[]Where do you work?
Please choose only one of the following:
Research/Academia
O Industry
O Other
[]In which sector?
Only answer this question if the following conditions are met: Answer was 'Research/Academia' at question '1 [work]' (Where do you work?)
Please choose only one of the following:
O Software development
O Energy Systems
Heating, Ventilation and Air Conditioning
O Automotive Industry
O Robotics
Maritime
O Agriculture
O Systems-on-Chip
Integrated Circuits
Other Other
[]In which sector?
Only answer this question if the following conditions are met: Answer was 'Industry' at question '1 [work]' (Where do you work?)
Please choose only one of the following:
 Energy System (Smart Grids, Power Systems, District Heating, etc.)
O Software development
O Control
O Mathematics
O Physics
Mobility
Other Other
[]What is your field of expertise?

Please write your answer here:

[]Please mark which properties apply to the simulators that you have worked in co-simulation:
Please choose all that apply:
The simulator approximates the solution to sets of differential equations.
The simulator is a dedicated piece of hardware (e.g., a SCALEXIO).
The simulator specializes in finite element modelling.
The simulator receives input from a human-machine interface (e.g., a flight controller).
The simulator specializes in networks.
The simulator specializes in software controllers (e.g., Overture Tool).
Other:

Description of the SWOT Analysis

This part comprises a SWOT analysis. For each group, i.e. strengths, weaknesses, opportunities, and threats, three factors are proposed. The factors are based on the answers to a previous expert survey.

[]

Comparison of Strengths of co-simulation

How important do you consider the following three factors? Please compare the pairs of factors in the	ne
group "Strengths"and rate their relative importance.	

group "Strengths"and rate th	eir relativ	e imp	ortan	ce.						
9 = much more important; 1 = equal	ally importar	nt								
Please choose the appropriate res	ponse for ea	ach iter	n:							
	much more important			2	equally important	2	F	7	much more important	
	9	7	5	3	1	3	5	7	9	It supports cross- company cooperation (e.g., suppliers and system
It supports cross-discipline developments	0	0	0	0	0	0	0	0	0	integrators can exchange virtual "trial components" before signing contracts) Every sub- system can be implemented
It supports cross-company cooperation (e.g., suppliers and system integrators can exchange virtual "trial components" before signing contracts)	•	0	0	0	•	0	0	0	0	in a tool that meets the particular requirements for the domain, the structure of the model and the simulation algorithm Every subsystem can be implemented in a tool that meets the
It supports cross-discipline developments	0	0	0	0	0	0	0	0	0	particular requirements for the domain, the structure of the model and the simulation algorithm

[]
Do you consider any other factor than the above as being more important? If yes, please name it:
Please write your answer here:

Comparison of Weaknesses of co-simulation

This part comprises a SWOT analysis. For each group, i.e. strengths, weaknesses, opportunities, and threats, three factors are proposed. The factors are based on the answers to a previous expert survey.

[]										
Please compare the pairs of	factors in	the g	roup '	'Weak	nesses" ar	nd rate	their	relati	ve import	tance.
9 = much more important; 1 = equal	ly important	.								
	ones for so	ah itam								
Please choose the appropriate resp	much more important 9	7	5	3	equally important 1	3	5	7	much more important 9	
Computational performance of co-simulation compared to monolithic simulation	0	0	0	0	0	0	0	0	0	Robustness of co- simulation compared to Monolithic simulation. Licenses for all
Computational performance of co-simulation compared to monolithic simulation	0	0	0	0	0	0	0	0	0	programs are required to couple different simulation programs Licenses for all
Robustness of co-simulation compared to Monolithic simulation.	0	0	0	0	0	0	0	0	0	programs are required to couple different simulation programs
[]										
Do you consider any oth please name it:	er facto	r tha	n the	e abo	ve as be	ing n	nore	impo	rtant? I	f yes,
Please write your answer here:										

Comparison of Opportunities of co-simulation

This part comprises a SWOT analysis. For each group, i.e. strengths, weaknesses, opportunities, and threats, three factors are proposed. The factors are based on the answers to a previous expert survey.

[]										
Please compare the propertion importance.	pairs of f	actoi	s in	the g	roup "O _l	port	uniti	ies" a	and rate	their relative
9 = much more importan	t; 1 = equa	illy im	porta	nt *						
Please choose the appropriate	response for	r each i	tem:							
	much more important 9	7	5	3	equally important 1	3	5	7	much more important 9	
Growing co-simulation community/growing industrial adoption	0	0	0	0	0	0	0	0	0	User-friendly tools (pre- defined master algorithms, integrated error estimation)
Growing co-simulation community/growing industrial adoption	0	0	0	0	0	0	0	0	0	Better communication between different domains
User-friendly tools (predefined master algorithms, integrated error estimation)	0	0	0	0	0	0	0	0	0	Better communication between different domains
[] Do you consider any please name it: Please write your answer here		ctor t	:han	the a	bove as	bein	g mo	re in	nportant	? If yes,

Comparison of Threats of co-simulation

This part comprises a SWOT analysis. For each group, i.e. strengths, weaknesses, opportunities, and threats, three factors are proposed. The factors are based on the answers to a previous expert survey.

[]										
Please compare the importance.	e pairs of	f fact	ors i	n the	group "	Thre	ats"	and ı	rate the	ir relative
9 = much more importa	ant; 1 = eq	ually	impo	rtant						
*										
Please choose the appropria	ite response	for eac	ch item	:						
	much more important 9	7	5	3	equally important 1	3	5	7	much more important 9	
Insufficient knowledge/information of users in co- simulation may lead to improper use (e.g. wrong or missing error estimation, stability issues).	0	0	0	0	0	0	0	0	0	Incompatibility of different standards and co-simulation approaches.
Insufficient knowledge/information of users in co- simulation may lead to improper use (e.g. wrong or missing error estimation, stability issues).	0	0	0	0	0	0	0	0	0	Lack of exchange/cooperation between theoretical/numerical part, implementation and application/industry.
Lack of exchange/cooperation between theoretical/numerical part, implementation and application/industry.	0	0	0	0	0	0	0	0	0	Incompatibility of different standards and co-simulation approaches.
[] Do you consider an please name it:	y other f	acto	r tha	n the	above a	ıs be	ing n	nore	importa	nt? If yes,
Please write your answer he	re [.]									
sasse your answer ne					7					

Comparison of SWOT-categories

This part comprises a SWOT analysis. For each group, i.e. strengths, weaknesses, opportunities, and threats, three factors are proposed. The factors are based on the answers to a previous expert survey.

[] Please compare the SW simulation.	/OT-cate	gorie	s and	d rate	e their re	elativ	e im	porta	nce for	co-
9 = much more importa	ant; 1 = 0	equa	lly in	port	ant					
*										
Please choose the appropriate res	sponse for ea	ach item	n:							
Strengths Strengths Strengths Weaknesses Weaknesses Opportunities	much more important 9 0 0	7 0 0 0 0	5 00 00 0	3 0 0 0 0 0	equally important 1 0 0 0 0 0	3 0 0 0 0 0	5 0 0 0 0 0	7 0 0 0 0	much more important 9 0 0	Weaknesses Opportunities Threats Opportunities Threats Threats

Research fields, standards and tools

[]To which extent do you agree that the following research topics in the field of co-simulation have not received enough attention up to now?

Please choose the appropriate response for each item:

Please choose the appropriate	e response to	or each item:		N1 20			
				Neither agree			
	Entirely agree	Mostly agree	Somewhat agree	nor disagree	Somewhat disagree	Mostly disagree	Entirely disagree
Uncertainty quantification/propagation	0	0	0	0	0	0	0
Theoretical understanding of how to accurately include different kinds of controllers in different cosimulation approaches	0	0	0	0	0	0	0
Systematic categorization of different co-simulation approaches, including a better understanding of how their model of computations and requirements overlap and differ.	0	0	0	0	0	0	0
Simulator black boxing and IP Protection	0	0	0	0	0	0	0
Usability and performance	0	0	0	0	0	0	0
Integration of a wide variety of simulators despite different structures (while achieving/maintaining high performance)	0	0	0	0	0	0	0
Hybrid co-simulation (e.g., variable structure systems, switched systems, impulsive systems, etc)	0	0	0	0	0	0	0
Impact of using different tolerances in a sub-component on the overall simulation	0	0	0	0	0	0	0
Acausal approaches for co-simulation	0	0	0	0	0	0	0
Representation and enforcement of model validity assumptions (e.g., a model of a spring is only valid up to a given maximum displacement, derived from experimentation with the material of the spring. In a co-simulation, we would like to know whether the simulators are being used within the assumptions	•	0	0	0	0	0	0

Numerical stability	\circ	0	0	0	0	0	0
Impact of coupled error controlled algorithms	0	0	0	0	0	0	0
Impact of updating inputs (and the discontinuity it introduces) in the subsystems	0	0	0	0	0	0	0
Parallelization	0	0	0	0	0	0	0
Simultaneous events	0	0	0	0	0	0	0
[]Established standard standard for continuous							epted
Please choose only one of the	following:						
O FMI							
Simulink S-functions							
OpenMI							
O High Level Architecture							
O Other							
What standard do you to Please choose only one of the FMI Simulink S-functions OpenMI High Level Architecture		ontinuous	time co-sin	nulation?			
Other							
[]What tools do you us	e for co	ntinuous ti	me co-simi	ılation?			
Please write your answer here:		intiliaoao ti		<u> </u>			
-							

made in their

corresponding models)

[]Established standards for <u>discrete event co-simulation</u> . In your opinion, is there a widely accepted standard for discrete event co-simulation in industry and academia? (choose)
Please choose only one of the following:
O FMI
○ SystemC
O High Level Architecture
O DEVS formalism
Open
O Other
[]What standard do you use for <u>discrete event co-simulation</u> ?
Please choose only one of the following:
O FMI
O SystemC
O High Level Architecture
O DEVS formalism
Other Other
[]What tools do you use for <u>discrete event co-simulation</u> ?
[]What tools do you use for discrete event co-simulation? Please write your answer here:
Please write your answer here:
Please write your answer here: []Established standards for hybrid co-simulation. In your opinion, is there a widely accepted standard for discrete event co-simulation in industry and academia? (choose) Please choose only one of the following:
Please write your answer here: []Established standards for hybrid co-simulation. In your opinion, is there a widely accepted standard for discrete event co-simulation in industry and academia? (choose)
Please write your answer here: []Established standards for hybrid co-simulation. In your opinion, is there a widely accepted standard for discrete event co-simulation in industry and academia? (choose) Please choose only one of the following: O FMI

[]What standard do you use for <u>hybrid co-simulation</u> ?	
Please choose only one of the following:	
O FMI	
High Level Architecture	
O Other	
[]What tools do you use for hybrid co-simulation? Please write your answer here:	
	_

Personal experience and assessment

[]What is the main reason that you work with co-simulation?						
Please write your answer here:						

[]						
Please choose the appropriate respon	se for each item:					
	Very Frequently	Frequently	Occasionally	Rarely	Very Rarely	Never
Have you encountered issues with algebraic loops?	0	0	0	0	0	0
Have you ever encountered issues because of too simplistic extrapolation functions?	0	0	0	0	0	0
Have you experienced difficulties in judging the validity of a cosimulation, i.e. estimating the associated communication error?	0	0	0	0	0	0
Have you experienced difficulties in practical aspects, like IT-prerequisites in cross-company collaboration?	0	0	0	0	0	0
Have you experienced difficulties due to insufficient communication between theorists and practitioners?	0	0	0	0	0	0
Have you experienced numerical stability issues of co-simulation?	0	0	0	0	0	0
Have you experienced difficulties in how to define the macro step size for a specific co-simulation?	0	0	0	0	0	0
Have you experienced difficulties in how to define tolerances?	0	0	0	0	0	0
Have you experienced difficulties in choosing the right co-simulation orchestration algorithm (master)?	0	0	0	0	0	0

[] Please choose the appropriate response for each item: Very Fairly Slightly important Important important important Not important Is Intellectual Property Protection important 0 0 0 0 0 when you are using a co-simulation? Is usability and performance important when you are using a co-simulation? Is Simulator black boxing and IP 0 Protection important for your work? []

Please choose the appropriate response for each item:								
	Fully agree	Mostly agree	Somewhat	Neither agree nor disagree	Somewhat disagree	Mostly disagree	Fully disagree	
The major benefit of co-simulation is to increase performance, when compared to a monolithic simulation?	0	0	0	0	0	0	0	
A clearer categorization of different cosimulation approaches would help for your particular field of work?	0	0	0	0	0	0	0	
A acausal approaches can boost the use of cosimulation in your field?	0	0	0	0	0	0	0	
For academia it is difficult to experiment with different cosimulation approaches as there is a huge learning curve: in terms of learning the specification and also gaining access to models as well as being able to make changes to existing approaches and test new ideas?				•	•	•	•	