		(Jun et al., 2021)	(Holder et al., 2018)		(Li et al., 2020)		(Jasinski, 2019)			(Schlager et al., 2020)			(Cao et al., 2015)	(Ngo et al., 2021)					(Ngo et al., 2020)						(Holder, 2021)						(Thieling et al., 2021)		(Muckenhuber et al., 2019)			
		Functional	Phenomenological	Physical	Geometric	Physical	Physical	Scattering Center	Data Driven	High Fidelity	Medium Fidelity	Low Fidelity	Grey box	Physical	Probabilistic	Phenomenological	Ideal Radar Model	Data-Driven Model	Time Domain EM-Wave	Ray-Tracing	Data-Driven	Raw Data Level	Detection Level	Object Level	Object In Object Out	Objet In Detection Out	Objet In Raw Out	Rendering In Object Out	Rendering In Detection Out	Rendering In Raw Out	Phenomenological	Physical	Ideal Model	Probabilistic	Physical	Sum:
OPERATIONAL	(Roth et al., 2011)																						x	x											2
	(Hanke et al., 2015)										x																			x					2
	(Stolz and Nestlinger, 2018)										x													x							x				3
	(Muckenhuber et al., 2019)										x																								1
	(Elgharbawy et al., 2016)																							x						x					2
	(Velazquez et al., 2018)																													x					1
	(Gschwandtner et al., 2011)			x																															1
	(Hanke, 2022)																																		0
	(Deng et al., 2009)	x																																	1
FUNCTIONAL	(Hirsenkorn et al., 2015)		x								x														x									x		4
	(Hirsenkorn et al., 2016)								x																										1
	(Bernsteiner et al., 2015)	x	x								x														x										4
	(Cao et al., 2015), (Cao, 2017)	x									x		x									x						x							5
	(Choi et al., 2021)																																		0
	(Holder et al., 2018)	x																		x											x				3
	(Slavik and Mishra, 2019)																																		0
	(Martowicz et al., 2019)							x															x												2
	(Muckenhuber et al., 2021)																																		0
	(Arnelid et al., 2019)																																		0
	(Zec et al., 2018)																								x										1
	(Song et al., 2019)																																		0
	(Suhre and Malik, 2018)																				x			x											2
	(Wheeler et al., 2017)			x					x		x										x						x							x		6
	(Cao et al., 2021)																																		0
	(Guo et al., 2017)					x	x																												2
	(Li et al., 2020)	x																																	1
	(Mishra et al., 2020)																																		0
	(Choi et al., 2020)																																		0
	(Belyaev et al., 2019)																																		0
	(Scheel and Dietmayer, 2019)								x									x																	2
	(Jasinski, 2019)																																		0
	(H. Buddendick and T.F. Eibert, 2009)							x																											1
	(Schubert et al., 2014)	x																																	1
	(Sligar, 2020)													x																					1
	(Buhren and Yang, 2007b)										x																								1
	(Hartstern et al., 2020)														x																				1
	(Ponn et al., 2020)															x																			1
	(Haider et al., 2019)																								x		x								2
	(Dietmayer, 2016)																								x										1
	(Dörr and IPG Automotive GmbH, 2017)																								x										1
	(Stellet et al., 2016)																								x										1
	(Gubelli et al., 2013)																																		0
	(Schneider, 1998)																																		0
	(Deng et al., 2011)	x			x																														2
TECHNICAL	(Dallmann et al., 2018)																																		0
	(Gowdu et al., 2018)																																		0
	(Zhu et al., 2021)																																		0
	(Sobotka and Novak, 2020)																																		0
	(Diewald et al., 2021)																																		0
	(Gadringer, Schreiber et al., 2018)																												x						1
	(Gadringer, Maier et al., 2018)																																		0
	(Cheng et al., 2020)																																		0
	(Asghar et al., 2021)4																																		0
	(Lutz et al., 2014)																																	x	1
	(van Driesten and Schaller, 2019)																													x					1
	(Feilhauer and Häring, 2017)																								x										1
	(Maier, 2022)																																		
	(Maier, F. M. et al., 2018)									x																			x						2
INDIVIDUAL	(Dudek et al., 2010)	x																																	1
	(Hirsenkorn et al., 2017)						x			x																				x		x			x	5
	(Schuesler et al., 2021)																																		0
	(Thieling et al., 2021)																													x					1
	(Zhu et al., 2021)																																		0
	(Buhren and Yang, 2007a)										x																								1
	(Prinz et al., 2021)																																		0
	(Schuler et al., 2008)							x			x						x									x	x								5
	(Maier, M. et al., 2018)																												x					x	2
	(Holder et al., 2019)									x																						x				2
	(Bogdan and Dorina, 2020)																																		0
	(Blasch and Hensel, 2004)																																		0
	(Etinger et al., 2017)	x																																	1
	(Hammarstrand, Lundgren, Svensson, 2012)	x									x																								2
	(Hammarstrand, Svensson et al., 2012)																											x							1
	(Hanke et al., 2017)																																	x	1
	(Ling et al., 1989)						x																												1
	(Bhalla and Ling, 1996)							x																											1
	(Peinecke et al., 2008)									x																									1
	(Buhren and Yang, 2006)										x															x									2
	(Buhren and Yang, 2007c)										x																								1
	(Danielsson, 2010)										x																								1
	(Schuler, 2007)										x																								1
	(Hermann Buddendick et al., 2010)																x										x								2
	(Harrington, 1993)																		x																1
	(Weinmann, 2006)																										x								1
	(Rosenberger et al., 2019)																		x																1
	(Machida and Owaki, 2019)																		x	x															2
	(Yee, 1966)																		x																1
	(Chipengo et al., 2018)																			x												x				2
	(Owaki and Machida, 2019)																				x	x													2
	(Schäferle, 2019)																								x										1
	(Eder et al., 2019)																									x									1
	(Koch, 2007)																											x							1
	(Berthold et al., 2018)																											x							1
	(Felbecker et al., 2012)																													x					1
	(Herrmann and Schön, 2019)																													x					1
	(Yun and Iskander, 2015)																													x					1
	(Topak et al., 2011)																															x				1
	(Eder, 2021)																																		0
	(Hirsenkorn), p.92-110																																		0
	(Degen et al., 2021)																																		0
	(Kedzia et al., 2016)	x																																	1

References

References

Arnelid, H., Zec, E. L. and Mohammadiha, N. (2019) *Recurrent Conditional Generative Adversarial Networks for Autonomous Driving Sensor Modelling: Auckland, New Zealand, 27-30 October 2019* [Online], Piscataway, NJ, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=8907344.

Asghar, M. E., Buddappagari, S., Baumgartner, F., Graf, S., Kreutz, F., Loffler, A., Nagel, J., Reichmann, T., Stephan, R. and Hein, M. A. (2021) 'Radar Target Simulator and Antenna Positioner for Real-Time Over-the-air Stimulation of Automotive Radar Systems', *2020 17th European Radar Conference (EuRAD)*. Utrecht, Netherlands, 10.01.2021 - 15.01.2021, IEEE, pp. 95–98.

Belyaev, A. A., Frolov, I. O., Suanov, T. A. and Trots, D. O. (2019) *Object Detection in an Urban Environment Using 77GHz Radar: Divnomorskoe, Krasnodar Region, Russia, June 24-28, 2019 : conference proceedings* [Online], Piscataway, NJ, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=8784099.

Bernsteiner, S., Magosi, Z., Lindvai-Soos, D. and Eichberger, A. (2015) 'Radar Sensor Model for the Virtual Development Process', *ATZelektronik worldwide*, vol. 10, no. 2, pp. 46–52.

Berthold, P., Michaelis, M., Luettel, T., Meissner, D. and Wuensche, H. J. J. (2018) *An Abstracted Radar Measurement Model for Extended Object Tracking: November 4-7, Maui, Hawaii* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8543039.

Bhalla, R. and Ling, H. (1996) 'Three-Dimensional Scattering Center Extraction Using the Shooting and Bouncing Ray Technique'.

Blasch, E. and Hensel, M. (2004) 'Fusion of Distributions for Radar Clutter Modeling', *Defense Technical Information Center* [Online]. Available at https://apps.dtic.mil/sti/pdfs/ADA524586.pdf.

Bogdan, T. and Dorina, I. (2020) 'Simulation of Automotive MIMO Radar', *2020 International Symposium on Electronics and Telecommunications (ISETC).* Timisoara, Romania, 05.11.2020 - 06.11.2020, IEEE, pp. 1–4.

Buhren, M. and Yang, B. (2006) 'Simulation of Automotive Radar Target Lists using a Novel Approach of Object Representation', *2006 IEEE Intelligent Vehicles Symposium.* Meguro-Ku, Japan, 13-15 June 2006, IEEE, pp. 314–319.

Buhren, M. and Yang, B. (2007a) 'Extension of Automotive Radar Target List Simulation to consider further Physical Aspects', *2007 7th International Conference on ITS Telecommunications*, pp. 1–6.

Buhren, M. and Yang, B. (2007b) 'Initialization Procedure for Radar Target Tracking without Object Movement Constraints'.

Buhren, M. and Yang, B. (2007c) 'Simulation of Automotive Radar Target Lists Considering Clutter and Limited Resolution,'.

Cao, P. (2017) *Modeling Active Perception Sensors for Real-Time Virtual Validation of Automated Driving Systems*, PhD thesis, Darmstadt, Germany, Technische Universität Darmstadt [Online]. Available at https://d-nb.info/1162621664/34?msclkid=38e29c5cc0a611eca63b2d3ee53bb5c6 (Accessed 20 April 2022).

Cao, P., Wachenfeld, W. and Winner, H. (2015) 'Perception sensor modeling for virtual validation of automated driving', *it - Information Technology*, vol. 57, no. 4, pp. 243–251.

Cao, X., Lan, J., Li, X. R. and Liu, Y. (2021) 'Automotive Radar-Based Vehicle Tracking Using Data-Region Association', *IEEE Transactions on Intelligent Transportation Systems*, pp. 1–14.

Cheng, J.-J., Xu, Z.-G., Gao, Y., Wang, Z., Wang, W.-W. and Zhao, X.-M. (2020) 'An Indoor Rapid Testing Platform for Autonomous Vehicles Using Vehicle-in-the-Loop Simulation', *CICTP 2020.* Xi'an, China (Conference Cancelled), August 14–16, 2020. Reston, VA, American Society of Civil Engineers, pp. 411–422.

Chipengo, U., Krenz, P. M. and Carpenter, S. (2018) 'From Antenna Design to High Fidelity, Full Physics Automotive Radar Sensor Corner Case Simulation', *Modelling and Simulation in Engineering*, vol. 2018, pp. 1–19.

Choi, W. Y., Kang, C. M., Lee, S.-H. and Chung, C. C. (2020) 'Radar Accuracy Modeling and Its Application to Object Vehicle Tracking', *International Journal of Control, Automation and Systems*, vol. 18, no. 12, pp. 3146–3158.

Choi, W. Y., Yang, J. H. and Chung, C. C. (2021) 'Data-Driven Object Vehicle Estimation by Radar Accuracy Modeling with Weighted Interpolation', *Sensors (Basel, Switzerland)*, vol. 21, no. 7.

Dallmann, T., Mende, J.-K. and Wald, S. (2018) 'A Radar Target Simulator for Complex Traffic Scenarios ATRIUM', *2018 IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM).* Munich, Germany, 15.04.2018 - 17.04.2018, IEEE, pp. 1–4.

Danielsson, L. (2010) *Tracking and radar sensor modelling for automotive safety systems* (Zugl.: Göteborg, Univ., Diss., 2010), Göteborg, Chalmers Univ. of Technology.

Degen, R., Ott, H., Overath, F., Schyr, C., Leijon, M. and Ruschitzka, M. (2021) 'Methodical Approach to the Development of a Radar Sensor Model for the Detection of Urban Traffic Participants Using a Virtual Reality Engine', *Journal of Transportation Technologies*, vol. 11, no. 02, pp. 179–195.

Deng, W., Dai, J., Zhao, Q., Litkouhi, B., Moshchuk, N. and Nisonger, R. (2009) 'Modeling of range sensing and object detection, for vehicle active safety', *2009 12th International IEEE Conference on Intelligent Transportation Systems.* St. Louis, 04.10.2009 - 07.10.2009, IEEE, pp. 1–6.

Deng, W., Zeng, S., Zhao, Q. and Dai, J. (2011) 'Modeling and simulation of sensor-guided autonomous driving', *International Journal of Vehicle Design*, vol. 56, 1/2/3/4, p. 341.

Dietmayer, K. (2016) 'Predicting of Machine Perception for Automated Driving', in Maurer, M., Gerdes, J. C., Lenz, B. and Winner, H. (eds) *Autonomous Driving*, Berlin, Heidelberg, Springer Berlin Heidelberg, pp. 407–424.

Diewald, A., Kurz, C., Kannan, P. V., Gießler, M., Pauli, M., Göttel, B., Kayser, T., Gauterin, F. and Zwick, T. (2021) 'Radar Target Simulation for Vehicle-in-the-Loop Testing', *Vehicles*, vol. 3, no. 2, pp. 257–271.

Dörr, D. and IPG Automotive GmbH (2017) 'Using Virtualization to Accelerate the Development of ADAS & Automated Driving Functions'.

Dudek, M., Wahl, R., Kissinger, D., Weigel, R. and Fischer, G. (2010) 'Millimeter wave FMCW radar system simulations including a 3D ray tracing channel simulator', *2010 Asia-Pacific Microwave Conference*, pp. 1665-1668.

Eder, T. (2021) *Simulation of Automotive Radar Point Clouds in Standardized Frameworks*, Göttingen, Cuvillier Verlag.

Eder, T., Hachicha, R., Sellami, H., van Driesten, C. and Biebl, E. (2019) 'Data Driven Radar Detection Models: A Comparison of Artificial Neural Networks and Non Parametric Density Estimators on Synthetically Generated Radar Data', *2019 Kleinheubach Conference* [Online]. Available at https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8890237 (Accessed 23 June 2022).

Elgharbawy, M., Schwarzhaupt, A., Scheike, G., Frey, M. and Gauterin, F. (2016) 'A generic architecture of ADAS sensor fault injection for virtual tests', *2016 IEEE/ACS 13th International Conference of Computer Systems and Applications (AICCSA).* Agadir, Morocco, 29.11.2016 - 02.12.2016, IEEE, pp. 1–7.

Etinger, A., Litvak, B. and Pinhasi, Y. (2017) 'Multi Ray Model for Near-Ground Millimeter Wave Radar', *Sensors (Basel, Switzerland)*, vol. 17, no. 9.

Feilhauer, M. and Häring, J. (2017) 'A real-time capable multi-sensor model to validate ADAS in a virtual environment', in Isermann, R. (ed) *Fahrerassistenzsysteme 2017*, Wiesbaden, Springer Fachmedien Wiesbaden, pp. 227–256.

Felbecker, R., Raschkowski, L., Keusgen, W. and Peter, M. (2012) 'Electromagnetic wave propagation in the millimeter wave band using the NVIDIA OptiX GPU ray tracing engine', *2012 6th European Conference on Antennas and Propagation (EUCAP).* Prague, Czech Republic, 26.03.2012 - 30.03.2012, IEEE, pp. 488–492.

Gadringer, M. E., Maier, F. M., Schreiber, H., Makkapati, V. P., Gruber, A., Vorderderfler, M., Amschl, D., Metzner, S., Pflügl, H., Bösch, W., Horn, M. and Paulweber, M. (2018) 'Radar target stimulation for automotive applications', *IET Radar, Sonar & Navigation*, vol. 12, no. 10, pp. 1096–1103.

Gadringer, M. E., Schreiber, H., Gruber, A., Vorderderfler, M., Amschl, D., Bösch, W., Metzner, S., Pflügl, H. and Paulweber, M. (2018) 'Virtual reality for automotive radars', *e & i Elektrotechnik und Informationstechnik*, vol. 135, 4-5, pp. 335–343.

Gowdu, S. B. J., Asghar, M. E., Stephan, R., Hein, M. A., Nagel, J. and Baumgartner, F. (2018) 'System architecture for installed-performance testing of automotive radars over-the-air', *2018 IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM).* Munich, 15.04.2018 - 17.04.2018, IEEE, pp. 1–4.

Gschwandtner, M., Kwitt, R., Uhl, A. and Pree, W. (2011) 'BlenSor: Blender Sensor Simulation Toolbox', *Advances in Visual Computing.* Berlin, Heidelberg, 2011. Berlin, Heidelberg, Springer Berlin Heidelberg, pp. 199–208.

Gubelli, D., Krasnov, O. and Yarovyi, O. (2013) 'Ray-tracing simulator for radar signals propagation in radar networks', *2013 European Radar Conference*, vol. 2013, pp. 73–76 [Online]. Available at https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6689116.

Guo, J., Deng, W., Zhang, S., Qi, S., Li, X., Wang, C. and Wang, J. (2017) 'A Novel Method of Radar Modeling for Vehicle Intelligence', *SAE International Journal of Passenger Cars - Electronic and Electrical Systems*, vol. 10, no. 1, pp. 50–56.

H. Buddendick and T.F. Eibert (eds) (2009) *Radio channel simulations using multiple scattering center models*, IEEE.

Haider, A., Kim, J., Sachse, M., Zeh, T., Schneider, S. A., Thumann, M., Eryildirim, A. and Ebeling, T. (2019) 'Automotive Radar Sensor Behavioral Models for Closed Loop Simulations' [Online]. Available at https://www.researchgate.net/profile/Arsalan-Haider-2/publication/336648656_Automotive_Radar_Sensor_Behavioral_Models_for_Closed_Loop_Simulations/links/5da9b032a6fdccc99d913ef1/Automotive-Radar-Sensor-Behavioral-Models-for-Closed-Loop-Simulations.pdf (Accessed 21 April 2022).

Hammarstrand, L., Lundgren, M. and Svensson, L. (2012) 'Adaptive Radar Sensor Model for Tracking Structured Extended Objects', *IEEE Transactions on Aerospace and Electronic Systems*, vol. 48, no. 3, pp. 1975–1995.

Hammarstrand, L., Svensson, L., Sandblom, F. and Sorstedt, J. (2012) 'Extended Object Tracking using a Radar Resolution Model', *IEEE Transactions on Aerospace and Electronic Systems*, vol. 48, no. 3, pp. 2371–2386.

Hanke, T. (2022) *Virtual Sensorics: Simulated Environmental Perception for Automated Driving Systems*, PhD thesis, Darmstadt, Germany, TU Darmstadt [Online]. Available at https://mediatum.ub.tum.de/doc/1519952/1519952.pdf (Accessed 23 June 2022).

Hanke, T., Hirsenkorn, N., Dehlink, B., Rauch, A., Rasshofer, R. and Biebl, E. (2015) 'Generic architecture for simulation of ADAS sensors', *Generic Architecture for Simulation of ADAS Sensors.* Dresden, Germany, 24.06.2015 - 26.06.2015, IEEE, pp. 125–130.

Hanke, T., Schaermann, A., Matthias, G., Konstantin, W., Hirsenkorn, N., Rauch, A. and Stefan-Alexander Schneider (2017) *Generation and validation of virtual point cloud data for automated driving systems: 20th International Conference on Intelligent Transportation Systems : Mielparque Yokohama in Yokohama, Kanagawa, Japan, October 16-19, 2017* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8307147.

Harrington, r. F. (1993) *Field computation by moment methods* [Online], Wiley-IEEE Press. Available at https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnx2aXZla2Rob290aW5kaWFufGd4OjY0YTg4YjViMjY1NmRlNA&msclkid=8da2ddf8c13211ecb0d87597c773046a (Accessed 21 April 2022).

Hartstern, M., Rack, V., Kaboli, M. and Stork, W. (2020) 'Simulation-based Evaluation of Automotive Sensor Setups for Environmental Perception in Early Development Stages', *2020 IEEE Intelligent Vehicles Symposium (IV).* Las Vegas, NV, USA, 19.10.2020 - 13.11.2020, IEEE, pp. 858–864.

Hermann Buddendick, Thomas Eibert and Jurgen Hasch (2010) *Bistatic Scattering Center Models_for_the_simulation_of_wave_propagation_in_automotive_radar_systems: (GeMiC 2010) ; Berlin, Germany, 15 - 17 March 2010*, Piscataway, NJ, IEEE.

Herrmann, M. and Schön, H. (2019) 'Efficient Sensor Development Using Raw Signal Interfaces', in Bertram, T. (ed) *Fahrerassistenzsysteme 2018*, Wiesbaden, Springer Fachmedien Wiesbaden, pp. 30–39.

Hirsenkorn, N., Hanke, T., Rauch, A., Dehlink, B., Rasshofer, R. and Biebl, E. (2015) 'A non-parametric approach for modeling sensor behavior', *2015 16th International Radar Symposium (IRS).* Dresden, Germany, 24.06.2015 - 26.06.2015, IEEE, pp. 131–136.

Hirsenkorn, N., Hanke, T., Rauch, A., Dehlink, B., Rasshofer, R. and Biebl, E. (2016) 'Virtual sensor models for real-time applications', *Advances in Radio Science*, vol. 14, pp. 31–37.

Hirsenkorn, N., Subkowski, P., Hanke, T., Schaermann, A., Rauch, A., Rasshofer, R. and Biebl, E. (eds) (2017) *A ray launching approach for modeling an FMCW radar system: 28-30 June 2017* [Online], The 18th International Radar Symposium IRS 2017, June 28-30, 2017, Prague, Czech Republic, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8001662.

Hirsenkorn, N. Q. *Modellbildung und Simulation der Fahrzeugumfeldsensorik*, Dissertation, Verlag Dr. Hut.

Holder, M., Linnhoff, C., Rosenberger, P. and Winner, H. (eds) (2019) *The Fourier Tracing Approach for Modeling Automotive Radar Sensors* [Online], 20th International Radar Symposium (IRS), IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8764049.

Holder, M. F. (2021) *Synthetic Generation of Radar Sensor Data for Virtual Validation of Autonomous Driving*, PhD thesis, TU Darmstadt.

Holder, M. F., Makkapati, V. P., Rosenberger, P., Dï¿½hondt, T., Slavik, Z., Maier, F. M., Schreiber, H., Magosi, Z., Winner, H., Bringmann, O. and Rosenstiel, W. (2018) *Measurements revealing Challenges in Radar Sensor Modeling for Virtual Validation of Autonomous Driving: November 4-7, Maui, Hawaii* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8543039.

Jasinski, M. (2019) *A Generic Validation Scheme for real-time capable Automotive Radar Sensor Models integrated into an Autonomous Driving Simulator* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8854467.

Jun, Z., Kai, Y., Xuecai, D., Zhangu, W., Huainan, Z. and Chunguang, D. (2021) 'New modeling method of millimeter-wave radar considering target radar echo intensity', *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*, vol. 235, 10-11, pp. 2857–2870.

Kedzia, J.-C., Souza, P. de and Gruyer, D. (2016) 'Advanced RADAR sensors modeling for driving assistance systems testing', *2016 10th European Conference on Antennas and Propagation (EuCAP).* Davos, Switzerland, 10.04.2016 - 15.04.2016, IEEE, pp. 1–2.

Koch, W. (2007) 'Verfeinerte Sensormodelle für Tracking-Anwendungen (Advanced Sensor Models for Tracking Applications)', *tm - Technisches Messen*, vol. 74, no. 3, pp. 112–120.

Li, X., Deng, W., Zhang, S., Li, Y., Song, S., Wang, S. and Wang, G. (2020) 'Research on Millimeter Wave Radar Simulation Model for Intelligent Vehicle', *International Journal of Automotive Technology*, vol. 21, no. 2, pp. 275–284.

Ling, H., Chou, R.-C. and Lee, S.-W. (1989) 'Shooting and bouncing rays: calculating the RCS of an arbitrarily shaped cavity', *IEEE Transactions on Antennas and Propagation*, vol. 37, no. 2, pp. 194–205.

Lutz, S., Erhart, C., Walte, T. and Weigel, R. (2014) 'Target simulator concept for chirp modulated 77 GHz automotive radar sensors', *2014 11th European Radar Conference*, pp. 65–68.

Machida, T. and Owaki, T. (2019) *Rapid and Precise Millimeter-wave Radar Simulation for ADAS Virtual Assessment: Auckland, New Zealand, 27-30 October 2019* [Online], Auckland, New Zealand, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=8907344.

Maier, F. M. (2022) *Radar Perception Simulation for Automated Driving Tests*, PhD thesis, Graz, Graz University of Technology.

Maier, F. M., Makkapati, V. P. and Horn, M. (2018) 'Environment perception simulation for radar stimulation in automated driving function testing', *e & i Elektrotechnik und Informationstechnik*, vol. 135, 4-5, pp. 309–315.

Maier, M., Makkapati, V. P. and Horn, M. (2018) 'Adapting Phong into a Simulation for Stimulation of Automotive Radar Sensors', *2018 IEEE MTT-S International Conference on Microwaves for Intelligent Mobility (ICMIM).* Munich, 15.04.2018 - 17.04.2018, IEEE, pp. 1–4.

Martowicz, A., Gallina, A. and Karpiel, G. (2019) *2019 24th International Conference on Methods and Models in Automation and Robotics (MMAR)* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8854467.

Mishra, K. V., Shankar M.R., B. and Ottersten, B. (2020) 'Stochastic-Geometry-Based Interference Modeling in Automotive Radars Using Matérn Hard-Core Process', *2020 IEEE Radar Conference (RadarConf20).* Florence, Italy, 21.09.2020 - 25.09.2020, IEEE, pp. 1–5.

Muckenhuber, S., Holzer, H., Rubsam, J. and Stettinger, G. (2019) *Object-based sensor model for virtual testing of ADAS/AD functions: The 8th IEEE International Conference on Connected Vehicles and Expo (ICCVE)* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8952572.

Muckenhuber, S., Museljic, E. and Stettinger, G. (2021) 'Performance evaluation of a state-of-the-art automotive radar and corresponding modeling approaches based on a large labeled dataset', *Journal of Intelligent Transportation Systems*, pp. 1–20.

Ngo, A., Bauer, M. P. and Resch, M. (2020) *A Sensitivity Analysis Approach for Evaluating a Radar Simulation for Virtual Testing of Autonomous Driving Functions: ACIRS 2020 : July 17-19, 2020, Singapore* [Online], Piscataway, NJ, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=9154368.

Ngo, A., Bauer, M. P. and Resch, M. (2021) *A Multi-Layered Approach for Measuring the Simulation-to-Reality Gap of Radar Perception for Autonomous Driving* [Online]. Available at http://arxiv.org/pdf/2106.08372v2.

Owaki, T. and Machida, T. (2019) *Hybrid Physics-Based and Data-Driven Approach to Estimate the Radar Cross-Section of Vehicles: Auckland, New Zealand, 27-30 October 2019* [Online], Piscataway, NJ, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=8907344.

Peinecke, N., Döhler, H.-U. and Korn, B. R. (2008) 'Simulation of imaging radar using graphics hardware acceleration', *Enhanced and Synthetic Vision 2008.* Orlando, FL, Sunday 16 March 2008, SPIE, 69570L.

Ponn, T., Lanz, T. and Diermeyer, F. (2020) 'Automatic Generation of Road Geometries to Create Challenging Scenarios for Automated Vehicles Based on the Sensor Setup', *2020 IEEE Intelligent Vehicles Symposium (IV).* Las Vegas, NV, USA, 19.10.2020 - 13.11.2020, IEEE, pp. 694–700.

Prinz, A., Peters, L.-T., Schwendner, J., Ayeb, M. and Brabetz, L. (2021) 'Automotive Radar Signal and Interference Simulation for Testing Autonomous Driving', in Martins, A. L., Ferreira, J. C., Kocian, A. and Costa, V. (eds) *Intelligent transport systems, from research and development to the market uptake: 4th EAI international conference, INTSYS 2020, virtual event, December 3, 2020, proceedings*, Cham, Switzerland, Springer, pp. 223–240.

Rosenberger, P., Wendler, J. T., Holder, M., Linnhoff, C., Berghöfer, M., Hermann Winner and and Markus Maurer (2019) 'Towards a Generally Accepted Validation Methodology for Sensor Models - Challenges, Metrics, and First Results', *Graz Symposium Virtual Vehicle (GSVF) 2019*.

Roth, E., Dirndorfer, T. J., Knoll, A., v. Neumann-Cosel, K., Ganslmeier, T., Kern, A. and Fischer, M.-O. (2011) 'Analysis and Validation of Perception Sensor Models in an Integrated Vehicle and Environment Simulation', *22nd International Technical Conference on the Enhanced Safety of Vehicles (ESV)* [Online]. Available at http://www-esv.nhtsa.dot.gov/Proceedings/22/isv7/main.htm.

Schäferle, S. (2019) *How do I choose the correct sensor model for my specific application?: CarMaker Tips & Tricks No. 6-004*, IPG Automotive GmbH [Online]. Available at https://ipg-automotive.com/uploads/tx_pbfaqtickets/files/98/SensorModelLevels.pdf (Accessed 21 April 2022).

Scheel, A. and Dietmayer, K. (2019) 'Tracking Multiple Vehicles Using a Variational Radar Model', *IEEE Transactions on Intelligent Transportation Systems*, vol. 20, no. 10, pp. 3721–3736.

Schlager, B., Muckenhuber, S., Schmidt, S., Holzer, H., Rott, R., Maier, F. M., Saad, K., Kirchengast, M., Stettinger, G., Watzenig, D. and Ruebsam, J. (2020) 'State-of-the-Art Sensor Models for Virtual Testing of Advanced Driver Assistance Systems/Autonomous Driving Functions', *SAE International Journal of Connected and Automated Vehicles*, vol. 3, no. 3, pp. 233–261.

Schneider, R. (1998) *Modellierung der Wellenausbreitung für ein bildgebendes Kfz-Radar*, PhD thesis, Karlsruhe, Universität Karlsruhe.

Schubert, R., Mattern, N. and Bours, R. (2014) 'Simulation of Sensor Models for the Evaluation of Advanced Driver Assistance Systems', *ATZelektronik worldwide*, vol. 9, no. 3, pp. 26–29.

Schuesler, C., Hoffmann, M., Braunig, J., Ullmann, I., Ebelt, R. and Vossiek, M. (2021) 'A Realistic Radar Ray Tracing Simulator for Large MIMO-Arrays in Automotive Environments', *IEEE Journal of Microwaves*, vol. 1, no. 4, pp. 962–974.

Schuler, K. (2007) *Intelligente Antennensysteme für Kraftfahrzeug-Nahbereichs-Radar-sensorik*, Ph.D. Thesis, Universität Karlsruhe [Online]. Available at https://publikationen.bibliothek.kit.edu/1000007776 (Accessed 20 April 2022).

Schuler, K., Becker, D. and Wiesbeck, W. (2008) 'Extraction of Virtual Scattering Centers of Vehicles by Ray-Tracing Simulations', *IEEE Transactions on Antennas and Propagation*, vol. 56, no. 11, pp. 3543–3551.

Slavik, Z. and Mishra, K. V. (2019) 'Phenomenological Modeling of Millimeter-Wave Automotive Radar', *2019 URSI Asia-Pacific Radio Science Conference (AP-RASC).* New Delhi, India, 09.03.2019 - 15.03.2019, IEEE, pp. 1–4.

Sligar, A. P. (2020) 'Machine Learning-Based Radar Perception for Autonomous Vehicles Using Full Physics Simulation', *IEEE Access*, vol. 8, pp. 51470–51476.

Sobotka, J. and Novak, J. (2020) *Digital Vehicle Radar Sensor Target Simulation: International Instrumentation & Measurement Technology Conference : May 25-29, 2020, Valamar Riviera, Dubrovnik, Croatia : 2020 conference proceedings* [Online], Piscataway, NJ, USA, IEEE. Available at https://ieeexplore.ieee.org/servlet/opac?punumber=9123988.

Song, Y., Wang, Y. and Li, Y. (2019) 'Radar data simulation using deep generative networks', *The Journal of Engineering*, vol. 2019, no. 20, pp. 6699–6702.

Stellet, J. E., Schumacher, J., Lange, O., Branz, W., Niewels, F. and Zöllner, J. M. (2016) 'Statistical Modelling of Object Detection in Stereo Vision-Based Driver Assistance', in Menegatti, E., Michael, N., Berns, K. and Yamaguchi, H. (eds) *Intelligent Autonomous Systems 13*, Cham, Springer International Publishing, pp. 749–761.

Stolz, M. and Nestlinger, G. (2018) 'Fast generic sensor models for testing highly automated vehicles in simulation', *e & i Elektrotechnik und Informationstechnik*, vol. 135, 4-5, pp. 365–369.

Suhre, A. and Malik, W. (eds) (2018) *Simulating object lists using neural networks in automotive radar*.

Thieling, J., Frese, S. and Roßmann, J. (2021) 'Scalable and Physical Radar Sensor Simulation for Interacting Digital Twins', *IEEE Sensors Journal*, vol. 21, no. 3, pp. 3184–3192.

Topak, A. E., Hash, J. and Zwick, T. (2011) 'A system simulation of a 77 GHz phased array radar sensor', *12th International Radar Symposium (IRS)*, pp. 175–180.

van Driesten, C. and Schaller, T. (2019) 'Overall Approach to Standardize AD Sensor Interfaces: Simulation and Real Vehicle', in Bertram, T. (ed) *Fahrerassistenzsysteme 2018*, Wiesbaden, Springer Fachmedien Wiesbaden, pp. 47–55.

Velazquez, J. M. R., Mailly, F. and Nouet, P. (2018) 'A generic model for sensor simulation at system level', *2018 Symposium on Design, Test, Integration & Packaging of MEMS and MOEMS (DTIP).* Roma, 22.05.2018 - 25.05.2018, IEEE, pp. 1–4.

Weinmann, F. (2006) 'Ray Tracing With PO/PTD for RCS Modeling of Large Complex Objects', *IEEE Transactions on Antennas and Propagation*, vol. 54, no. 6, pp. 1797–1806.

Wheeler, T. A., Holder, M., Winner, H. and Kochenderfer, M. J. (2017) 'Deep stochastic radar models', *2017 IEEE Intelligent Vehicles Symposium (IV).* Los Angeles, CA, USA, 11.06.2017 - 14.06.2017, IEEE, pp. 47–53.

Yee, K. (1966) 'Numerical solution of initial boundary value problems involving maxwell's equations in isotropic media', *IEEE Transactions on Antennas and Propagation*, vol. 14, no. 3, pp. 302–307.

Yun, Z. and Iskander, M. F. (2015) 'Ray Tracing for Radio Propagation Modeling: Principles and Applications', *IEEE Access*, vol. 3, pp. 1089–1100.

Zec, E. L., Mohammadiha, N. and Schliep, A. (2018) *Statistical Sensor Modelling for Autonomous Driving Using Autoregressive Input-Output HMMs: November 4-7, Maui, Hawaii* [Online], Piscataway, NJ, IEEE. Available at http://ieeexplore.ieee.org/servlet/opac?punumber=8543039.

Zhu, L., He, D., Ai, B., Zhong, Z., Zhu, F. and Wang, Z. (2021) 'Measurement and Ray-Tracing Simulation for Millimeter-Wave Automotive Radar', *2021 IEEE 4th International Conference on Electronic Information and Communication Technology (ICEICT).* Xi'an, China, 18.08.2021 - 20.08.2021, IEEE, pp. 582–587.