id	How long do you develop robotics or other Cyber Physical Systems? (months)	How long do you manage technology development teams? (months)	What is/are your technology domain? Choose one or more from:	How many setups had the most complicated system you developed, or how big was the product family of the system?	Were you familiar with technology, including science or engineering or applied information technician or related?	Did you receive a certificate of simulation... Are you a member of a university in the field of systems engineering, robotics, engineering...	In which phase of the system life cycle have you utilized simulation technology, including... Choose one or more from:	Briefly describe your decomposition of systems engineering applied to your domain.	How valuable is it for technology domain? Answer Yes/No and briefly why.	Is the requirement-based decomposition applicable to your system design?	How sure are you that the requirement-based decomposition strengthens comprehensiveness analysis and the requirements? verification?	How sure are you that the requirement-based decomposition would help you in a modelling language to specify and share the system design?	Would you apply SPSysML Modelling language to specify and share the requirement-based decomposition? Write architecture? Write who or why not.	Would you apply the system design?	Would you apply agent-based architecture? Write who or why not.	Would you apply the simulation-physical integrity factors evaluation for the design development? Write why or why not.	Would you apply the systematic procedure (based on the simulation-implementation factor) to plan and analyse the development order of components? Write who or why not.	Do you agree that:	the Controller integrity factor and change the system design to control it (enter your probability 0-100%)	the Driver generalization factor and change the system design to control it 0-100%	the Digital Twin coverage and control it. factor and control it while developing the system (enter your probability 0-100%)	the Mirror integrity factor and control it while developing the system (enter your probability 0-100%)	How clear (1-5) are the rules for improving the system based on the proposed design? Expand on the previous answer. Clarity scale:	Expand on the previous answer. Please tell us what aspects: a1 are clear (for answer 1), or b1 what was not deep enough presented (for answer 2), or c1 what is fuzzy to you (for answer 3) or SPSysML/SPSysDP performance?	Do you have any other comments on the SPSysML/SPSysDP (for answer 3), or of what performance?	the Controller integrity factor while modifying the system design (enter your probability 0-100%)	the Driver generalization factor while modifying the system design (enter your probability 0-100%)	the Digital Twin coverage while modifying the system design (enter your probability 0-100%)	the Mirror integrity factor while modifying the system design (enter your probability 0-100%)	Do you see profits in joining simulation and physical models as SPSysML proposes?	What profits do you see?	If you were a complex cyber-physical system project designer, Now would SPSysML help you in change analysis? Choose one or more from:	If you were a complex cyber-physical system project designer, what sure are you that features of SPSysML would help you maintain the system?	If you were a complex cyber-physical system project designer, how would help you maintain the system?	What difficulties do you see in the application of SPSysML as a language for system specification and presentation?
1	43	0	Robotics;	20	Yes		Development;Testing;Implementation;Maintenance;Evaluation;	In my MSc thesis I was modeling heterogeneous multi-robot system using SysML and MoROS metamodel.	3 Yes	65	80		Not now. At first glance it's time consuming	Yes, it helps to trace all concept isn't well-known about	Rather not. This descriptive and useful	Yes, I think it's quite executive and useful	No, because lack of time during project development.		100	100	90	95	4 – I feel confident to most of it.	General concept is clear	No	100	100	90	90	Yes	At early stage of system development it can show some issues regarding system design	tracing change from a requirement to the system components' attributes;	requirement-based decomposition	60	Quite high entry level
2	43	0	Robotics;	6	Yes	Yes	Design;Implementation;Testing;	Design and implementation of manipulation system, which was able to move chess pawns.	Yes	100	100	physics systems.	I would, because it simplify decomposition of cyber hardware parts.	Yes, because it helps to describe required parts of system. It enables to assign requirements to low part functionality	Yes, it helps validate system and point out the week parts of the system	Yes, it is clearly described and shows the way of achiving end-product			100	100	100	100	4 – I feel confident to comment on most of it.			100	100	100	100	Yes	Ability to transfer physics system to simulation and test it without any physics hardware damages	promote wider simulation-based change verification,;promote wider simulation-based change validation,;	requirement-based decomposition	80	Not clearly specified when agent based on ROS is hybrid. E.g. same topics names and structure
3	84	0	Robotics;Artificial Intelligence;	1	No;	Yes	Analysis;Design;Development;Testing;Implementation;	Creating a description of robots system and how it works	4 Yes	100	100	easy to understand.	Yes, it seems clear and are required for a Robot.	Yes, it should help to decide what functions with each other, making the system clear.	Yes, it divides a project into seperate working metric for evaluating how much of a control detect mistakes on system is universal for both simulation and physical agents.	I would, it is better to systems;Consider simulation and fix them before testing on factor for simulation-physical robot.			80	80	100	80	4 – I feel confident to comment on most of it.			80	80	80	80	Yes	It allows the testing of the system in simulation before deploying the physical ones.	promote wider simulation-based change verification,;promote wider simulation-based change validation,;	requirement-based decomposition	90	Unwillingness of others to learn new specification language
4	21	0	Robotics;Artificial Intelligence;	1	No	Yes	Analysis;Design;Testing;	design and implementation of an intrusion detection system for mobile robots	Yes, it can be used to increase the clarity of requirements	5 fulfillment	90	80 architectures.	I would apply SPSysML for specifying and sharing a cyber-physical system, particularly because of its rich feature set for modeling complex systems and its support for Digital Twin concept based architectures.	I would apply requirement based decomposition. This approach ensures that the system is developed to meet functional requirements, enhances traceability, modularity, risk management, and efficient development.	I would consider applying agent-based architecture if the system involves complex, distributed interactions, and would benefit from the robustness and fault tolerance offered by autonomous agents.	I would apply simulation physical integrity factors evaluation for the design evaluation as it provides a comprehensive assessment			100	80	90	90	4 – I feel confident to comment on most of it.			100	80	90	90	Yes	joining simulation and physical models provides numerous benefits. SPSysML allows to clearly depict this in system architecture.		requirement based decomposition	80	model management complexities and need for organizational change
5	144	0	Robotics;Artificial Intelligence;	3	Yes	Design;Development;Testing;Implementation; and Evaluation;	Institute of Electrical and Electronics Engineers (IEEE);	Development of a real-time robotic system for a two-arm robot.	5 yes	100	easy to understand.	Yes. It is a clear graphical language, of requirements.	Yes, due to traceability of requirements.	Yes, it provides a good balance between constrained simulation and physical parts.	Yes - to make right decisions about division between simulation and decisions should be made early.	Yes. Order of development of components is important and physical systems;			80	50	50		4 – I feel confident to comment on most of it.			80	70	80		Yes	It is a systematic framework for joining simulation and physical systems. This process can be controlled with SPSysML.	promote wider simulation-based change verification,;tracing change from a requirement to the system components' attributes,;	requirement-based decomposition	90	The diagrams are very detailed. Some of elements can be omitted on some diagrams due to better visibility of other elements. That may cause that some elements may be lost. A dedicated software for diagram analysis can solve this problem, e.g. to check if all requirements are allocated.
6	36	100	Robotics;Information systems;Artificial Intelligence;		Yes	Analysis;Design;Development;Testing;Implementation.	Designing task scheduling system in multi robot environment	Yes, as it provides methodology to describe the common problem of utilization of simulation alongside physical hardware.	5 Yes	90	physical hardware.	Yes, from my perspective it gives clear connection between the requirements (what we want the system to do) and system components. Potentially this approach would allow to notice redundant/not necessary parts of the systems.	For sure it depends on the application. But most of current systems' architecture utilize distributed approach and/or consist on multiple components, in general simulation-physical I would apply.	Yes, I would require some additional description as the non optimal output is not always the indicator of the faulty architecture. Even though, this approach gives a clear measure to describe/compare the most important components of the system integrity.	Yes, as this would allow me to prioritise the implementation of the most important components of the system factor for simulation-physical systems;			90	80	90	100	4 – I feel confident to comment on most of it.	I think the importance of the components is omitted while calculating factors - it might give unclear outputs.		90	90	90	90	Yes	Mostly the emphasized importance of propagation of sharing/reusing the components, logic etc. between simulation and real hardware.	component change propagation analysis,;tracing change from a requirement to the system components' design;	SPSys Modelling Language as a modelling language to specify changes and share the system design	90	It might be difficult for the audience to comprehend the notation, especially when seeing it the first time.
7	12	1	Robotics;Information systems;		Yes	Design;	Supervised student's projects (6 DOF robotic arm), industrial process control systems.	5 Yes	80	90 Yes		Yes, I find it clear and well-structured.	Yes, I'm familiar with embodied agent concept and find it useful.	Yes.	Yes, it allows to verify the system in simulation before its deployment.			90	80	95		3 – I understand most of it but can give hesitant comments.			90	80	100	50	Yes		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,;communicate and share the system change impact,;	SPSys Modelling Language as a modelling language to specify changes and share the system design		Everyone in the team should be familiar with the SPSysML.
8	51	41	Robotics;	64	Yes		Development;Testing;Implementation;Evaluation;	Leading the design of mobile inspection robot for FLASH particle accelerator at DESY	Yes. Besides hardware interfaces, all robot software subsystems are first developed in a simulation and later validated and used on the physical system. Therefore, most of the code is tested before, with 5. both.	100	entire methodology	Possibly. I would apply the proposed methodology because it improves the development process. Using SPSysML would necessitate that other team members understand its syntax. Therefore, I would consider using SPSysML if it is simple and quick to learn, without requiring a comprehensive understanding of the entire methodology.	Yes. It provides an organized approach to the development process with clear benefits. Although including simulation at such an early design stage is not initially obvious, it allows for a more comprehensive analysis, maximizing opportunities for improvement. This results in a simulation system that familiarise myself with more closely reflects the physical system, and vice versa.	Possibly. Although I was not familiar with the agent-based architecture before the integrity factors are good metrics for needing improvement. However, the proposed concept is convincing, summarising design evaluation and could be beneficial in other application.	Probably not. I don't see a clear benefit in terms of design-evaluation, as calculating these factors already requires an advanced and comprehensive analysis that provides detailed insights into the design and areas Yes. While the development order of components depends on other important factors, the proposed procedure is helpful in assigning priorities to a significant evaluation processes, such as factor for simulation-tracking project simulated and hybrid development. 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;Controller integrity factor is a significant evaluation factor for simulation-physical systems;Driver generalization factor is a significant evaluation factor for simulation-physical systems;		20	100	100		3 – I understand most of it but can give hesitant comments.	IIf and DGF are very similar metrics, it's not clear what might be one offer that the other does not.		100	100	100	100	Yes	Better integrity of the simulated and physical system. This minimises the amount of work required with the actual robot in the dedicated requirement, leading to faster developement.	tracing change from a requirement to the system components' attributes,;promote wider simulation-based change validation,;component change propagation analysis,;	requirement-based decomposition	60	Since SPSysML is a novel language, it is not widely known. It would benefit from a simple introduction and clear guidelines to help its presentation to people who are not familiar with it.
9	80	10	Robotics;Information systems;	12	No	Yes	design;	Analysis and plan of system integration for several thousand customers.	Yes. Dividing the system into microservices is not possible without analyzing the domain and business requirements.	4	100	100	I would like to apply as a proof of concept in a team of domain architects.	Yes. Requirement-based decomposition is a natural approach to creating system architecture. Requirements between them. This allocation ensures that all requirements are met. This makes it easier to plan connections planning application.	Yes. I would use agent-based architecture as a an attempt to properly arrange microservices and plan connections between them. This would consider this a proof of concept and test this method of create "spaghetti evaluation on my architecture" system.	Yes. This seems to be an interesting approach to evaluation. Again, I would consider this a proof of concept and I would consider this a proof of concept.	Mirror integrity factor is a significant evaluation factor for simulation-physical systems;Digital Twin coverage is a significant evaluation factor for simulation-physical systems;Controller integrity factor is a significant evaluation factor for simulation-physical systems;		90	70	100		5 – I understand it fully and feel confident giving precise comments on all its aspects.	The approach is clear because it is described in a standard description language, which is SysML. The subject matter is not trivial, it requires getting used to the taxonomies and names, but thanks to the diagrams, getting started does not take long.		90	80	90	95	Yes	This certainly gives you the opportunity to evaluate the system architecture and make conscious design decisions.	promote wider simulation-based change validation,;promote wider simulation-based change verification,;tracing change from a requirement to the system components' attributes,;	SPSys Modelling Language as a modelling language to specify changes and share the system design	90	The methodology requires deeper knowledge. Only then can its use be effective. So it would be used by a small group of architects.

This page is a single very wide survey-response data table (spreadsheet export). The body consists of column-header definitions, respondent rows, and a summary-statistics block at the bottom. Much of the fine print is only partially legible.

Column header definitions (partial):

- Based on your experience and knowledge, does the method comply with the V model?
- What difficulties do you see in the application of SPSysDP as a development procedure
- What difficulties do you see in the application of… design assessment markers
- What difficulties do you see in the application of… simulation-physical classes of these components
- What difficulties do you see in… The requirement-based decomposition in finding system's components and…
- What difficulties do you see in… The proposed requirement model in tracing component requirements
- Do you have any other comments on the…
- To which Zachman Framework will SPSysML applies, and to which it does not. Please write…
- Do you have any other comments on the…
- Linked to Decision Support: denotes the fundamental quality of models that seamlessly integrate into decision-making frameworks.
- Model Credibility: signifies the degree to which decision-makers trust the results produced by a model.
- Clear Scope: defines the extent of system modelling required for process of utilizing a project. This involves determining which system or subsystem processes, or…
- Verification & Validation With Models: refers to the model's ability to verify and validate products, integrated into the model. Following a structured Model Development Process enables easy Identification of the…
- Understandable and Well-Organised: clarifies where and how additional components can be interrogated and offer clear insight into the factors influencing their outputs. They and assumptions.
- Applicable and Traceable: this quality denotes models that can be readily interrogated within predefined boundaries of data, conditions, physics, and assumptions. Great models explicitly delineate their validity range. d)
- Data Extrapolation: refers to the capability of models to operate within a predefined Purpose: signifies that the model comprehensively throughout its modelling requirements and…
- Complete Relative to Scope and Intended Purpose: signifies that the model comprehensively encompasses all pertinent physics or components. For instance, assumptions such as the gravity constant remain consistent across…
- Internally Consistent: denotes a model that maintains coherence without direct contradictions throughout its modelling requirements and components. For instance, assumptions align with calibration data, enhancing its credibility for decision-making purposes.
- Verifiable: this signifies that the model's outputs can be verified to meet the needs and expectations. For descriptive models, this involves align with calibration data, enhancing its credibility for decision-making purposes.
- Validation: entails ensuring that the model aligns with and satisfies customer needs and expectations. For descriptive models, this involves presentation of information, often through layers.
- Model Fidelity: refers to how closely the model possesses the correct level of detail and effectiveness, avoiding unnecessary complexity. For instance, an elegant model minimizes model excesses.
- Elegant: denotes a model crafted with a balance of simplicity and effectiveness, avoiding unnecessary complexity. For instance, an elegant model minimizes model excesses.
- Well Formed for Optimization: refers to constructing a model that avoids "black boxes" with obscure or inaccessible internal features. Such…
- Avoid Optimizing on a Black Box: advises against optimizing models that operate as interfaces to interact with underlying data and outputs and…
- 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…
- How clear is the System (SPSys) to you?
- How clear is the idea to you?
- How clear is the SPSys decomposition to you?
- How clear is the SPSys Procedure to you?
- How clear is the steps of the SPSys Development Procedure to you?
- How clear are the SPSys Development Procedure to you?
- How clear is the idea of evaluation factors to you?
- How clear is the relationship of SPSysML and SPSysDP with V-model?
- How clear is the relationship of SPSysML and SPSysDP with SysML?
- How clear is the presentation's/author's qualities/usefulness to you?
- Do you have any other comments on the presentation/ questionnaire?

Respondent rows (leftmost free-text responses, partial):

Comply w/ V model	Difficulty (SPSysDP)	Difficulty (markers)	Difficulty (components)	Difficulty (decomposition)	Other comments	Zachman mapping	Other
I don't know the V model	System decomposition is a hard task	No difficulties.	Choice of decomposition criteria	None	No	After presentation I understand general concept of SPSysML.	No
I don't know the V model	Early decomposition is the hardest part						
Yes	Possible pushback from other developers, as they may prefer to push system without testing it thoroughly.	None come to mind	None come to mind	None come to mind		It seems to be possible to apply to most of them, but I think it would apply to rows 3 and 4 the most.	
I don't know the V model			determining the appropriate level of decomposition			APPLIES WELL: …	
Yes	It should be understood by all members of the team. The diagrams are detailed, and it may be challenging to understand them.					APPLIES WELL: …	
Yes	The maintaining the documentation in SysML, calculating and updating the factors. For use the automated tools would be of great help.	Evaluation factors might be abused as the importance of components is not taken into account as it is iterative process.	It is not easy to find all essential requirements.	As diagrams might get complicated, it might be difficult to trace component requirements.		APPLIES WELL: …	
Yes						Applies well: …	
I don't know the V model	I don't find any difficulties	I don't find any difficulties	I don't find any difficulties	The proposed design evaluation factors are not clearly understandable without a good grasp of SPSysML. Additionally, it is unclear what unique insights can be gained from the I/F that cannot already be derived from the DGF and MiR.		APPLIES WELL: …	
Yes	This requires proper training of developers, who often have less experience with similar models than architects.		With a large number of requirements that have a complex structure, the diagrams may be unreadable. The solution would be a requirements association table.			APPLIES WELL: …	

Summary statistics row (bottom): 4.375 | 4.625 | 4.625 | 4.5 | 4.375 | 4.875 | 3.875 | 3.75 | 4.5 | 4.5 | 4.25 | 4.25 | 4 | 4.25 | 4 | 4.125 | 4.28571429 | 4.75
4 | 4.5 | 4 | 4 | 3
5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3

Confidence-scale legend cells (right-side columns, repeated per respondent):
- 5 – I feel confident in giving precise comments on all its aspects.
- 4 – I feel confident to give comments on most of it.
- 3 – I understand most of it but can give hesitant comments on it.
- 2 – I get the general concept of it. I can give abstract comments and relate it roughly to my knowledge.
- 1 – It is completely fuzzy. I cannot even comment on it.