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**Linked to Decision Support:** denotes the fundamental quality of models that seamlessly integrate into decision-making frameworks. Exceptional models within this paradigm serve as invaluable tools for navigating scenarios where numerous parameters must be carefully balanced. They excel in elucidating the precise manner in which their outputs inform and guide decision-making processes.

1	2	3	4	5
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**Model Credibility:** signifies the degree to which decision-makers trust the results produced by a model. The credibility of a model is pivotal, as it directly impacts the decision-making process. When models lack credibility, decision-makers hesitate to base their decisions on their outputs, potentially leading to squandering time and resources or even jeopardizing the project's success. Building model credibility encompasses various strategies, including the establishment of rigorous standards and processes to evaluate and validate the model's performance.

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**Clear Scope:** defines the extent of system modelling required for a project. This involves determining which system or subsystem will be modelled, ensuring alignment with project objectives. For instance, in automotive design, it could mean broad modelling of all engine components initially, followed by narrower modelling focusing on individual components with stable interfaces.

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**Verification & Validation With Models:** refers to the process of utilizing models to verify and validate products, processes, or businesses. A quality systems engineering model should explicitly demonstrate why modelling is the preferred route for verification and validation tasks. However, it's essential to note that relying solely on a single model for verification and validation is discouraged.

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50

**Understandable and Well-Organized:** clarifies where and how additional components can be integrated into the model. Following a structured Model Development Process enhances modularity and organization, fostering greater comprehensibility.

1	2	3	4	5
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**Analyzable and Traceable:** this quality denotes models that can be readily interrogated and offer clear insight into the factors influencing their outputs. They enable easy identification of the specific variables or sections of the model that contribute to the results.

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**Data Extrapolation:** refers to the capability of models to operate within predefined boundaries of data, conditions, physics, and assumptions. Great models explicitly delineate their validity range, distinguishing where they are applicable and where they are not.

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**Complete Relative to Scope and Intended Purpose:** signifies that the model comprehensively encompasses all pertinent physics or dynamics within its defined scope and purpose.

1	2	3	4	5
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54

**Internally Consistent:** denotes a model that maintains coherence without direct contradictions throughout its components. For instance, assumptions such as the gravity constant remain consistent across all model sections.

1	2	3	4	5
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**Verifiable:** this signifies that the model's outputs can be verified to meet the modelling requirements and align with calibration data, enhancing its credibility for decision-making purposes.

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**Validation:** entails ensuring that the model aligns with and satisfies customer needs and expectations. For descriptive models, this involves effective presentation of information, often through layered or unlayered approaches. For analytical models, validation requires demonstrating their efficacy in enhancing decision-making processes as intended.

1	2	3	4	5
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**Model Fidelity:** refers to ensuring that the model possesses the correct level of detail in relation to the decision being made and the design phase. Excessive fidelity can complicate evaluation and waste resources, while insufficient fidelity can lead to flawed decisions or unwarranted confidence. Selecting the appropriate fidelity level hinges on the system requirements and operational parameters

1	2	3	4	5
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**Elegant:** denotes a model crafted with a balance of simplicity and effectiveness, avoiding unnecessary complexity. For instance, an elegant model minimizes redundancy, such as by storing and reusing computed results rather than recalculating them repeatedly from the same data.

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**Well Formed for Optimization:** refers to constructing a model to enable optimization if required. It ensures that the model provides pertinent optimization information, such as gradients or convexity, to facilitate efficient optimization processes.

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**Avoid Optimizing on a Black Box:** advises against optimizing models that operate as "black boxes" with obscure or inaccessible internal features. Such optimization routines may perform inadequately when applied to black box models. Instead, optimization processes should leverage the explicit structure and features of the model whenever feasible.

1	2	3	4	5
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**Availability of Interfaces:** signifies that great models offer readily accessible interfaces to interact with underlying data and outputs and components

1	2	3	4	5
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**Reusable:** means designing models that are applicable across various systems or scenarios beyond their initial creation context. Achieving this involves adopting a modular model structure and avoiding hardcoded parameters. While model reuse can expedite product development and reduce costs, it may also introduce risks if applied beyond the validated range of applicability.

1	2	3	4	5
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## Methodology presentation quality

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How clear is the motivation of Simulation-Physical System (SPSys) to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

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How clear is the SPSys idea to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

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How clear is the requirement-based decomposition to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the motivation of SPSys Development Procedure to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the idea of SPSys Development Procedure to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear are the steps of the SPSys Development Procedure to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the idea of evaluation factors to you?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the relationship of SPSysML and SPSysDP with V-model?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the relationship of SPSysML and SPSysDP with Zachman framework?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

How clear is the relationship of SPSysML and SPSysDP with SysML?

- ☐ 1 – It is completely fuzzy. I cannot even comment on it.
- ☐ 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- ☐ 3 – I understand most of it but can give hesitant comments on it,
- ☐ 4 – I feel confident to give comments on most of it,
- ☐ 5 – I feel confident in giving precise comments on all its aspects.

Do you have any other comments on the presentation's quality/straightness/form or the questionnaire?

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