

● Samples in Stage I (duration: 1983-1999; Sample number 99)

No.	Seminal paper (title)	Publication Year	Labels	Label compositions		
1	Arc welding robot systems for large steel constructions	1983	$Tc_{172}A_{54}$	s_{11}	ca_{12}	-
2	Walking robot for underwater construction	1983	$Tc_{181}A_{55}$	-	ca_2	-
3	Arc welding robot with maximum flexibility for large steel construction	1984	$Tc_{237}A_{54}$	s_{11}	ca_{120}	-
4	Application of intelligent robot arc-welding system to large-sized steel construction	1985	$Tc_{236}A_{54}$	-	ca_8	-
5	Robotized welding of large offshore constructions	1986	$Tc_{171}A_{54}$	-	ca_{13}	-
6	Blockbot: a robot to automate construction of cement block walls	1988	Tm_9A_{11}	a_4	hd_{15}	bc_2
7	Using robots in the tubular structural constructions	1988	$Tm_{25}A_{54}$	-	hd_{67}	bc_2
8	Development of positioning systems for autonomous robots on construction sites	1989	$Tc_{43}A_{14}$	s_{125}	ca_{120}	-
9	Application of robotics in bridge deck fabrication	1989	$Tb_{14}A_{54}$	-	bm_{14}	-
10	A concept of control system for construction robot	1989	$Tm_{157}A_{50}$	-	hd_{52}	bc_3
11	Pipe manipulator enhancements for increased automation	1989	$Tm_{35}A_{21}$	a_2	hd_2	bc_2
12	A master-slave manipulator for excavation and construction tasks	1989	$Tm_{141}A_7$	a_4	hd_{12}	bc_2
13	Framework for construction robot fleet management system	1990	$Tc_{97}A_{31}$	-	ca_{42}	-
14	Automation and robotics for road construction and maintenance	1990	Tc_7A_1	s_{65}	ca_{63}	-
15	Robots and automated systems for the civil and construction industries	1990	$Tm_{35}A_7$	a_2	hd_2	bc_2
16	Position-force adaptive control of a robot with applications in construction	1991	$Tc_{19}A_{50}$	s_{33}	ca_{36}	-
17	Automation of surface treatment in construction by using a robot	1991	$Tc_{11}A_{20}$	s_{34}	ca_{36}	-
18	Construction robot fleet management system prototype	1991	$Tc_{97}A_{31}$	-	ca_{42}	-
19	Ssr: a mobile robot on ferromagnetic surfaces	1992	$Tc_{115}A_4$	s_{76}	ca_{95}	-
20	Air-force construction automation robotics	1992	$Tm_{62}A_7$	a_2	hd_2	bc_1
21	A remotely operated building inspection cell	1992	$Tm_{156}A_6$	a_3	hd_{12}	bc_1
22	Automation of concrete slab-on-grade construction	1992	$Tm_{123}A_{31}$	a_2	hd_{52}	bc_2
23	Robotic materials handling for automated building construction technology	1992	$Tm_{61}A_{29}$	a_5	hd_{27}	bc_2
24	Outpost service and construction robot (oscr)	1992	$Tm_{157}A_{47}$	-	hd_{52}	bc_3

25	Object-oriented programming in robotics research for excavation	1992	$Tm_{36}A_7$	a_3	bd_{12}	bc_2
26	Real-time robot path planning using the potential function method	1993	$Tc_{82}A_{24}$	-	ca_{33}	-
27	Position-force adaptive control for construction robots	1993	$Tc_{64}A_{20}$	s_6	ca_{38}	-
28	Managing multiple construction robots with a computer	1993	$Tc_{97}A_7$	-	ca_{42}	-
29	Model-based guidance by the longest common subsequence algorithm for indoor autonomous vehicle navigation using computer vision	1993	$Tc_{106}A_{32}$	s_{39}	ca_{52}	-
30	Map representation of a large in-door environment with path planning and navigation abilities for an autonomous mobile robot with its implementation on a real robot	1993	$Tc_{80}A_{24}$	s_{10}	ca_{65}	-
31	Full-scale building with interior finishing robot	1993	$Tm_{33}A_{20}$	a_3	bd_{21}	bc_2
32	Prototype robotic masonry system	1993	$Tm_{39}A_{22}$	a_3	bd_{55}	bc_2
33	Artificial intelligence in the control and operation of construction plant-the autonomous robot excavator	1993	$Tm_{142}A_7$	a_4	bd_{12}	bc_2
34	Articulated multi-vehicle robot for inspection and testing of pipeline interiors	1993	$Tm_{126}A_6$	a_5	bd_2	bc_2
35	Automation potential of pipe laying operations	1993	$Tm_{36}A_{21}$	a_3	bd_{12}	bc_2
36	Self-position measuring method for moving robot working at construction sites	1994	$Tc_{13}A_{14}$	-	ca_{115}	-
37	Logistics support system for construction robotics implementation	1994	$Tc_{97}A_{48}$	-	ca_{42}	-
38	Study on active vibration control of arm for construction machinery – modeling and linear-control simulation	1994	$Tc_{87}A_{50}$	-	ca_5	-
39	Path planning and sensing for an experimental masonry building robot	1994	$Tc_{75}A_{22}$	s_{74}	ca_{73}	-
40	Construction robot force control in cleaning operations	1994	$Tc_{137}A_{45}$	s_{50}	ca_{79}	-
41	Air force construction automation/robotics	1994	$Tm_{151}A_{21}$	-	bd_{52}	bc_1
42	Mobile robot for on-site construction of masonry	1994	$Tm_{40}A_{22}$	a_2	bd_{56}	bc_2
43	A mobile robot for on-site construction of masonry	1994	$Tm_{40}A_{22}$	a_2	bd_{56}	bc_2
44	Application specific realisation of a mobile robot for on-site construction of masonry	1994	$Tm_{19}A_{22}$	a_2	bd_2	bc_2
45	A robotic manipulation for inspection and maintenance of tall structures	1994	$Tm_{98}A_6$	a_3	bd_{19}	bc_2
46	Modularity of prm type cartesian robots and their application in the production of construction materials	1994	$Tm_{13}A_{29}$	a_3	bd_7	bc_2

47	Robotics and automation in the construction of the sliding domes of king fahd's extension of the prophet's holy mosque in madinah, kingdom of saudi arabia	1994	$Tm_{60}A_{34}$	a_3	bd_{12}	bc_2
48	Robot for interior-finishing works in building: feasibility analysis	1994	$Tm_{22}A_{58}$	a_3	bd_{32}	bc_2
49	Requirements for application of robotics and automation in highway maintenance and construction tasks	1994	$Tm_{25}A_{53}$	-	bd_{67}	bc_2
50	Construction process simulation with rule-based robot path planning	1994	$Tm_{23}A_{24}$	-	bd_{32}	bc_2
51	On the dynamic control of a hydraulic large range robot for construction applications	1995	$Tc_{51}A_{50}$	s_{22}	ca_{10}	-
52	A behavioral language for motion planning in building construction	1995	$Tc_{84}A_{24}$	-	ca_{103}	-
53	Robotics in highway construction & maintenance	1995	Tb_2A_{53}	-	bm_2	-
54	First results in autonomous retrieval of buried objects	1995	$Tm_{124}A_{59}$	a_2	bd_{12}	bc_2
55	High tractive power wall-climbing robot	1995	$Tm_{10}A_{11}$	a_3	bd_{16}	bc_2
56	Conceptual design of a flooring robot: development methodology and results	1995	$Tm_{34}A_{20}$	a_3	bd_{32}	bc_2
57	Automatic assembly of a commercial cavity block system	1995	$Tm_{49}A_{34}$	-	bd_{36}	bc_2
58	New tig arc welding processes and welding robot for construction of storage tank	1995	$Tm_{25}A_{54}$	-	bd_{67}	bc_2
59	Development of welding robot technology for civil engineering and construction	1995	$Tm_{25}A_{54}$	-	bd_{67}	bc_2
60	Wall assembly robot - its development and its integration in construction management mauerwerksroboter - entwicklung und integration in die ausfuehrungs-planung	1995	$Tm_{28}A_{11}$	-	-	bc_2
61	Task planning experiment toward an autonomous robot system for the construction of overhead distribution lines	1995	$Tm_{88}A_{44}$	a_3	bd_2	bc_2
62	Integration of cad drawings and construction robot motion controllers	1996	$Tc_{84}A_{34}$	-	ca_{103}	-
63	Construction robot for three-dimensional shapes based on the nesting behavior of paper wasps	1996	$Tc_{164}A_{50}$	-	ca_{114}	-
64	Self-position measuring method for moving robot working at construction sites (2nd report, improvement of pillar-detecting algorithm)	1996	$Tc_{13}A_{14}$	-	ca_{115}	-
65	Controlled hydraulics for a direct drive brick laying robot	1996	$Tc_{79}A_{22}$	s_{21}	ca_{70}	-
66	Development of interior finishing unit assembly system with robot: wascor iv research project report	1996	$Tc_{116}A_{58}$	-	ca_{70}	-

67	Technological aspects in the development of a mobile bricklaying robot	1996	$Tc_{78}A_{22}$	s_1	ca_{71}	-
68	Automatic generation of the controlling-system for a wall construction robot	1996	$Tc_{27}A_{11}$	-	ca_{90}	-
69	Evolution of an automated crack sealer: a study in construction technology development	1996	$Tm_{11}A_1$	a_2	bd_{32}	bc_2
70	Development of a construction robot for marking on ceiling boards	1996	$Tm_{59}A_{28}$	a_3	bd_{15}	bc_2
71	Automatic task modelling for sewer studies	1996	$Tm_{127}A_6$	a_3	bd_{36}	bc_2
72	Methods of control for robotic brick masonry	1996	$Tm_{41}A_{22}$	a_5	bd_{12}	bc_2
73	Compact arc welding robot system for huge construction parts	1996	$Tm_{25}A_{54}$	-	bd_{67}	bc_2
74	Development of automated cleaning system for construction aluminum scaffolding boards	1996	$Tm_{28}A_{17}$	-	-	bc_2
75	Control of construction robots using camera-space manipulation	1996	$Tm_{64}A_{50}$	-	bd_{30}	bc_3
76	Robotic mapping of building interior - precision analysis	1997	$Tc_{140}A_{46}$	s_1	ca_{120}	-
77	Steel frame welding robot systems and their application at the construction site	1997	$Tc_{170}A_{54}$	s_{14}	ca_{14}	-
78	Robot assembly system for the construction process automation	1997	$Tc_{117}A_{34}$	s_{70}	ca_{26}	-
79	A fuzzy navigation system for mobile construction robots	1997	$Tc_{189}A_{32}$	-	ca_{26}	-
80	Feasibility of automating military's environmental operations (tele-operate remote)	1997	$Tc_{189}A_{56}$	-	ca_{26}	-
81	Development of a distributed multiple mobile robot control system for automatic highway maintenance and construction	1997	$Tc_{60}A_{53}$	s_{14}	ca_{46}	-
82	Selection of optimal construction robot using genetic algorithm	1997	$Tc_{33}A_{12}$	-	ca_{49}	-
83	The development of a rapid-prototyping technique for mechatronic-augmented heavy plant	1997	$Tc_{121}A_{26}$	s_{154}	ca_{90}	-
84	Distributed control of a multiple tethered mobile robot system for highway maintenance and construction	1997	$Tc_{42}A_{53}$	s_{54}	ca_{90}	-
85	Programming construction robots using virtual reality techniques	1997	$Tc_{205}A_{50}$	-	ca_{92}	-
86	Vision-based interactive path planning for robotic bridge paint removal	1997	$Tc_{29}A_{12}$	s_{39}	ca_{96}	-
87	Concept of a robot for interior building trades by the example of wall slits in masonry	1997	$Tm_{11}A_{11}$	a_3	bd_{17}	bc_2
88	Construction manipulators of steel towers for the transmission of electricity	1997	Tm_8A_8	a_3	bd_2	bc_3

89	A new facility for testing accurate positioning systems for road construction robotics	1998	Tc_6A_1	s_{66}	ca_{64}	-
90	Autopave: towards an automated paving system for asphalt pavement compaction operations	1998	Tc_5A_1	s_{67}	ca_{65}	-
91	Automated and robotics-based techniques for road construction	1998	Tc_4A_1	s_6	ca_{73}	-
92	Automation infrastructure system for a robotic 30-ton bridge crane	1998	$Tc_{31}A_{12}$	s_{94}	ca_{96}	-
93	Development of the construction methods for distribution line materials using a robot system remotely controlled from the ground	1998	$Tm_{62}A_{29}$	a_2	bd_2	bc_1
94	Development of automated construction system for high-rise reinforced concrete buildings	1998	$Tm_{24}A_{17}$	a_2	bd_{67}	bc_2
95	Robotic assembly of rebar cages for beams and columns	1998	$Tm_{13}A_8$	a_3	bd_7	bc_2
96	Robotic welding speeds Olympic stadium construction	1998	$Tm_{60}A_{54}$	a_3	bd_{12}	bc_2
97	Construction manipulators for transmission towers	1998	$Tm_{106}A_{49}$	-	bd_{49}	bc_2
98	Teleoperation control of ets-7 robot arm for on-orbit truss construction	1999	$Tc_{200}A_{56}$	-	ca_{81}	-
99	Development of a construction robot for marking on ceiling boards: 2nd report, drawing a long straight line on the ceiling	1999	$Tc_{70}A_{38}$	-	ca_{89}	-

● Samples in Stage II (duration: 2000-2008; Sample number 112)

No.	Seminal paper (title)	Publication Year	Labels	Label compositions		
1	Robot assembly system for computer-integrated construction	2000	$Tc_{118}A_{34}$	s_{138}	ca_{26}	-
2	Impedance control of a hydraulically actuated robotic excavator	2000	$Tc_{226}A_7$	s_{44}	ca_{43}	-
3	Process and quality control with a video camera, for a floor-tilling robot	2000	$Tc_{57}A_2$	s_{39}	ca_{61}	-
4	Automated construction system for high-rise reinforced concrete buildings	2000	Tb_9A_{29}	-	bm_9	-
5	Tele-operated construction robot using virtual reality - (cg presentation of virtual robot for increasing working efficiency)	2000	$Tm_{152}A_{56}$	a_3	bd_{67}	bc_1
6	Master-slave control for tele-operation construction robot system	2000	$Tm_{151}A_{56}$	-	bd_{52}	bc_1
7	Designing for automated construction	2000	$Tm_{12}A_{11}$	a_2	bd_7	bc_2
8	Development of a robotic bridge maintenance system	2000	$Tm_{19}A_{12}$	a_2	bd_2	bc_2
9	Automated cleaning of windows on standard facades	2000	$Tm_{96}A_{45}$	a_3	bd_{34}	bc_2
10	Development of a teachingless robot system for welding a large-sized box-type construction	2001	$Tc_{169}A_{12}$	-	ca_{15}	-
11	Welding automation in space-frame bridge construction	2001	$Tm_{112}A_{54}$	-	bd_{11}	bc_2
12	Technological enhancement and creation of a computer-aided construction system for the shotcreting robot	2001	$Tm_{32}A_{20}$	a_2	bd_{12}	bc_3
13	Lan-based building maintenance and surveillance robot	2002	$Tc_{54}A_{19}$	s_{118}	ca_{115}	-
14	A framework for rapid local area modeling for construction automation	2002	$Tc_{41}A_{14}$	s_{39}	ca_{56}	-
15	Automated excavation in construction using robotics trajectory and envelop generation	2002	$Tc_{224}A_7$	s_{45}	ca_{89}	-
16	Disaster restoration work for the eruption of Mt Usuzan using an unmanned construction system	2002	$Tm_{85}A_{42}$	a_2	bd_3	bc_1
17	Adaptive control strategy of climbing robot for inspection applications in construction industry	2002	$Tm_{128}A_6$	a_3	bd_{70}	bc_2
18	Robotic excavation in construction automation	2002	$Tm_{143}A_7$	a_4	bd_{33}	bc_2
19	Blind bulldozing: multiple robot nest construction	2003	$Tc_{95}A_{30}$	s_6	ca_{100}	-

20	Development of a construction robot for marking on ceiling boards (3rd report, prototype of the laser pointer system)	2003	$Tc_{124}A_{38}$	s_{14}	ca_{115}	-
21	Application of robots using pneumatic artificial rubber muscles for operating construction machines	2003	$Tc_{87}A_{26}$	s_8	ca_5	-
22	Construction robot path-planning for earthwork operations	2003	$Tc_{144}A_5$	s_{86}	ca_{87}	-
23	Development of a hydraulic tele-operated construction robot using virtual reality: new master-slave control method and an evaluation of a visual feedback system	2003	$Tm_{152}A_{56}$	a_3	bd_{67}	bc_1
24	A tele-operated humanoid robot drives a backhoe in the open air	2003	$Tm_{150}A_{56}$	a_2	bd_1	bc_2
25	Portable robotic system for steel h-beam welding	2003	$Tm_{113}A_{54}$	a_3	bd_{10}	bc_2
26	A cleaning robot for construction out-wall with complicated curve surface	2003	$Tm_{28}A_{11}$	-	-	bc_2
27	A remotely controlled robot operates construction machine remote)	2003	$Tm_{91}A_{56}$	a_1	bd_{67}	bc_3
28	Manipulators help out with plaster panels in construction	2003	$Tm_{55}A_{28}$	a_3	bd_{36}	bc_2
29	Field test of remote control system for construction machines using robot arm	2004	$Tc_{187}A_{56}$	-	ca_{31}	-
30	Development of remote control system of construction machinery using pneumatic robot arm	2004	$Tc_{187}A_{56}$	-	ca_{31}	-
31	Analysis of a climbing parallel robot for construction applications	2004	$Tc_{138}A_{45}$	s_{33}	ca_{43}	-
32	A control architecture for robotic excavation in construction	2004	$Tc_{222}A_7$	s_{47}	ca_{47}	-
33	Application of ga in optimal robot selection for bridge restoration	2004	$Tc_{33}A_{12}$	-	ca_{49}	-
34	The study of remotely teleoperated robotic manipulator system for underwater construction	2004	$Tc_{182}A_{55}$	s_1	ca_{62}	-
35	Real-time sense-and-act' operation for construction robots	2004	$Tc_{56}A_2$	s_{54}	ca_{62}	-
36	Spatial model for path planning of multiple mobile construction robots	2004	$Tc_{76}A_{24}$	-	ca_{73}	-
37	Balancing human-and-robot integration in building tasks	2004	$Tb_{14}A_{35}$	-	bm_{14}	-
38	Distance measurement technology development at remotely teleoperated robotic manipulator system for underwater constructions	2004	$Tm_{117}A_{55}$	a_1	bd_2	bc_1
39	Construction of ceiling adsorbed mobile robots platform utilizing permanent magnet inductive traction method	2004	$Tm_{60}A_{28}$	a_3	bd_{12}	bc_2
40	Adapting a teleoperated device for autonomous control using three-dimensional positioning sensors: experiences with the Nist Robocrane	2004	$Tm_{26}A_8$	-	bd_{49}	bc_2

41	Automated construction by contour crafting - related robotics and information technologies	2004	$Tm_{14}A_{63}$	-	bd_7	bc_2
42	A service robot for construction industry	2004	$Tm_{28}A_{11}$	-	-	bc_2
43	Automating inspection and documentation of remote building construction using a robotic camera	2005	$Tc_{216}A_6$	s_{54}	ca_{102}	-
44	A heavy climbing robotic platform for geotechnical applications	2005	$Tc_{26}A_{11}$	s_{22}	ca_{25}	-
45	Climbing robots with adaptive grippers for construction	2005	$Tc_{23}A_{11}$	s_{23}	ca_{26}	-
46	A hybrid pole climbing and manipulating robot with minimum DOFs for construction and service applications	2005	$Tc_{93}A_3$	s_{39}	ca_{36}	-
47	(Road) robotic systems for pavement lane painting operations	2005	Tc_3A_1	s_{54}	ca_{67}	-
48	Graphical simulation of remote control construction robot based on virtual reality	2005	$Tm_{107}A_{56}$	-	-	bc_1
49	A robotized drilling system for rocky wall consolidation	2005	$Tm_{65}A_{60}$	a_1	bd_{70}	bc_2
50	Multiconfigurable inspection robots for low diameter canalizations	2005	$Tm_{129}A_6$	a_3	bd_{74}	bc_2
51	Application of robots for inspection and restoration of historical sites	2005	$Tm_{130}A_6$	a_3	bd_{70}	bc_2
52	The analysis of the curtain wall installation robot: based on the test in the construction site	2005	$Tm_{28}A_{11}$	-	-	bc_2
53	Development of a parallel typed robot with a sensorless observer for harbor construction	2005	$Tm_{81}A_{40}$	a_2	bd_{49}	bc_3
54	Development of hybrid robot for construction works with pneumatic actuator	2005	Tm_7A_{11}	a_5	bd_{20}	bc_3
55	Example of experimental use of 3D measurement system for construction robot based on component design concept	2006	$Tc_{132}A_{42}$	s_{14}	ca_{109}	-
56	Pose estimation of construction materials using multiple id devices for construction automation	2006	$Tc_{232}A_{51}$	s_{87}	ca_{109}	-
57	Sustainable cooperative robotic technologies for human and robotic outpost infrastructure construction and maintenance	2006	$Tc_{55}A_{19}$	s_{38}	ca_{114}	-
58	A distributed feedback mechanism to regulate wall construction by a robotic swarm	2006	$Tc_{22}A_{11}$	s_{24}	ca_{27}	-
59	Wireless sensor-driven intelligent navigation robots for indoor construction site security and safety	2006	$Tc_{105}A_{32}$	s_{142}	ca_{31}	-

60	Control architecture characteristics for intelligence in autonomous mobile construction robots	2006	$Tc_{154}A_{50}$	-	ca_{46}	-
61	Closure to "construction robot path-planning for earthwork operations" by sung-keun kim, jeffrey s. Russell, and kyo-jin koo	2006	$Tc_{145}A_5$	s_{87}	ca_{65}	-
62	A 3d model based control of an excavator	2006	Tc_2A_1	s_{68}	ca_{68}	-
63	Autonomous robot for pavement construction in challenging environments	2006	Tc_1A_1	s_{69}	ca_{69}	-
64	Research on RBF-PID control for the 6-dof motion base in construction tele-robot system	2006	$Tc_{197}A_{50}$	s_{81}	ca_{79}	-
65	Development of a real-time control system architecture for automated steel construction	2006	$Tc_{27}A_8$	s_{39}	ca_{90}	-
66	Development of a remote control system for construction machinery for rescue activities with a pneumatic robot	2006	$Tm_{84}A_{41}$	a_1	bd_{30}	bc_1
67	Experiment on teleoperation of underwater backhoe with haptic information	2006	$Tm_{118}A_{55}$	a_2	bd_3	bc_1
68	A novel distributed telerobotic system for construction machines based on modules synchronization	2006	$Tm_{94}A_{56}$	a_2	-	bc_1
69	Automation of incineration plant demolition and utilization of information technology	2006	$Tm_{18}A_{11}$	a_3	bd_{32}	bc_1
70	Examination of practical utility of remotely controlled robots in disasters	2006	$Tm_{86}A_{42}$	-	bd_3	bc_1
71	Using rescue robots to increase construction site safety	2006	$Tm_{53}A_{23}$	a_3	bd_{66}	bc_2
72	Massive rock handling by a breaker - graspless manipulation and object recognition	2006	$Tm_{51}A_{59}$	-	bd_{30}	bc_2
73	Construction automation based on parts and packets unification	2006	$Tm_{25}A_{34}$	-	bd_{67}	bc_2
74	A multidegree-of-freedom manipulator for curtain-wall installation	2006	Tm_8A_{11}	a_3	bd_2	bc_3
75	The application of the human-robot cooperative system for construction robot manipulating and installing heavy materials	2006	$Tm_{89}A_{44}$	-	-	bc_3
76	The study in using an autonomous robot for pavement inspection	2007	$Tc_{215}A_6$	s_{39}	ca_{103}	-
77	Graphical modeling and simulation for design and control of a tele-operated clinker clearing robot	2007	$Tc_{93}A_{56}$	s_{39}	ca_{36}	-
78	A multicriteria approach for the optimal design of 2 DOFparallel robots used in construction applications	2007	$Tc_{33}A_{50}$	-	ca_{49}	-

79	Modified stereo vision calibration method for construction robot	2007	$Tc_{76}A_{52}$	-	ca_{73}	-
80	Development of immersive augmented reality interface for construction robotic system	2007	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-
81	Pre-acting manipulator for shock isolation in steel construction	2007	$Tc_{229}A_8$	-	ca_{91}	-
82	Intelligent painting process planner for robotic bridge painting	2007	Tb_6A_{12}	-	bm_6	-
83	Control schemes for tele-robotic pipe installation	2007	$Tm_{38}A_{21}$	a_2	bd_{69}	bc_1
84	Intuitive OCU (operator control unit) of MFR (multipurpose field robot) on construction site	2007	$Tm_{93}A_{44}$	-	bd_2	bc_1
85	Concrete paving productivity improvement using a multi-task autonomous robot	2007	Tm_1A_1	a_2	bd_{32}	bc_2
86	A UAV for bridge inspection: visual serving control law with orientation limits	2007	$Tm_{80}A_6$	a_3	bd_{58}	bc_2
87	Cable-suspended robotic contour crafting system	2007	$Tm_{16}A_{63}$	a_6	bd_{25}	bc_2
88	Design of a bolting robot for constructing steel structure	2007	$Tm_{146}A_8$	-	bd_{26}	bc_2
89	Cable-suspended robotic contour crafting system (vol 17, pg 45, 2007)	2007	$Tm_{25}A_{63}$	-	bd_{67}	bc_2
90	Design of a ceiling glass installation robot	2007	$Tm_{56}A_{28}$	a_3	bd_{42}	bc_3
91	Auto inspection system using a mobile robot for detecting concrete cracks in a tunnel	2007	$Tm_{63}A_6$	a_3	bd_{32}	bc_3
92	Development of the curtain wall installation robot: performance and efficiency tests at a construction site	2007	Tm_8A_{11}	a_3	bd_2	bc_3
93	Mfr (multipurpose field robot) for installing construction materials	2007	Tm_8A_{44}	a_3	bd_2	bc_3
94	Robotic technologies for the automatic assemble of massive beams in high-rise building	2007	$Tm_{70}A_{34}$	-	bd_{60}	bc_3
95	Human-robot cooperation control for installing heavy construction materials	2007	$Tm_{90}A_{44}$	-	bd_{67}	bc_3
96	Construction of welding robot network control system	2008	$Tc_{168}A_{54}$	-	ca_{16}	-
97	Development of prototype of a unmanned transport robot for transport of construction materials	2008	$Tc_{89}A_{29}$	s_{114}	ca_{36}	-
98	Anti-swinging input shaping control of an automatic construction crane	2008	$Tc_{119}A_{34}$	s_{39}	ca_{79}	-
99	Improved force feedback control method for construction telerobot	2008	$Tc_{198}A_{56}$	s_6	ca_{79}	-
100	Construction telerobot system with virtual reality (development of a bilateral construction robot)	2008	$Tc_{86}A_{56}$	-	ca_{86}	-

101	Development of an automated verticality alignment system for a vibro-lance	2008	$Tc_{149}A_{50}$	s_{89}	ca_{90}	-
102	Task management of robots for the automatic construction	2008	$Tb_{92}A_{29}$	-	bm_9	-
103	Remote control of backhoe at construction site with a pneumatic robot system	2008	$Tm_{122}A_{56}$	a_1	bd_{12}	bc_1
104	Power assist devices for installing plaster panels in construction	2008	$Tm_{95}A_{44}$	a_3	bd_{32}	bc_1
105	A robotic system for road lane painting	2008	Tm_2A_1	a_3	bd_{52}	bc_2
106	A new type of bolting robot for steel-frame structure constructions	2008	$Tm_{13}A_8$	a_3	bd_7	bc_2
107	A comparison of two innovative technologies for safe pipe installation - "pipeman" and the stewart-gough platform-based pipe manipulator	2008	$Tm_{37}A_{21}$	a_2	bd_{25}	bc_3
108	Human robot cooperative control and task planning for a glass ceiling installation robot	2008	$Tm_{57}A_{28}$	a_3	bd_{44}	bc_3
109	Autonomous drilling robot for landslide monitoring and consolidation	2008	$Tm_{139}A_{60}$	a_3	bd_{12}	bc_3
110	Wearable haptic glove using micro hydraulic system for control of construction robot system with VR environment	2008	$Tm_{71}A_{34}$	-	bd_{45}	bc_3
111	A human-robot cooperative system helps out with glass panels in construction	2008	$Tm_{89}A_{10}$	-	-	bc_3
112	Development of automation system for steel construction based on robotic crane	2008	$Tm_{144}A_8$	a_2	bd_{63}	bc_3

● Samples in StageIII(duration: 2009-2015; Sample number 139)

No.	Seminal paper (title)	Publication Year	Labels	Label compositions		
1	Feasibility verification of brick-laying robot using manipulation trajectory and the laying pattern optimization	2009	$Tc_{71}A_{22}$	s_{18}	ca_{105}	-
2	A laser-technology-based lifting-path tracking system for a robotic tower crane	2009	$Tc_{91}A_{29}$	s_{113}	ca_{111}	-
3	Haptic interaction in tele-operation control system of construction robot based on virtual reality	2009	$Tc_{192}A_{56}$	s_{134}	ca_{113}	-
4	Light-weight 3D ladar system for construction robotic operations	2009	$Tc_{104}A_{32}$	s_{14}	ca_{25}	-
5	Simulation of industrial robots for laser welding of load bearing construction	2009	$Tc_{167}A_{54}$	s_{14}	ca_{32}	-
6	Tele-operation construction robot control system with virtual reality	2009	$Tc_{186}A_{56}$	s_{133}	ca_{36}	-
7	Work state identification using primitive static states - implementation to demolition work in double-front work machines	2009	$Tc_{128}A_{41}$	s_{81}	ca_{59}	-
8	Bridge inspection robot system with machine vision	2009	$Tc_{209}A_6$	s_{104}	ca_{73}	-
9	Position error modeling for automated construction manipulators	2009	$Tb_{10}A_{14}$	-	bm_{10}	-
10	Development of conceptual model of construction factory for automated construction	2009	$Tb_{12}A_{35}$	-	bm_{12}	-
11	A performance evaluation of a stewart platform based Hume concrete pipe manipulator	2009	Tb_7A_{21}	-	bm_7	-
12	Chronological development history of x-y table based pavement crack sealers and research findings for practical use in the field	2009	Tm_3A_1	a_1	bd_2	bc_2
13	Design, construction, and testing of a new class of mobile robots for cave exploration	2009	$Tm_{129}A_6$	a_3	bd_{74}	bc_2
14	Experimental evaluation of a robotic bolting device in steel beam assembly	2009	$Tm_{13}A_8$	a_3	bd_7	bc_2
15	Basic study of smart robotic construction lift for increasing resource lifting efficiency in high-rise building construction	2009	$Tm_{26}A_{29}$	-	bd_{49}	bc_2
16	Robotic automation system for steel beam assembly in building construction	2009	$Tm_{145}A_8$	a_3	bd_{63}	bc_3
17	Virtual reality-based teleoperation construction robot control system with 3d visor device	2010	$Tc_{190}A_{56}$	s_{135}	ca_{26}	-
18	Specific mechanisms for construction mobile robots	2010	$Tc_{160}A_{50}$	-	ca_{45}	-
19	Labview based control and simulation of a construction robot	2010	$Tc_{162}A_{50}$	s_{57}	ca_{79}	-
20	Research on improved force feedback control method for construction telerobot	2010	$Tc_{198}A_{56}$	s_6	ca_{79}	-

21	Development of immersive augmented reality interface system for construction robotic system	2010	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-
22	Bilateral hydraulic servo control system based on force sense for construction robot	2010	$Tc_{196}A_{50}$	s_6	ca_{84}	-
23	Research on bilateral hydraulic servo control system of construction robotics	2010	$Tc_{201}A_{50}$	s_6	ca_{86}	-
24	Study on master-slave control method using load force and impedance identifiers for tele-operated hydraulic construction robot	2010	$Tc_{86}A_{56}$	-	ca_{86}	-
25	Climbing and pole line hardware installation robot for construction of distribution lines	2010	$Tm_{92}A_{44}$	a_2	hd_{24}	hc_2
26	Self-traveling robotic system for autonomous abrasive blast cleaning in double-hulled structures of ships	2010	$Tm_{50}A_{45}$	a_3	hd_{36}	hc_2
27	Implementation of a foldable 3-dof master device to a glass window panel fitting task	2010	$Tm_{66}A_{10}$	a_3	hd_{25}	hc_2
28	Mechanism and analysis of a robotic bolting device for steel beam assembly	2010	$Tm_{14}A_8$	-	hd_7	hc_2
29	Development of a dual robotic arm system to evaluate intelligent system for advanced construction machinery	2010	$Tm_{54}A_{26}$	a_2	hd_{61}	hc_3
30	An improved multipurpose field robot for installing construction materials	2010	Tm_8A_{44}	a_3	hd_2	hc_3
31	Robot-aided tunnel inspection and maintenance system	2011	$Tc_{214}A_6$	-	ca_{104}	-
32	Strateg+d171 autonomous robots to inspect pavement distresses	2011	$Tc_{211}A_6$	s_{109}	ca_{107}	-
33	A conceptualization for the automation of a lift car operation in high rise building construction	2011	$Tc_{49}A_{17}$	s_{157}	ca_{112}	-
34	Ltl-based decentralized supervisory control of multi-robot tasks modelled as petri nets	2011	$Tc_{164}A_{50}$	-	ca_{114}	-
35	Concept of a wall building industrial robotic system	2011	$Tc_{20}A_{11}$	-	ca_{28}	-
36	Development of pressure observer to measure cylinder length of harbor-construction robot	2011	$Tc_{24}A_{40}$	s_8	ca_{38}	-
37	Study on a vision sensing system for the parameter estimation of a serial construction robot	2011	$Tc_{155}A_{52}$	s_{108}	ca_{62}	-
38	A plan for lunar outpost construction by using robots	2011	$Tc_{94}A_{30}$	s_{109}	ca_{62}	-
39	Relative accuracy enhancement system based on internal error range estimation for external force measurement in construction manipulator	2011	$Tb_{10}A_{52}$	-	bm_{10}	-
40	Dimension optimization of an orientation fine-tuning manipulator for segment assembly robots in shield tunneling machines	2011	Tb_4A_9	-	bm_4	-
41	A methodology to quantitatively evaluate the safety of a glazing robot	2011	Tb_5A_{10}	-	bm_5	-
42	Tele-operation construction robot control system with virtual reality technology	2011	$Tm_{119}A_{56}$	a_2	-	hc_1
43	Wearable robotic system using hydraulic actuator	2011	$Tm_{68}A_{33}$	a_2	hd_{45}	hc_2

44	Field application of a robotic system on cable stays of Lincheon bridge for snow removal	2011	$Tm_{20}A_{12}$	a_3	bd_{57}	bc_2
45	Development of building-façade maintenance robot with docking station based on vertical climbing mechanism (maintenance)	2011	$Tm_{10}A_{19}$	a_3	bd_{16}	bc_2
46	Robot system for removing asbestos sprayed on beams	2011	Tm_4A_{20}	a_3	bd_2	bc_2
47	An experimental study of automatic cleaning tool and robot for façade in high-rise buildings	2011	$Tm_{97}A_{45}$	a_5	bd_{26}	bc_2
48	Real-time NDE of steel cable using Elasto-magnetic sensors installed in a cable climbing robot	2011	$Tm_{148}A_8$	a_6	bd_{24}	bc_2
49	Development of robotic-crane based automatic construction system for steel structures of high-rise buildings	2011	$Tm_{26}A_{17}$	-	bd_{49}	bc_2
50	Building of a sample scenario of a built-in guide type robot for external wall maintenance work of a skyscraper	2011	$Tm_{28}A_{17}$	-	-	bc_2
51	Window contamination detection method for the robotic building maintenance system	2011	$Tm_{28}A_{19}$	-	-	bc_2
52	Development of high accuracy position making system applying mark robot in construction site	2011	$Tm_{28}A_{38}$	-	-	bc_2
53	Robot-aided tunnel inspection and maintenance system by vision and proximity sensor integration	2011	$Tm_{153}A_6$	a_3	bd_2	-
54	Development of double arm working machine for demolition and scrap processing	2011	$Tm_{82}A_{41}$	a_2	bd_{61}	bc_2
55	Tunnel boring machine positioning automation in tunnel construction	2012	$Tc_{25}A_9$	s_{39}	ca_{115}	-
56	High accuracy position marking system applying mobile robot in construction site	2012	$Tc_{13}A_{38}$	-	ca_{115}	-
57	Automatic welding robot system for the horizontal position in the shipyard	2012	$Tc_{13}A_{54}$	-	ca_{115}	-
58	Development of high accuracy position marking system in construction site applying automated mark robot	2012	$Tc_{125}A_{38}$	-	ca_{119}	-
59	Model analysis and experimental technique on computing accuracy of seam spatial position information based on stereo vision for welding robot	2012	$Tc_{165}A_{54}$	s_{16}	ca_{19}	-
60	Autonomous task control system of construction tele-robot based on stereo vision	2012	$Tc_{189}A_{56}$	-	ca_{26}	-
61	Autonomous construction of a roofed structure: synthesizing planning and stigmergy on a mobile robot	2012	$Tc_{10}A_{11}$	s_{25}	ca_{29}	-
62	Development of refractory brick construction robot in steel works	2012	$Tc_{68}A_{22}$	s_{72}	ca_3	-
63	Research on roi image processing technology of teleoperation construction robot based on trinocular stereo vision	2012	$Tc_{184}A_{56}$	-	ca_{62}	-

64	Sensor based motion planning and estimation of high-rise building facade maintenance robot	2012	$Tc_{48}A_{17}$	s_{119}	ca_{67}	-
65	Study on 3D laser-scanning-based machine vision system for robotic construction vehicles	2012	$Tc_{100}A_{32}$	s_{14}	ca_{73}	-
66	Force feedback control of tele-operated construction robot based on regression model	2012	$Tc_{191}A_{56}$	-	ca_{84}	-
67	Application of a position-force control method in a master-slave teleoperation construction robot system	2012	$Tc_{86}A_{25}$	-	ca_{86}	-
68	Operability of a control method for grasping soft objects in a construction teleoperation robot tested in virtual reality	2012	$Tc_{86}A_{25}$	-	ca_{86}	-
69	Master-slave control method with force feedback for grasping soft objects using a teleoperation construction robot	2012	$Tc_{86}A_{25}$	-	ca_{86}	-
70	Human-robot-environment interaction interface for robotic grit-blasting of complex steel bridges	2012	$Tc_{35}A_{12}$	s_{14}	ca_{90}	-
71	Evaluation of construction robot telegrasping force perception using visual, auditory and force feedback integration	2012	$Tb_{11}A_{56}$	-	bm_{11}	-
72	A robotic system for underwater eco-sustainable wire-cutting	2012	$Tm_{115}A_{55}$	a_3	bd_4	bc_2
73	Autonomous construction of a roofed structure: synthesizing planning and stigmergy on a mobile robot	2012	$Tm_{27}A_{28}$	a_3	bd_{46}	bc_2
74	Heterogeneous multi-configurable chained microrobot for the exploration of small cavities	2012	$Tm_{129}A_6$	a_3	bd_{74}	bc_2
75	Design and construction of an in-pipe robot for inspection and maintenance	2012	$Tm_{22}A_6$	a_3	bd_{32}	bc_2
76	High accuracy position marking system applying mobile robot in construction site	2012	$Tm_{28}A_{38}$	-	-	bc_2
77	Open robot control for services in construction	2012	$Tm_{63}A_3$	a_3	bd_{32}	bc_3
78	An easy handling system for installing heavy glass using human robot cooperation	2012	$Tm_{64}A_{10}$	-	bd_{30}	bc_3
79	Autonomous robotic dozing for rapid material removal	2013	$Tc_{84}A_{29}$	-	ca_{10}	-
80	Human-robot integration for pose estimation and semi-autonomous navigation on unstructured construction sites	2013	$Tc_{109}A_{32}$	-	ca_{112}	-
81	A novel surface segmentation approach for robotic manipulator-based maintenance operation planning	2013	$Tc_{53}A_{19}$	s_{54}	ca_{116}	-
82	Development of fail-safety system for building wall cleaning robot	2013	$Tc_{18}A_{11}$	s_{26}	ca_{30}	-
83	Mutli-robot distributed control for construction tasks based on intelligent beacons	2013	$Tc_{157}A_{50}$	-	ca_{37}	-
84	Autonomous thin spray-on liner application in irregular tunnel and mine roadway surfaces	2013	$Tc_{62}A_{20}$	s_{37}	ca_{40}	-

85	Path planning of wheel loader type robot for scooping and loading operation by genetic algorithm	2013	$T_{c33}A_{24}$	-	ca_{49}	-
86	Potentials of robotic fabrication in wood construction: elastically bent timber sheets with robotically fabricated finger joints	2013	$T_{c87}A_{37}$	s_8	ca_5	-
87	Design and research of a construction robot based on series parallel structure	2013	$T_{c96}A_{31}$	-	ca_{54}	-
88	Geometric and kinematics modeling of tele-operated virtual construction robot	2013	$T_{c27}A_{56}$	-	ca_{90}	-
89	An implementation of a teleoperation system for robotic beam assembly in construction	2013	$T_{c114}A_{34}$	s_{54}	ca_{95}	-
90	Analysis on autonomous task trajectory tracking performance of construction robot with online gravity compensation	2013	$Tb_{10}A_{35}$	-	bm_{10}	-
91	Job planning and supervisory control for automated earthmoving using 3d graphical tools	2013	$Tm_{107}A_5$	-	-	bc_1
92	Development of an automated freeform construction system and its construction materials	2013	$Tm_{13}A_{29}$	a_3	bd_7	bc_2
93	Optimal machine operation planning for construction by contour crafting	2013	$Tm_{140}A_{63}$	a_6	bd_{57}	bc_2
94	Design and construction of a scale robotic excavator work-cell to test automated excavation algorithms	2013	$Tm_{51}A_7$	-	bd_{30}	bc_2
95	Robot-based construction automation: an application to steel beam assembly (Part i)	2013	$Tm_{147}A_8$	a_2	bd_7	bc_3
96	Prototype for glazed panel construction robot	2013	$Tm_{149}A_{10}$	a_3	bd_{62}	bc_3
97	Robot-based construction automation: an application to steel beam assembly (part ii)	2013	Tm_8A_8	a_3	bd_2	bc_3
98	Glazed ceiling panel construction robot	2013	$Tm_{58}A_{28}$	-	bd_{44}	bc_3
99	Installation of heavy duty glass using an intuitive manipulation device	2013	$Tm_{64}A_{10}$	-	bd_{30}	bc_3
100	Potential of time-of-flight range imaging for object identification and manipulation in construction	2014	$T_{c34}A_{29}$	s_{39}	ca_{112}	-
101	Chip-based real-time gesture tracking for construction robot's guidance	2014	$T_{c156}A_{50}$	s_{39}	ca_{26}	-
102	Modified discrete event simulation algorithm for control of automated construction operations	2014	$T_{c160}A_{50}$	-	ca_{45}	-
103	Automating construction operations using discrete event simulation models	2014	$T_{c160}A_{50}$	-	ca_{45}	-
104	(Tiling) robotic tile placement: tools, techniques and feasibility	2014	$T_{c58}A_2$	s_{64}	ca_{60}	-
105	Development of a teleoperation system for a construction robot	2014	$T_{c185}A_{56}$	s_{136}	ca_{62}	-
106	Automatic detection and verification of pipeline construction features with multi-modal data	2014	$T_{c66}A_{21}$	s_{39}	ca_{62}	-

107	Development of a BIM-based automated construction system	2014	$Tc_{21}A_{34}$	-	ca_{75}	-
108	Virtual prototyping for robotic fabrication of rebar cages in manufactured concrete construction	2014	$Tc_{228}A_8$	s_{92}	ca_{92}	-
109	Rapid and automated determination of rusted surface areas of a steel bridge for robotic maintenance systems	2014	$Tc_{30}A_{12}$	s_{39}	ca_{98}	-
110	A tree-based algorithm for construction robots	2014	$Tc_{113}A_{34}$	-	ca_{98}	-
111	Underwater construction robot for rubble leveling on the seabed for port construction	2014	$Tm_{137}A_{55}$	a_2	bd_2	bc_1
112	Considerations regarding the construction of a minirobot for surveillance and inspection	2014	$Tm_{131}A_6$	a_3	bd_{71}	bc_2
113	Towards a vision controlled robotic home environment	2014	$Tm_{121}A_{57}$	a_3	bd_{83}	bc_2
114	Mobile 3d mapping for surveying earthwork projects using an unmanned aerial vehicle (UAV) system	2014	$Tm_{47}A_5$	a_3	bd_{58}	bc_2
115	A lightweight bridge inspection system using a dual-cable suspension mechanism	2014	Tm_4A_6	a_3	bd_2	bc_2
116	Towards on-site autonomous robotic floor tiling of mosaics	2014	$Tm_{31}A_2$	-	bd_1	bc_2
117	Introduction of human-robot cooperation technology at construction sites	2014	$Tm_{26}A_{10}$	-	bd_{49}	bc_2
118	Collision-free 4d trajectory planning in unmanned aerial vehicles for assembly and structure construction	2014	$Tm_{46}A_{34}$	-	bd_{58}	bc_2
119	Robotic explosive charging in mining and construction applications	2014	$Tm_{105}A_{47}$	a_2	bd_2	bc_3
120	In-situ fabrication: mobile robotic units on construction sites	2014	$Tm_{72}A_{34}$	-	bd_{42}	bc_3
121	Modeling and control of automated pipe hoisting in oil and gas well construction	2015	$Tc_{67}A_{21}$	-	ca_{101}	-
122	Construction site navigation for the autonomous excavator Thor	2015	$Tc_{111}A_{32}$	s_{143}	ca_{105}	-
123	Position reaction force control of teleoperation construction robot for grasping soft objects	2015	$Tc_{40}A_{14}$	s_{127}	ca_{113}	-
124	Automated measurement and estimation of concrete strength by mobile robot with small-sized grinding drill	2015	$Tc_{158}A_{52}$	s_6	ca_{113}	-
125	Vision guided autonomous robotic assembly and as-built scanning on unstructured construction sites	2015	$Tc_{108}A_{34}$	s_{54}	ca_{118}	-
126	Intuitive task programming of stud welding robots for ship construction	2015	$Tc_{135}A_{54}$	s_{39}	ca_{20}	-

127	Automatic path-planning algorithm for realistic decorative robotic painting	2015	$Tc_{61}A_{20}$	s_{39}	ca_{41}	-
128	Design and construction of a translational parallel robot for drilling tasks	2015	$Tc_{85}A_{25}$	-	ca_{50}	-
129	Towards a new BIM 'dimension'-translating BIM data into actual construction using robotics	2015	$Tc_{21}A_{22}$	-	ca_{75}	-
130	Augmented reality-based tele-robotic system architecture for on-site construction	2015	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-
131	Development of a telerobotics system for construction robot using virtual reality	2015	$Tc_{202}A_{56}$	s_{136}	ca_{86}	-
132	A framework of indicators for assessing construction automation and robotics in the sustainability context	2015	$Tb_{12}A_{35}$	-	bm_{12}	-
133	A robotic cutting tool for contaminated structure maintenance and decommissioning	2015	$Tm_{30}A_{19}$	a_2	bd_{57}	bc_2
134	Design and construction of a robot hand prototype for underwater applications	2015	$Tm_{116}A_{55}$	a_3	bd_5	bc_2
135	Assistive robotic micro-rooms for independent living	2015	$Tm_{121}A_{57}$	a_3	bd_{83}	bc_2
136	A low-cost robotic system for the efficient visual inspection of tunnels	2015	Tm_2A_6	a_3	bd_{52}	bc_2
137	Cable robot for non-standard architecture and construction: a dynamic positioning system	2015	$Tm_{52}A_{29}$	a_6	bd_{13}	bc_2
138	Between manual and robotic approaches to brick construction in architecture expanding the craft of manual bricklaying with the help of video projection techniques	2015	$Tm_{43}A_{22}$	-	bd_{54}	bc_2
139	Ceiling work scenario based hardware design and control algorithm of supernumerary robotic limbs	2015	$Tm_{29}A_{28}$	a_3	bd_{45}	bc_3

● Samples in StageIV(duration: 2016-2021; Sample number 229)

No.	Seminal paper (title)	Publication Year	Labels	Label compositions		
1	Robotic SHM and model-based positioning system for monitoring and construction automation	2016	$Tc_{136}A_{14}$	s_{126}	ca_{108}	-
2	Estimation for torques applied to the master side in a construction robot teleoperation system	2016	$Tc_{177}A_{56}$	s_6	ca_{20}	-
3	Research on improving the efficiency and welding quality of welding robot for construction machinery structure	2016	$Tc_{122}A_{54}$	-	ca_{21}	-
4	Parameter study of chain trenching machines of underwater construction robots via analytical model	2016	$Tc_{180}A_{55}$	-	ca_3	-
5	Robotic 3d-printing for building and construction	2016	$Tc_{45}A_{18}$	s_{39}	ca_{44}	-
6	Machine learning approach to automatic bucket loading	2016	$Tc_{148}A_{29}$	s_{85}	ca_{73}	-
7	Site automation: automated/robotic on-site factories	2016	$Tc_{76}A_{34}$	-	ca_{73}	-
8	Simulation of automated construction using wire robots	2016	$Tc_{21}A_{22}$	-	ca_{75}	-
9	Support system for slope shaping based on a teleoperated construction robot	2016	$Tc_{195}A_{56}$	-	ca_{78}	-
10	Support system for teleoperation of slope shaping by a construction robot	2016	$Tc_{203}A_{56}$	s_{39}	ca_{86}	-
11	A realisation of a construction scale robotic system for 3d printing of complex formwork	2016	$Tc_{218}A_{61}$	-	ca_9	-
12	Smart automation system dedicated to in frastructure and construction	2016	$Tc_{28}A_{12}$	s_{96}	ca_{99}	-
13	Bridge maintenance automation	2016	Tb_6A_{12}	-	bm_6	-
14	Key challenges in automation of earth-moving machines	2016	$Tm_{108}A_5$	a_2	bd_{32}	bc_1
15	Design and analysis of climbing robot based on construction surface inspection	2016	$Tm_{136}A_6$	a_3	bd_{19}	bc_1
16	Prototyping a remotely-controlled machine for concrete surface grinding operations	2016	$Tm_{120}A_{56}$	a_3	bd_{32}	bc_1
17	An electro-hydraulic servo controller for construction robot using system-on-chip device	2016	$Tm_{110}A_{50}$	a_4	bd_{52}	bc_1
18	Automated construction of masonry buildings using cable- driven parallel robots	2016	$Tm_{44}A_{22}$	a_6	bd_{26}	bc_2

19	Study on parts processing of the traditional wooden construction method using articulated robot	2016	$Tm_{109}A_{37}$	-	bd_{78}	bc_2
20	Local search on trees and a framework for automated construction using multiple identical robots	2016	$Tm_{109}A_{50}$	-	bd_{78}	bc_2
21	Robotic timber construction - expanding additive fabrication to new dimensions	2016	$Tm_{14}A_{37}$	-	bd_7	bc_2
22	Autonomous construction with compliant building material	2016	$Tm_{23}A_{29}$	-	bd_{32}	bc_2
23	Automation of modular assembly of structural frames for buildings	2016	$Tm_{74}A_{34}$	a_3	bd_9	bc_3
24	Applications of supernumerary robotic limbs to construction works: case studies	2016	$Tm_{29}A_{29}$	a_3	bd_{45}	bc_3
25	Human-machine interaction for intuitive programming of assembly tasks in construction	2016	$Tm_{73}A_{34}$	-	bd_{30}	bc_3
26	A cable-driven robot for architectural constructions: a visual-guided approach for motion control and path-planning	2017	$Tc_{83}A_{24}$	s_{39}	ca_{105}	-
27	Automatic interpretation of unordered point cloud data for UAV navigation in	2017	$Tc_{110}A_{32}$	s_{14}	ca_{110}	-
28	Using local force measurements to guide construction by distributed climbing robots	2017	$Tc_{234}A_{52}$	s_6	ca_{114}	-
29	Robotic system for plaster and finishing works on the construction site	2017	$Tc_{16}A_{58}$	-	ca_{32}	-
30	Development of a remotely controlled semi-underwater heavy carrier robot for unmanned construction works	2017	$Tc_{238}A_{55}$	-	ca_4	-
31	Smcspo based 3d printing simulator control for building construction	2017	$Tc_{44}A_{16}$	-	ca_{44}	-
32	Development of 3d printing simulator nozzle system using PID control for building construction	2017	$Tc_{44}A_{16}$	-	ca_{44}	-
33	Automation of robotic concrete printing using feedback control system	2017	$Tc_{44}A_{16}$	-	ca_{44}	-
34	Classification of building systems for concrete 3d printing	2017	$Tc_{44}A_{16}$	-	ca_{44}	-
35	Active control for rock grinding works of an underwater construction robot consisting of hydraulic rotary and linear actuators	2017	$Tc_{87}A_{55}$	s_8	ca_5	-
36	A method based on c-k theory for fast strc development: the case of a drilling robot design	2017	$Tc_{217}A_{60}$	-	ca_{57}	-
37	Development of the control algorithm for longitudinal motion of underwater construction robot with trenching	2017	$Tc_{176}A_{55}$	s_6	ca_6	-

38	A stochastic learning approach for construction of brick structures with a ground robot	2017	$Tc_{77}A_{22}$	-	ca_{72}	-
39	Online learning control of hydraulic excavators based on echo-state networks	2017	$Tc_{223}A_{50}$	s_{43}	ca_{73}	-
40	Beam for the steel fabrication industry robotic systems	2017	$Tc_{73}A_8$	s_{14}	ca_{75}	-
41	Model-based development of robotic systems and services in construction robotics	2017	$Tc_{21}A_3$	-	ca_{75}	-
42	Scene understanding for adaptive manipulation in robotized construction work	2017	$Tc_{120}A_{34}$	s_{127}	ca_{82}	-
43	A master-slave control method with gravity compensation for a hydraulic teleoperation construction robot	2017	$Tc_{204}A_{56}$	s_{137}	ca_{86}	-
44	Robotic fabrication of freeform foam structures with quadrilateral and puzzle shaped panels	2017	$Tc_{27}A_{34}$	-	ca_{90}	-
45	Pyroshield - a hvac fire curtain testing robot	2017	$Tc_{221}A_{62}$	s_{39}	ca_{94}	-
46	Target-focused local workspace modeling for construction automation applications	2017	$Tc_{98}A_{32}$	s_{82}	ca_{96}	-
47	Potential benefits of digital fabrication for complex structures: environmental assessment of a robotically fabricated concrete-wall	2017	Tb_1A_{11}	-	bm_1	-
48	Development of a wall-climbing platform with modularized wall-cleaning units	2017	$Tm_{104}A_{45}$	a_3	bd_{35}	bc_1
49	Autonomous robotic system with tunnel inspection tool positioning	2017	$Tm_{138}A_6$	a_3	bd_2	bc_1
50	Three types of robot builder for the unsupervised construction of mars habitats	2017	$Tm_{65}A_{30}$	a_1	bd_{70}	bc_2
51	Robotic mechanical design for brick-laying automation	2017	$Tm_{45}A_{22}$	a_3	bd_{59}	bc_2
52	Wall contact by octo-rotor uav with one dof manipulator for bridge inspection	2017	$Tm_{47}A_6$	a_3	bd_{58}	bc_2
53	Development of a novel post-construction quality assessment robot system	2017	$Tm_{22}A_{15}$	a_3	bd_{32}	bc_2
54	Design and construction of an inspection robot for the sewage pipes	2017	$Tm_{22}A_6$	a_3	bd_{32}	bc_2
55	Autonomous big-scale additive manufacturing using cable-driven robots	2017	$Tm_{16}A_{11}$	a_6	bd_{25}	bc_2
56	Ja-wa - a wall construction system using unilateral material application with a mobile robot	2017	$Tm_{15}A_{11}$	-	bd_{23}	bc_2
57	Industrial robots application in the construction of buildings and structures	2017	$Tm_{67}A_{60}$	-	bd_{75}	bc_2
58	Towards force-aware robot collectives for on-site construction	2017	$Tm_{111}A_{52}$	-	bd_{16}	bc_2
59	Construction inspection with unmanned aerial vehicle [bauwerksinspektion mit unbemannten flugsystemen]	2017	$Tm_{46}A_6$	-	bd_{58}	bc_2

60	A novel building post-construction quality assessment robot: design and prototyping	2017	$Tm_{23}A_{15}$	-	bd_{32}	bc_2
61	Construction techniques used to automatically pass standard box girders through special passenger-line tunnels	2017	$Tm_{77}A_9$	-	bd_2	bc_2
62	Bottom-up cognitive analysis of bionic inspection robot for construction site	2017	$Tm_{28}A_6$	-	-	bc_2
63	Design of modular re-configurable robotic system for construction and digital fabrication	2017	$Tm_{75}A_{34}$	a_5	bd_7	bc_3
64	On-site robotic construction assistance for assembly using a-priori knowledge and human-robot collaboration	2017	$Tm_{64}A_3$	-	bd_{30}	bc_3
65	Automated localization of uavs in gps-denied indoor construction environments using fiducial markers	2018	$Tc_{99}A_{32}$	s_{109}	ca_{103}	-
66	Construction equipment collision-free path planning using robotic approach	2018	$Tc_{84}A_{24}$	-	ca_{103}	-
67	A robotic wearable exoskeleton for construction worker's safety and health	2018	$Tc_{84}A_{33}$	-	ca_{103}	-
68	Identification of usage scenarios for robotic exoskeletons in the context of the Hong Kong construction industry	2018	$Tc_{84}A_{45}$	-	ca_{103}	-
69	Mapping and localization module in a mobile robot for insulating building crawl spaces	2018	$Tc_{142}A_{46}$	s_{14}	ca_{110}	-
70	Study on down-cutting ladder trencher of an underwater construction robot for seabed application	2018	$Tc_{174}A_{55}$	-	ca_{113}	-
71	Slam-driven intelligent autonomous mobile robot navigation for construction applications	2018	$Tc_{107}A_{32}$	s_{29}	ca_{118}	-
72	Building an integrated mobile robotic system for real-time applications in construction	2018	$Tc_{38}A_{32}$	s_{39}	ca_{118}	-
73	Vision-based integrated mobile robotic system for real-time applications in construction	2018	$Tc_{38}A_{32}$	s_{39}	ca_{118}	-
74	Implementation of admittance control on a construction robot using load cells	2018	$Tc_{233}A_{43}$	s_6	ca_{17}	-
75	The study on the integrated control system for curtain wall building façade cleaning robot	2018	$Tc_{17}A_{11}$	s_{28}	ca_{31}	-
76	Modular data communication methods for a robotic excavator	2018	$Tc_{225}A_7$	s_{48}	ca_{31}	-
77	Large-scale 3d printing by a team of mobile robots	2018	$Tc_{45}A_{18}$	s_{39}	ca_{44}	-

78	Map - a mobile agile printer robot for on-site construction	2018	$Tc_{50}A_{18}$	s_{48}	ca_{44}	-
79	Active control strategy for trenching work of track-based underwater construction robot	2018	$Tc_{178}A_{55}$	s_6	ca_5	-
80	The autonomous vehicle celina as educational platform on final works in computer science	2018	$Tc_{103}A_{32}$	s_{109}	ca_{73}	-
81	Real-time simulation of construction workers using combined human body and hand tracking for robotic construction worker system	2018	$Tc_{150}A_{50}$	s_{146}	ca_{73}	-
82	Multimodal trip hazard affordance detection on construction sites	2018	$Tc_{127}A_{39}$	s_{158}	ca_{73}	-
83	Stacked hourglass networks for markerless pose estimation of articulated construction robots	2018	$Tc_{32}A_{51}$	s_{39}	ca_{73}	-
84	Industrial robot control with object recognition based on deep learning	2018	$Tc_{32}A_{59}$	s_{39}	ca_{73}	-
85	Automated defect classification in sewer closed circuit television inspections using deep convolutional neural networks	2018	$Tc_{32}A_6$	s_{39}	ca_{73}	-
86	Synthesis of the ac and DC drives fault diagnosis method for the cyber-physical systems of building robots	2018	$Tc_{76}A_{36}$	-	ca_{73}	-
87	A cyber-physical system of diagnosing electric drives of building robots	2018	$Tc_{76}A_{36}$	-	ca_{73}	-
88	Concept studies of automated construction using cable-driven parallel robots	2018	$Tc_{73}A_{22}$	s_{14}	ca_{75}	-
89	Design of robot based work progress monitoring system for the building construction site	2018	$Tc_{37}A_{13}$	s_{29}	ca_{75}	-
90	BIM plus robot creates a new era of building construction	2018	$Tc_{21}A_{15}$	-	ca_{75}	-
91	UAV-enabled site-to-BIM automation: aerial robotic- and computer vision-based development of as-built/as-is BIMs and quality control	2018	$Tc_{21}A_{15}$	-	ca_{75}	-
92	Perspectives on a BIM-integrated software platform for robotic construction through contour crafting	2018	$Tc_{21}A_{63}$	-	ca_{75}	-
93	Information modeling of an underground laboratory for the r&d of mining automation and tunnel construction robotics	2018	$Tc_{21}A_9$	-	ca_{75}	-
94	Dynamics modeling and structural analysis of underwater construction robot	2018	$Tc_{198}A_{55}$	s_6	ca_{79}	-
95	Workpiece modeling for adaptive robotized construction work	2018	$Tc_{12}A_{43}$	s_{129}	ca_{82}	-
96	Adaptive perception and modeling for robotized construction joint filling	2018	$Tc_{12}A_{43}$	s_{129}	ca_{82}	-

97	Enhancing perceived safety in human-robot collaborative construction using immersive virtual environments	2018	$Tc_{69}A_{22}$	-	ca_{82}	-
98	Teleoperated construction robot using visual support with drones	2018	$Tc_{203}A_{56}$	s_{39}	ca_{86}	-
99	Foam custom single task construction robot	2018	$Tc_{86}A_{34}$	-	ca_{86}	-
100	A propulsion performance test of underwater construction robot light work rovi-1 in circulation water channel	2018	$Tc_{173}A_{55}$	s_6	ca_9	-
101	Improved productivity, efficiency and cost savings following implementation of drone technology in the surveying industry	2018	$Tb_{14}A_{35}$	-	bm_{14}	-
102	Framework for human performance analysis in unmanned aircraft system (UAS) operations in dynamic construction environment	2018	$Tb_{15}A_{16}$	-	bm_{15}	-
103	Floor cleaning robot with reconfigurable mechanism	2018	$Tm_{99}A_{45}$	a_3	hd_{37}	hc_2
104	Development of a robot for boiler tube inspection	2018	$Tm_{154}A_6$	a_3	hd_{46}	hc_2
105	Glass facade cleaning robot with passive suction cups and self-locking trapezoidal lead screw drive	2018	$Tm_{98}A_{45}$	a_3	hd_{19}	hc_2
106	Automatic inspection of embankment by crawler-type mobile robot	2018	$Tm_{133}A_6$	a_3	hd_3	hc_2
107	Automatic traveling method for the self-propelled tunnel inspection system	2018	Tm_2A_6	a_3	hd_{52}	hc_2
108	Localisation of a mobile robot for bridge bearing inspection	2018	$Tm_{22}A_6$	a_3	hd_{32}	hc_2
109	Tunnel structural inspection and assessment using an autonomous robotic system	2018	Tm_4A_6	a_3	hd_2	hc_2
110	Cu-brick cable-driven robot for automated construction of complex brick structures: from simulation to hardware realisation	2018	$Tm_{42}A_{22}$	a_6	hd_{53}	hc_2
111	Process analysis of cable-driven parallel robots for automated construction	2018	$Tm_{44}A_{22}$	a_6	hd_{26}	hc_2
112	Cable-driven parallel robot for curtain wall modules automatic installation	2018	$Tm_{16}A_{11}$	a_6	hd_{25}	hc_2
113	On the improvements of a cable-driven parallel robot for achieving additive manufacturing for construction	2018	$Tm_{76}A_{34}$	a_6	hd_{25}	hc_2
114	A changeable jig-less welding cell for subassembly of construction machinery	2018	$Tm_{114}A_{54}$	-	hd_{14}	hc_2
115	Robotic inspection tests of tunnel lining concrete with crack light-section device on variable guide frame	2018	$Tm_{132}A_6$	-	hd_{72}	hc_2
116	Concrete inspection systems using hammering robot imitating sounds of workers	2018	$Tm_{132}A_6$	-	hd_{72}	hc_2

117	Robotic application of foam concrete onto bare wall elements - analysis, concept and robotic experiments	2018	Tm_6A_{11}	-	bd_{13}	bc_2
118	Improvement of the mobile robot location dedicated for habitable house construction by 3d printing	2018	Tm_5A_{11}	-	bd_{27}	bc_2
119	Feasibility study for drone-based masonry construction of real-scale structures	2018	$Tm_{46}A_{22}$	-	bd_{58}	bc_2
120	Planetary lego: designing a construction block from a Regolith derived feedstock for in situ robotic manufacturing	2018	$Tm_{23}A_{30}$	-	bd_{32}	bc_2
121	Automatic multi-image stitching for concrete bridge inspection by combining point and line features	2018	$Tm_{77}A_6$	-	bd_2	bc_2
122	Smart construction robot technology to improve construction and safety in outer walls of high-rise buildings	2018	$Tm_{28}A_{19}$	-	-	bc_2
123	Automation of the execution of monolithic reinforced ceilings	2018	$Tm_{28}A_{28}$	-	-	bc_2
124	A semi-autonomous mobile robot for bridge inspection	2018	$Tm_{125}A_6$	a_3	bd_{73}	bc_3
125	Construction and usage of three-dimensional data for road structures using terrestrial laser scanning and UAV with photo grammetry	2019	$Tc_{212}A_6$	s_{54}	ca_{106}	-
126	Framework for automated registration of UAV and UGV point clouds using local features in images	2019	$Tc_{131}A_{36}$	s_{39}	ca_{110}	-
127	Monocular vision-based parameter estimation for mobile robotic painting	2019	Tc_9A_{11}	s_{29}	ca_{118}	-
128	Implementation of an augmented reality AR workflow for human robot collaboration in timber prefabrication	2019	$Tc_{123}A_{24}$	s_{48}	ca_{118}	-
129	An occupancy grid mapping enhanced visual slam for real-time locating applications in indoor GPS-denied environments	2019	$Tc_{108}A_{24}$	s_{54}	ca_{118}	-
130	Collaborative welding system using BIM for robotic reprogramming and spatial augmented reality	2019	$Tc_{139}A_{54}$	s_{19}	ca_{22}	-
131	Towards mobile projective AR for construction co-robots	2019	$Tc_{133}A_{33}$	s_{39}	ca_{22}	-
132	Construction of the remote welding system based on power line communication	2019	$Tc_{159}A_{54}$	-	ca_{23}	-
133	Man-machine cooperation of building robot based on interactive force information	2019	$Tc_{14}A_{11}$	s_{31}	ca_{34}	-

134	3d printing for construction based on a complex wall of polymer-foam and concrete	2019	$T_{c44}A_{11}$	-	ca_{44}	-
135	Large-scale digital concrete construction – conprint3d concept for on-site, monolithic 3d-printing	2019	$T_{c44}A_{18}$	-	ca_{44}	-
136	Measuring and positioning system design of robotic floor-tiling	2019	$T_{c60}A_2$	s_{14}	ca_{46}	-
137	Tip localization analysis for mobile manipulator in construction field	2019	$T_{c60}A_{29}$	s_{14}	ca_{46}	-
138	Soft additive fabrication processes: material indeterminacy in 3d printing	2019	$T_{c90}A_{29}$	s_{39}	ca_{58}	-
139	Vision-based obstacle removal system for autonomous ground vehicles using a robotic arm	2019	$T_{c102}A_{32}$	s_{39}	ca_{66}	-
140	Computer vision for real-time extrusion quality monitoring and control in robotic construction	2019	$T_{c32}A_{15}$	s_{39}	ca_{73}	-
141	Real-time scene segmentation using a light deep neural network architecture for autonomous robot navigation on construction sites	2019	$T_{c32}A_{32}$	s_{39}	ca_{73}	-
142	Lnsnet: lightweight navigable space segmentation for autonomous robots on construction sites	2019	$T_{c32}A_{32}$	s_{39}	ca_{73}	-
143	Vision-based estimation of excavator manipulator pose for automated grading control	2019	$T_{c32}A_{50}$	s_{39}	ca_{73}	-
144	A vision-based marker-less pose estimation system for articulated construction robots	2019	$T_{c32}A_{51}$	s_{39}	ca_{73}	-
145	Analytical design of an underwater construction robot on the slope with an up-cutting mode operation of a cutter bar	2019	$T_{c4}A_{50}$	s_6	ca_{73}	-
146	Automated brick pattern generator for robotic assembly using machine learning and images	2019	$T_{c76}A_{22}$	-	ca_{73}	-
147	Teaching robots to perform construction tasks via learning from demonstration	2019	$T_{c76}A_{28}$	-	ca_{73}	-
148	Semantic relation detection between construction entities to support safe human-robot collaboration in construction	2019	$T_{c76}A_{33}$	-	ca_{73}	-
149	Formulation of the optimization problem of the cyber-physical diagnosis system configuration level for construction mobile robots	2019	$T_{c76}A_{36}$	-	ca_{73}	-

150	Automatical acquisition of point clouds of construction sites and its application in autonomous interior finishing robot	2019	$Tc_{206}A_{58}$	s_{19}	ca_{75}	-
151	Robotic construction & prototyping of a 3d-printed mars surface habitat	2019	$Tc_{92}A_{30}$	s_{54}	ca_{75}	-
152	An automated system for projection of interior construction layouts	2019	$Tc_{92}A_{38}$	s_{54}	ca_{75}	-
153	Game simulation to support construction automation in modular construction using BIM and robotics technology-stage 1	2019	$Tc_{21}A_{37}$	-	ca_{75}	-
154	Flexible virtual fixtures for human-excavator cooperative system	2019	$Tc_{193}A_{56}$	s_{140}	ca_{77}	-
155	Youwasps: towards autonomous multi-robot mobile deposition for construction	2019	$Tc_{163}A_{50}$	s_{84}	ca_{79}	-
156	Planning and execution for geometrically adaptive BIM-driven robotized construction processes	2019	$Tc_{69}A_{43}$	s_{54}	ca_{82}	-
157	Autonomous motion planning and task execution in geometrically adaptive robotized construction work	2019	$Tc_{69}A_{43}$	s_{54}	ca_{82}	-
158	Dynamic analysis of high precision construction cable-driven parallel robots	2019	$Tc_{235}A_{50}$	-	ca_{83}	-
159	Development of an earthmoving machinery autonomous excavator development platform	2019	$Tc_{146}A_5$	s_{84}	ca_{85}	-
160	Robotic autonomous systems for earthmoving in military applications	2019	$Tc_{146}A_5$	s_{84}	ca_{85}	-
161	Determinants of adoption of robotics in precast concrete production for buildings	2019	$Tc_{86}A_{16}$	-	ca_{86}	-
162	Trajectory adaptation for an impedance controlled cooperative robot according to an operator's force	2019	Tc_8A_{10}	s_6	ca_{89}	-
163	The analysis of factors influencing on efficiency of applying mobile bricklaying robots and tools for such analysis	2019	Tb_3A_{22}	-	bm_3	-
164	Dual-arm construction robot with remote-control function	2019	$Tm_{87}A_{42}$	a_2	hd_{61}	bc_1
165	Efforts to unmanned construction for post-disaster restoration and reconstruction	2019	$Tm_{86}A_{42}$	-	hd_3	bc_1
166	Control of a hyper-redundant robot for quality inspection in additive	2019	$Tm_{135}A_6$	a_1	hd_{15}	bc_2
167	A novel holonomic mobile manipulator robot for construction sites	2019	$Tm_{69}A_{60}$	a_2	hd_{76}	bc_2
168	Self-reconfigurable façade-cleaning robot equipped with deep-learning-based crack detection based on convolutional neural networks	2019	$Tm_{101}A_{45}$	a_3	hd_{38}	bc_2
169	Four-wheel steering and driving mechanism for a reconfigurable floor cleaning robot	2019	$Tm_{100}A_{45}$	a_3	hd_{39}	bc_2

170	Design and modelling of a modular window cleaning robot	2019	$Tm_{103}A_{45}$	a_3	bd_{40}	bc_2
171	Parallel 2-dof manipulator for wall-cleaning applications	2019	$Tm_{102}A_{45}$	a_3	bd_{41}	bc_2
172	Mobile robot for marking free access floors at construction sites	2019	$Tm_{79}A_{38}$	a_3	bd_{79}	bc_2
173	Development of automated mobile marking robot system for free access floor	2019	$Tm_{79}A_{38}$	a_3	bd_{79}	bc_2
174	Quicabot: quality inspection and assessment robot	2019	$Tm_{134}A_6$	a_3	bd_{13}	bc_2
175	Labview based brick laying robot	2019	$Tm_{48}A_{22}$	a_3	bd_{36}	bc_2
176	Design, modelling and simulation of novel hexapod-shaped passive damping system for coupling cable robot and end effector in curtain wall module installation application	2019	$Tm_{17}A_{11}$	a_6	bd_{28}	bc_2
177	Investigation of robot systems in masonry construction [baubetriebliche untersuchung von robotersystemen im mauerwerksbau]	2019	$Tm_{16}A_{22}$	a_6	bd_{25}	bc_2
178	Indoor visualization experiments at building construction site using high safety UAV	2019	$Tm_{46}A_6$	-	bd_{58}	bc_2
179	Automatic brick masonry system and its application in on-site construction	2019	$Tm_{51}A_{22}$	-	bd_{30}	bc_2
180	Towards automated installation of reinforcement using industrial robots	2019	$Tm_{14}A_{44}$	-	bd_7	bc_2
181	Robotic fabrication of nail laminated timber	2019	$Tm_{77}A_{37}$	-	bd_2	bc_2
182	Adaptive automation strategies for robotic prefabrication of parametrized mass timber building components	2019	$Tm_{77}A_{37}$	-	bd_2	bc_2
183	Construction waste recycling robot for nails and screws: computer vision technology and neural network approach	2019	$Tm_{77}A_{41}$	-	bd_2	bc_2
184	In-situ construction method for lunar habitation: Chinese super mason	2019	$Tm_{28}A_{30}$	-	-	bc_2
185	User interfaces for human-robot interaction in field robotics	2019	$Tm_{21}A_{13}$	-	bd_{31}	bc_3
186	An autonomous robotic platform for automatic extraction of detailed semantic models of buildings	2020	$Tc_{208}A_{59}$	s_{54}	ca_{110}	-
187	Lidar-equipped UAV path planning considering potential locations of defects for bridge inspection	2020	$Tc_{213}A_6$	s_{79}	ca_{110}	-
188	An integrated UGV-UAV system for construction site data collection	2020	$Tc_{101}A_{32}$	s_{144}	ca_{118}	-
189	Construction of slam algorithm for window cleaning robot moving along window frame	2020	$Tc_{101}A_{45}$	s_{144}	ca_{118}	-

190	A scene-adaptive descriptor for visual slam-based locating applications in built environments	2020	$T_{c38}A_{46}$	s_{39}	ca_{118}	-
191	Cooperative aerial-ground multi-robot system for automated construction tasks	2020	$T_{c123}A_{11}$	s_{48}	ca_{118}	-
192	Automated defect quantification in concrete bridges using robotics and deep learning	2020	$T_{c36}A_{12}$	s_{79}	ca_{118}	-
193	Development of construction robots using crazyflie	2020	$T_{c39}A_{14}$	-	ca_{118}	-
194	Robotic 3d clay printing of prefabricated non-conventional wall components based on a parametric-integrated design	2020	$T_{c16}A_{11}$	-	ca_{32}	-
195	Inspecting manufacturing precision of 3d printed concrete parts based on geometric dimensioning and tolerancing	2020	$T_{c46}A_{16}$	s_{144}	ca_{44}	-
196	Automation in the construction of a 3d-printed concrete wall with the use of a intel gripper	2020	$T_{c44}A_{16}$	-	ca_{44}	-
197	Bricklaying robot moving algorithms at a construction site	2020	$T_{c44}A_{22}$	-	ca_{44}	-
198	Additive manufacturing of cantilever - from masonry to concrete 3d printing	2020	$T_{c44}A_{22}$	-	ca_{44}	-
199	Generalized task allocation and route planning for robots with multiple depots in indoor building environments	2020	$T_{c33}A_{24}$	-	ca_{49}	-
200	The problem of manipulation and angular orientation of gripping devices of construction robots	2020	$T_{c85}A_{50}$	-	ca_{50}	-
201	Optimization of grasping efficiency of a robot used for sorting construction and demolition waste	2020	$T_{c129}A_{41}$	s_{54}	ca_{64}	-
202	Generic design aided robotically facade pick and place in construction site dataset	2020	$T_{c116}A_{34}$	-	ca_{70}	-
203	A general approach for automating teleoperated construction machines	2020	$T_{c188}A_{56}$	s_{139}	ca_{73}	-
204	Direct-visual-operation support system for unmanned construction	2020	$T_{c188}A_{56}$	s_{139}	ca_{73}	-
205	Robot construction simulation using deep reinforcement learning+b21b4:b22b6b4:b20b4:b24bb4:b20	2020	$T_{c153}A_{50}$	s_{18}	ca_{73}	-
206	Measurement for cracks at the bottom of bridges based on tethered creeping unmanned aerial vehicle	2020	$T_{c32}A_{12}$	s_{39}	ca_{73}	-
207	Proximity prediction of mobile objects to prevent contact-driven accidents in co-robotic construction	2020	$T_{c32}A_{24}$	s_{39}	ca_{73}	-
208	Augmented drawn construction symbols: a method for ad hoc robotic fabrication	2020	$T_{c32}A_{37}$	s_{39}	ca_{73}	-

209	Teaching robots to perform quasi-repetitive construction tasks through human demonstration	2020	$Tc_{130}A_{28}$	s_{54}	ca_{73}	-
210	Deep learning of grasping detection for a robot used in sorting construction and demolition waste	2020	$Tc_{130}A_{41}$	s_{54}	ca_{73}	-
211	Vision-based robotic system for on-site construction and demolition waste sorting and recycling	2020	$Tc_{130}A_{41}$	s_{54}	ca_{73}	-
212	Structural stay-in-place formwork for robotic in situ fabrication of non-standard concrete structures: a real scale architectural demonstrator	2020	$Tc_{75}A_{16}$	-	ca_{73}	-
213	Complete coverage path planning using reinforcement learning for Tetromino based cleaning and maintenance robot	2020	$Tc_{76}A_{24}$	-	ca_{73}	-
214	What lies beneath: material classification for autonomous excavators using proprioceptive force sensing and machine learning	2020	$Tc_{76}A_{29}$	-	ca_{73}	-
215	Agent based modeling to optimize workflow of robotic steel and concrete 3d printers	2020	$Tc_{33}A_8$	-	ca_{73}	-
216	Combining the robot operating system with building information modeling for robotic applications in construction logistics	2020	$Tc_{143}A_{48}$	s_{17}	ca_{75}	-
217	BIM-based task-level planning for robotic brick assembly through image-based 3d modeling	2020	$Tc_{74}A_{22}$	s_{39}	ca_{75}	-
218	Bond properties of reinforcing bar penetrations in 3d concrete printing	2020	$Tc_{227}A_{16}$	-	ca_{93}	-
219	Sampling robot for primary circuit pipelines of decommissioned nuclear facilities	2020	$Tc_{65}A_{21}$	s_{80}	ca_{95}	-
220	A comprehensive performance evaluation of different mobile manipulators used as displaceable 3d printers of building elements for the construction industry	2020	$Tb_{13}A_{35}$	-	bm_{13}	-
221	Determining a numerical efficiency indicator for a mobile bricklaying robot	2020	Tb_2A_{22}	-	bm_2	-
222	Life cycle cost analysis of the steel pipe pile head cutting robot	2020	Tb_8A_{21}	-	bm_8	-
223	Controller area network standard for unmanned ground vehicles hydraulic systems in construction applications	2020	$Tm_{158}A_{36}$	a_2	bd_{27}	bc_1
224	Flexible and transportable robotic timber construction platform – TIM	2020	$Tm_{78}A_{37}$	a_3	bd_{48}	bc_2
225	Automated manufacturing for timber-based panelised wall systems	2020	$Tm_{155}A_{37}$	-	bd_{50}	bc_2
226	Development of an automatic sorting robot for construction and demolition waste	2020	$Tm_{83}A_{41}$	-	bd_{60}	bc_2
227	Construction of land base station for UAV maintenance automation	2021	$Tc_{52}A_{19}$	s_{39}	ca_{117}	-

228	Robotic spray coating of self-sensing metakaolin geopolymer for concrete monitoring	2021	$Tc_{63}A_{16}$	s_{39}	ca_{39}	-
229	Automation of the construction process by using a hinged robot with interchangeable nozzles	2021	$Tm_{51}A_{22}$	-	bd_{30}	bc_2