

## **Publications and Review used in Simplified Structured Literature Study** complementary dataset

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### **MBSE within the engineering design community - an exploratory study**

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paper accepted

Attached you will find the lists of publications and the review-parameters used for a literature study regarding the usage and terminology of MBSE within the engineering design community.

The dataset includes 93 publications gathered from the Design Society library (57 papers) and the proceedings of the CIRP Design conferences (36 papers). These conferences are assumed to give a comprehensive insight into of the engineering design community and are, thus, representative of the current research and focus of the conducted review.

The publications were identified based on the term Model-based Systems Engineering, similar spellings or their abbreviation (MBSE) that are used in the title, abstract, or keywords. The search covers the period from 2007 when the first version of SysML was published by the OMG until today. However, the first publications found only date back to 2011.

The work is/will be published at the 2023 International Conference on Engineering Design. For the context of the study as well as the results of the literature study, please see the publication.

Pool	Author, Publisher or Institution	Year	Literature-Reference				MBSE-Elements			Modelling-Aspects			Linkages			Metainformation (MBSE used...)		
			Title	DOI	Tag	Method	Tool	Modelling-Language	Requirements	Structure	Behavior	from Requirements	from Structure	from Behaviour	Category	in Title	in Abstract	as Keyword
CIRP-Design	Abdoli, Shiva, Kara, Sami	2016	Designing Warehouse Logical Architecture by Applying Object Oriented Model Based System Engineering	10.1016/j.procir.2016.04.108	Abt16	related to established Method	Not specified	Other (UML)	considered	considered	considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Albers, Albert; Scherer, Helmut; Bursac, Nikola; Rachenkova, Galina	2015	Model Based Systems Engineering in Construction Kit Development – Two Case Studies	10.1016/j.procir.2015.01.044	Alb15	related to established Method	Not specified	SysML without adaptations	not considered	considered	not considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Albers, Albert; Stürminger, Tobias; Mandel, Constantin; Wang, Jinying; Frutos, Marta; Bañeres de Beharand, Matthias	2019	Identification of potentials in the context of Design for Industry 4.0 and modeling of interdependencies between product and production processes	10.1016/j.procir.2019.04.298	Alb19	related to established Method	Cameo Systems Modeler	Other (CONSENS)	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE		X	X
CIRP-Design	Bougain, Sébastien; Gerhard, Detlef	2020	Supporting product design decision with a SysML design history Assistant	10.1016/j.procir.2020.02.174	Bou20	no Method specified	Not specified	SysML without adaptations	not considered	not considered	not considered	-	-	-	Application of SysML		X	
CIRP-Design	Buchholz, Christian; Vorsatz, Thomas; Kind, Simon; Stark, Rainer	2017	SHIPbench – A Smart Hybrid Prototyping Based Environment for Early Testing, Verification and (user based) Validation of Advanced Driver Assistant Systems of Cars	10.1016/j.procir.2017.02.025	Buc17	related to established Method	Not specified	Not specified	not considered	not considered	not considered	-	-	-	Other			X
CIRP-Design	Bursac, Nikola; Albers, Albert; Schmitt, Thomas	2016	Model Based Systems Engineering in Modular Design – A Potential Analysis using Portal Type Scraper Reclaimers as an Example	10.1016/j.procir.2016.04.156	Bur16	Custom Method	Not specified	SysML without adaptations	considered	considered	considered	Linked to Behaviour-Elements	Linked to Behaviour-Elements	Linked to Requirements and Structure-Elements	Application of MBSE	X	X	X
CIRP-Design	Gardan, Julien; Matta, Nada	2017	Enhancing Knowledge Management into Systems Engineering through New Models in SysML	10.1016/j.procir.2017.01.052	Gar17	related to established Method	Not specified	SysML without adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE		X	X
CIRP-Design	Gräßler, Iris; Wiechel, Dominik; Roessmann, Daniel	2021	Integrating human factors in the model based development of cyber-physical production systems	10.1016/j.procir.2021.05.113	Grä21	Custom Method	Not specified	SysML with adpans	considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE		X	X
CIRP-Design	Haltenberg, Friedrich; Dörmezer, Jasmin; Menenuga, Mark; Herrmann, Christoph; Stark, Rainer	2021	Knowledge transfer and engineering methods for smart-circular product service systems	10.1016/j.procir.2021.05.088	Hal21	Custom Method	Microsoft Visio	Other (BPMN)	considered	considered	considered	-	-	-	Application of MBSE			X
CIRP-Design	Hanna, Michael; Schwelke, Johann; Schwede, Lea-Nadine; Laukötka, Fabian; Krause, Dieter	2021	Model-based application of the methodical process for modular lightweight design of aircraft cabins	10.1016/j.procir.2021.05.136	Han21	Custom Method	Cameo Systems Modeler	SysML without adaptations	considered	considered	considered	Linked to Behaviour-Elements and Structure-Elements	Linked to Behaviour-Elements and Requirements	Linked to Requirements and Structure-Elements	Application of SysML		X	X
CIRP-Design	Herzig, Sebastian; J.L. Paredis, Christiaan J.J.	2014	A Conceptual Basis for Inconsistency Management in Model-based Systems Engineering	10.1016/j.procir.2014.03.192	Her14	no Method specified	Not specified	Other (Graphs)	not considered	considered	not considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Inkermann, D.; Huht, T.; Vieto, T.; Grewe, A.; Knieke, C.; Rausch, A.	2019	Model-Based Requirement Engineering to Support Development of Complex Systems	10.1016/j.procir.2019.04.345	Ink19	Custom Method	Not specified	SysML with adaptations	considered	considered	considered	Linked to Behaviour-Elements	-	Linked to Requirements	Application of MBSE			X
CIRP-Design	Jägla, Patrick; Jacobs, Georg; Siebrecht, Justus; Wischmann, Stefan; Sprehe, Jonathan	2021	Using SysML to Support Impact Analysis on Structural Dynamics Simulation Models	10.1016/j.procir.2021.05.015	Jag21	Custom Method	Cameo Systems Modeler	SysML without adaptations	not considered	considered	not considered	-	-	-	Application of SysML			X
CIRP-Design	Japis, Sergej; Anacker, Harald; Dumitrescu, Roman	2021	SAVE: Security & safety by model-based systems engineering on the example of automotive industry	10.1016/j.procir.2021.05.053	Jap21	Custom Method	Not specified	Other (CONSENS)	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE	X	X	
CIRP-Design	Kaspar, Jerome; König, Kristian; Scholz, Johannes; Quirin, Steven; Kleiner, Sven; Fleischer, Jürgen; Herrmann, Hans-Georg; Völhaber, Michael	2022	SyProNet - A systematic product development process to exploit lightweight potentials while considering costs and CO2 emissions	10.1016/j.procir.2022.05.288	Kas22	Custom Method	Not specified	Not specified	not considered	not considered	not considered	-	-	-	Benefits MBSE		X	
CIRP-Design	Konrad, Christian; Jacobs, Georg; Raser, Rik; Riedel, Ricardo; Kätzwinkel, Tim; Siebrecht, Justus	2019	Enabling complexity management through merging business process modeling with SysML	10.1016/j.procir.2019.04.267	Kon19	Custom Method	Cameo Systems Modeler	SysML without adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Kruse, Benjamin; Gilz, Torsten; Shea, Kristina; Egner, Martin	2014	Systematic Comparison of Functional Models in SysML for Design Library Evaluation	10.1016/j.procir.2014.03.175	Kru14	related to established Method	Not specified	SysML without adaptations	considered	considered	considered	Linked to Behaviour-Elements	Linked to Behaviour-Elements	Linked to Requirements and Structure-Elements	Application of SysML			X
CIRP-Design	Kruse, Benjamin; Shea, Kristina	2016	Design Library Solution Patterns in SysML for Concept Design and Simulation	10.1016/j.procir.2016.04.132	Kru16	related to established Method	Magic Draw/CAMEO	SysML with adaptations	considered	considered	considered	-	-	-	Application of MBSE			X
CIRP-Design	Laukötka, Fabian; Hanna, Michael; Krause, Dieter	2021	Digital twins of product families in aviation based on an MBSE-assisted approach	10.1016/j.procir.2021.05.144	Lau21	no Method specified	Not specified	SysML without adaptations	not considered	considered	not considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Masior, Jonathan; Schneider, Benjamin; Kuroimöglu, Mehmet; Riedel, Oliver	2020	Beyond Model-Based Systems Engineering towards Managing Complexity	10.1016/j.procir.2020.02.183	Mas20	Custom Method	Not specified	Not specified	not considered	not considered	not considered	-	-	-	Benefits MBSE	X	X	X
CIRP-Design	Meißner, Maximilian; Jacobs, Georg; Jägla, Patrick; Sprehe, Jonathan	2021	Model based systems engineering as enabler for rapid engineering change management	10.1016/j.procir.2021.05.010	Mei21	Custom Method	Not specified	SysML with adaptations	considered	not considered	not considered	-	-	-	Application of MBSE	X	X	X
CIRP-Design	Nigischer, Christian; Bougain, Sébastien; Riegler, Rainer; Stanek, Heinz Peter; Grafinger, Manfred	2021	Multi-domain simulation utilising SysML: state of the art and future perspectives	10.1016/j.procir.2021.05.073	Nig21	no Method specified	nich specified	SysML without adaptations	not considered	not considered	not considered	-	-	-	Benefits SysML		X	
CIRP-Design	Obort, Johannes; Röhm, Benjamin; Kutscher, Vladimir; Anderl, Reiner	2022	Integration of Communication using OPC UA in MBSE for the Development of Cyber-Physical Systems	10.1016/j.procir.2022.05.241	Ob22	Custom Method	nich specified	SysML with adaptations	considered	not considered	not considered	-	-	-	Application of MBSE			
CIRP-Design	Riedel, Ricardo; Jacobs, Georg; Konrad, Christian; Singh, Rahul; Sprehe, Jonathan	2020	Managing knowledge and parameter dependencies with MBSE in textile product development processes	10.1016/j.procir.2020.01.138	Rie20	Custom Method	Cameo Systems Modeler	SysML with adaptations	considered	considered	considered	Linked to Behaviour-Elements	Linked to Behaviour-Elements	Linked to Requirements and Structure-Elements	Application of MBSE	X	X	X
CIRP-Design	Riedel, Ricardo; Jacobs, Georg; Wynwicz, Fabian; Siebrecht, Justus	2021	Identification of dependencies between product parameters and process stakeholders	10.1016/j.procir.2021.05.063	Rie21	Custom Method	Cameo Systems Modeler	SysML with adaptations	considered	not considered	not considered	-	-	-	Application of MBSE		X	
CIRP-Design	Riesener, Michael; Doelle, Christian; Perau, Stefan; Lossie, Philipp; Schuh, Günther	2021	Methodology for iterative system modeling in agile product development	10.1016/j.procir.2021.05.101	Ries21	Custom Method	Not specified	SysML without adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE		X	X
CIRP-Design	Scherer, Helmut; Albers, Albert; Bursac, Nikola	2017	Model Based Requirements Engineering for the Development of Modular Kits	10.1016/j.procir.2017.01.032	Sch17	Custom Method	IBM DOORS	Other (DOORS)	considered	not considered	not considered	-	-	-	Application of MBSE		X	X
CIRP-Design	Schumacher, Thomas; Inkermann, David	2022	Heterogeneous models to Support Interdisciplinary Engineering - Mapping Model Elements of SysML and CAD	10.1016/j.procir.2022.05.309	Sch22	Custom Method	Not specified	SysML with adaptations	not considered	not considered	not considered	-	-	-	Application of SysML			X
CIRP-Design	Spitz, Kathrin; Berges, Julius; Jacobs, Georg; Bertho, Jeroth; Konrad, Christian	2022	Classification of Simulation Models for the Model-based Design of Plastic-Metal Hybrid Joints	10.1016/j.procir.2022.05.211	Sp22	Custom Method	Not specified	SysML with adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE		X	X
CIRP-Design	Steiner, Chantal; Fischer, Jan; Aurich, Jan C.	2017	Model-based Design Process for the Early Phases of Manufacturing System Planning using SysML	10.1016/j.procir.2017.01.036	Ste17	Custom Method	Not specified	SysML without adaptations	considered	considered	considered	Linked to Behaviour-Elements	Linked to Behaviour-Elements	Linked to Requirements and Structure-Elements	Application of MBSE	X	X	
CIRP-Design	Stürminger, Tobias; Jost, Dinah; Mandel, Constantin; Behrendt, Matthias; Albers, Albert	2020	Impact and risk analysis in the integrated development of product and production system	10.1016/j.procir.2020.02.221	Stu20	related to established Method	Not specified	SysML without adaptations	considered	not considered	considered	Linked to Behaviour-Elements	-	Linked to Requirements	Application of MBSE		X	
CIRP-Design	Dickopf, Thomas; Hristo, Apostol; Patrick, Müller; Göbel, Jens C.; Sven, Forte	2019	A Holistic System Lifecycle Engineering Approach – Closing the Loop between System Architecture and Digital Twins	10.1016/j.procir.2019.04.257	Dic19	Custom Method	Cameo Systems Modeler	SysML with adaptations	considered	considered	considered	-	-	-	Benefits SysML		X	X
CIRP-Design	van Notten, Johan; Gadeyne, Klaas; Witters, Maarten	2017	Model-based Systems Engineering of Discrete Production Lines Using SysML: An Experience Report	10.1016/j.procir.2017.01.018	Van17	no Method specified	Not specified	SysML with adaptations	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE	X	X	
CIRP-Design	Wang, Yübo; Steinbach, Tanja Klein; Jonathan; Anderl, Reiner	2021	Integration of model based system engineering into the digital twin concept	10.1016/j.procir.2021.05.003	Wan21	Custom Method	Not specified	SysML with adaptations	considered	considered	not considered	-	-	-	Benefits SysML	X	X	X
CIRP-Design	Windisch, Emily; Mandel, Constantin; Rapp, Simon; Bursac, Nikola; Albers, Albert	2022	Approach for model-based requirements engineering for the planning of engineering generations in the agile development of mechatronic systems	10.1016/j.procir.2022.05.293	Win22	Custom Method	Not specified	SysML with adaptations	considered	not considered	not considered	-	-	-	Application of MBSE		X	X
CIRP-Design	Yvars, Pierre-Alain; Zimmer, Laurent	2022	Towards a correct by construction design of complex systems: The MBSS approach	10.1016/j.procir.2022.05.248	Yva22	Custom Method	DEPS Studio	Other (DEPS)	considered	considered	considered	Linked to Structure-Elements and Behaviour-Elements	Linked to Behaviour-Elements	Linked to Structure-Elements	Benefits MBSE		X	
Design Society	Albers, Albert; Zingel, Christian	2011	INTERDISCIPLINARY SYSTEMS MODELING USING THE CONTACT & CHANNEL MODEL FOR SYSLM		Alb11	Custom Method	Artisan Studio V7.2	SysML without adaptations	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of SysML			X
Design Society	Berschik, Markus C.; Laukötka, Fabian; Krause, Dieter	2021	Ansatz eines holistischen Datenstamms zur modellbasierten, domänenübergreifenden Nutzung in der Produktentwicklung	10.1019/df2021.19	Ber21	no Method specified	Cameo Systems Modeler	SysML without adaptations	considered	considered	considered	Linked to Behaviour-Elementen	Linked to Structure-Elements and Requirements	Linked to Structure-Elements and Requirements	Application of SysML			X
Design Society	Bleisinger, O.; Forte, S.; Apostolov, C.; Schmitt, M.	2020	APPLYING MODEL-BASED SYSTEMS ENGINEERING TO THE DEVELOPMENT OF AUTONOMOUS VESSEL FUNCTIONS	10.1017/dsd.2020.170	Ble20	Custom Method	Not specified	SysML with adaptations	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE	X	X	X
Design Society	Bougain, Sébastien; Gerh, Detlef	2018	A CBR APPROACH FOR SUPPORTING ECODSIGN WITH SYSLM		Bou17	Custom Method	MagicDraw	SysML without adaptations	considered	considered	not considered	Linked to Structure-Elements	-	Linked to Requirements	Application of SysML		X	
Design Society	Bursac, Nikola; Albers, Albert; Kull, Pascal; Rapp, Simon; Maul, Ludwig	2022	System Modelling in the Problem-Solving Process - A Human Oriented Approach to the Use of MBSE in Problem-Solving Processes	10.1019/NORDESIGN2022.41	Bur22	related to established Method	Not specified	Not specified	not considered	not considered	not considered	-	-	-	Application of MBSE	X	X	X
Design Society	Dworschak, Fabian; Zingl, Christoph; Schleich, Benjamin; Wartzack, Sandro	2019	Konzept für den MBSE-Einsatz zur automatisierten Individualisierung von komplexen Produkten	10.1019/df2019.24	Dwo19	related to established Method	Not specified	SysML with adaptations	considered	considered	considered	Linked to Structure-Elements and Behaviour-Elements	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of MBSE	X	X	
Design Society	Egner, M.; Gilz, T.; Zafrow, R.	2012	PROPOSAL FOR FUNCTIONAL PRODUCT DESCRIPTION AS PART OF A PLM SOLUTION IN INTERDISCIPLINARY PRODUCT DEVELOPMENT		Eg12	related to established Method	Not specified	SysML without adaptations	not considered	considered	considered	-	Linked to Behaviour-Elements	Linked to Structure-Elements	Application of SysML			X
Design Society	Egner, Martin; Dickopf, Thomas; Schneider, Marc; Schulte, Tim	2017	MICPRO – A HOLISTIC CONCEPT FOR THE MODEL-BASED DEVELOPMENT OF CYBERNETIC SYSTEMS		Eg17	Custom Method	Not specified	SysML with adaptations	considered	not considered	not considered	-	-	-	Application of MBSE		X	
Design Society	Egner, M.; Hüwig, C.; Dickopf, T.	2015	COST-BENEFIT ANALYSIS IN MODEL-BASED SYSTEMS ENGINEERING: STATE OF THE ART AND FUTURE POTENTIALS		Eg15	related to established Method	Not specified	Not specified	considered	considered	considered	-	-	-	Application of MBSE	X	X	
Design Society	Egner, Martin; Ernst, Joscha; Roubanov, Daniel; Dickopf, Thomas	2014	An Initial Approach for the Application of Product Assembly Information in the Early Phases of the Product Development Process by Using Methods of Model Based Systems Engineering		Eg14	related to established Method	Not specified	SysML without adaptations	considered	considered	not considered	Linked to Structure-Elements	Linked to Requirements	-	Application of MBSE	X	X	X
Design Society	Gadzo, Emir; Mehlstäubl, Jan	2021	Modellbasierte Umsetzung des Anforderungsmanagements zur Unterstützung der Entwicklung eines Experimentalsatelliten	10.1019/df2021.21	Gad21	related to established Method	MagicDraw	SysML without adaptations	considered	not considered	not considered	-	-	-	Application of MBSE			X
Design Society	Fahl, Joshua; Hirscher, Tobias; Wöhrle, Gabriel; Albers, Albert	2021	PROPOSING A SPECIFICATION STRUCTURE FOR COMPLEX PRODUCTS IN MODEL-BASED SYSTEMS ENGINEERING (MBSE)	10.1017/pds.2021.509	Fah21	Custom Method	Cameo Systems Modeler	SysML with adaptations	considered	considered	considered	-	-	-	Application of MBSE	X	X	X
Design Society	Gausemeier, Jürgen; Tschirner, Christian; Vasholz, Mareen	2012	SYSTEMS THINKING SENSITIZING FOR SYSTEMS ENGINEERING - EXPERIENCES FROM ACADEMIC TEACHING AND INDUSTRY WORKSHOPS		Gau12	related to established Method	Mechatronic Modeler	Other (CONSENS)	considered	considered	considered	Linked to Structure-Elements and Behaviour-Elements	Linked to Behaviour-Elements	Linked to Structure-Elements	Benefits MBSE		X	
Design Society	Goorden, Martijn; Etmans, Pascal; van de Mortel-Fronczak, Joanna; Rooda, Jacobus	2019	DSM-based Analysis for the Recognition of Modeling Errors in Supervisory Controller Design	10.1019/dsm2019.7	Go09	no Method specified	Not specified	Other (Graphs)	not considered	not considered	not considered	-	-	-	Other		X	
Design Society	Gräßler, Iris; Wiechel, Dominik	2021	Systematische Bewertung von Auswirkungsanalysen des Engineering Change Managements	10.1019/df2021.12	Grä21	no Method specified	Not specified	Not specified	not considered	not considered	not considered	-	-	-	Other		X	
Design Society	Heber, Dominik; Groll, Marco	2018	TOWARDS A DIGITAL TWIN: HOW THE BLOCKCHAIN CAN FOSTER E/E-TRACEABILITY IN CONSIDERATION OF MODEL-BASED SYSTEMS ENGINEERING		Heb17	Custom Method	Not specified	Not specified	considered	considered	not considered	-	-	-	Application of MBSE	X	X	
Design Society	Heilhoff, Schwede, J.; Kaiser, L.; Dumstrenner, R.	2020	AN MBSE-BASED APPROACH FOR THE DEFINITION AND EVALUATION OF ENGINEERING IT ARCHITECTURES	10.1017/dsd.2020.37	Hei20	related to established Method	Not specified	SysML with adaptations	not considered	considered	considered	-	-	-	Application of SysML	X		
Design Society	Hoefinger, Gregor; Kowalski, Julia; Faustmann, Clemens; Zewas, Thilo; Kranzolt, Philipp; Vazfai, Seyedmohammad; Jacobs, Georg; Hick, Hannes	2022	A Classification Method for the Systematic Identification of Models and Workflows in MBSE	10.1019/df2022.17	Hoef22	Custom Method	Not specified	SysML with adaptations	not considered	not considered	not considered	-	-	-	Benefits MBSE	X	X	X
Design Society	Husung, Stephan; Weber, Christian; Mahboob, Atil; Kleiner, Sven	2021	USING MODEL-BASED SYSTEMS ENGINEERING FOR NEED-BASED AND CONSISTENT SUPPORT OF THE DESIGN PROCESS	10.1017/pds.2021.598	Hus21	Custom Method	Not specified	SysML without adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE	X	X	X
Design Society	Inkermann, David	2019	Towards Model-based Process Engineering	10.1017/dsi.2019.381	Ink19	related to established Method	Not specified	Other (Business Process Model and Notation)	not considered	not considered	not considered	-	-	-	Benefits MBSE		X	
Design Society	Inkermann, David	2022	Potentials of Integrating MBSE and LCA to handle uncertainties and variants in early design stages	10.1019/df2022.19	Ink22	Custom Method	Not specified	SysML with adaptations	not considered	not considered	not considered	-	-	-	Application of MBSE	X	X	X
Design Society	Kätzwinkel, Tim; Löwer, Manuel	2019	MBSE-integrated Parametric Working Surfaces as part of a PLM Design Approach	10.1017/dsi.2019.374	Kat19	Custom Method	Cameo Systems Modeler	SysML with adaptations	considered	not considered	considered	Linked to Behaviour-Elements	-	Linked to Requirements	Application of MBSE	X	X	X