



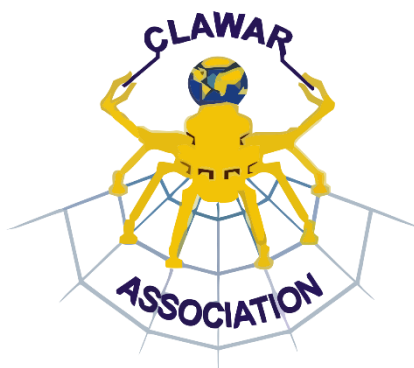
CLAWAR

August 24-26, 2020



MOSCOW, RUSSIA

Technical Program



RUSSIAN FOUNDATION
FOR BASIC RESEARCH

SCIENTIFIC COUNCIL ON ROBOTICS AND MECHATRONICS
OF THE RUSSIAN ACADEMY OF SCIENCE

Welcome to CLAWAR'20

It is our pleasure to welcome you all to the CLAWAR'20 conference, held virtually in Moscow, Russian Federation during 24 – 26 August 2020. CLAWAR'20 is the 23rd issue of the International Conference series on Climbing and Walking Robots and the Support Technologies for Mobile Machines. The technical conference includes three keynote presentations, given by well-known scientists in their fields of research, and 50 original articles with cutting-edge scientific findings in a wide range of topics related to the rapidly evolving areas of robotics. We hope that CLAWAR'20 will enable delegates to exchange research ideas and to establish collaborative networks for advancement of science and knowledge discovery in the field of robotics and associated technologies.

Due to the Covid-19 pandemic, the CLAWAR'20 is held on a virtual platform and we hope that this experience will be dynamic and interactive so that delegates gain the maximum benefit from the conference presentations and discussions. In addition to the full technical programme document delegates will receive a soft copy of the conference proceedings published by CLAWAR Association. The proceedings will subsequently be placed in open-access mode in the CLAWAR Association website.

Finally, if you have queries or require any assistance please do not hesitate to approach the conference helpers or members of the conference organising team. We wish you all a successful and fruitful CLAWAR'20 conference and hope you enjoy the event.

Valery G. Gradetsky, M. Osman Tokhi & Nikolay N. Bolotnik
General Co-Chairs, CLAWAR'20

CLAWAR 2020 Technical Programme

Monday 24 August 2020

Time: 08.00 - 09.20 (UTC)	
08:00-09:00	Conference Registration
09:00-09:20	Opening of Conference

Keynote Address – 1 Session Chair: Nikolay N. Bolotnik			
Time: 09.20 - 10.20 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
09.20-10.20	PL1		RUSSIAN ROBOTICS: STATE OF TODAY, VIEW FOR THE FUTURE <i>Ivan L. Ermolov</i>

Session – Mm1: Climbing robots Session Chair: Artem Sukhanov			
Time: 10:30 – 12:00 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
10:30-10:45	#15		A FOUR-LEGGED CLIMBING ROBOT ON A FRAGILE CYLINDER <i>Elena Melkumova and Yury Golubev</i>
10:45-11:00	#25		PARAMETRICAL ANALYSIS OF VACUUM CONTACT DEVICES FOR WALL CLIMBING ROBOTS <i>Maxim Knyazkov, Valery Gradetsky, Evgeniy Semenov and Artem Sukhanov</i>
11:00-11:15	#33		FIXING DEVICE AERODYNAMICS OF THE WALL CLIMBING ROBOT <i>Vladislav Chashchukhin</i>
11:15-11:30	#34		VACUUM GENERATION FOR WALL CLIMBING ROBOT ADAPTIVE CONTACT TO SURFACE <i>Valery Gradetsky, Maxim Knyazkov, Evgeniy Semenov, Artem Sukhanov and Vladislav Chashchukhin</i>

11:30-11:45	#45		DESIGN AND PARAMETRIC INVESTIGATIONS OF PERMANENT MAGNET ADHESION MECHANISM FOR ROBOTS CLIMBING ON REINFORCED CONCRETE WALLS <i>Vijayagopala Rao M. V., Adthiya Balachandran, Sheetal P. Jadhav, Tula Sridath, Manju Mohan, Kuppan Chetty Ramanathan, Dinakaran D., Ramya M. M., Tokhi Mohammad Osman and Sattar Tariq</i>
11:45-12:00	#64		A ROBOT DESIGN FOR WIND GENERATOR SUPPORT STRUCTURE INSPECTION <i>Shyamal Mondal</i>

Session – Ma1: Innovative actuators and power supplies

Session Chair: Bryan Bridge

Time: 13:00 – 14:00 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
13:00-13:15	#10		CHOSE OF OPTIMAL PARAMETERS OF THE PNEUMATIC/HYDRAULIC ACTUATOR <i>Kirill Trukhanov</i>
13:15-13:30	#37		MATHEMATICAL MODELING AND MOTION ANALYSIS OF CONVEYING OBJECT MOVING ON ROTATING SHAFTS <i>Fumihiko Asano</i>
13:30-13:45	#48		TECHNICAL ADVANTAGES AND DISADVANTAGES OF BIARTICULAR ACTUATORS IN BIPEDAL ROBOTS <i>Atabak Nezhadford, Karsten Berns and Patrick Vonwirth</i>
13:45-14:00	#63		ANTAGONISTIC DRIVE MECHANISM TO INCREASE IMPULSIVE FORCE INSPIRED BY EXOSKELETON SPRING OF MANTIS SHRIMP <i>Kurumaya Shunichi, Fumio Ito, Riki Ono, Katushi Kagaya and Taro Nakamura</i>

Session – Ma2: Innovative design of CLAWAR

Session Chair: Armen Nunuparov

Time: 14:15-15:15 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
14:15-14:30	#2		DESIGN AND DEVELOPMENT OF A MULTI-ROBOT SYSTEM FOR BLOCKAGE REMOVAL <i>Sergey Manko, Valery Lokhin, Sekou Diane and Vladimir Tsyarkin</i>

14:30-14:45	#16		POLYHEDRAL ROLLING ROBOT WITH EXPANDED ICOSIDODECAHEDRON BODY <i>Mizuho Shibata and Yushi Azuma</i>
14:45-15:00	#35		DEVELOPMENT OF EXPERIMENTAL PAPER-FEEDING SYSTEM USING CRAWLING-LIKE LOCOMOTION ROBOT <i>Lin Guo, Fumihiko Asano and Longchuan Li</i>
15:00-15:15	#47		SPHERICAL ROLLING ROBOTS: DIFFERENT DESIGNS AND CONTROL ALGORITHMS <i>Yury Karavaev, Ivan Mamaev, Alexander Kilin and Elena Pivovarova</i>

Session – Ma3: Wearable assistive devices
Session Chair: Khaled Goher

Time: 15:30-16:45 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
15:30-15:45	#26		SIMULATION OF A WALKING ROBOT-EXOSKELETON MOVEMENT ON A MOVABLE BASE <i>Sergey Jatsun, Andrei Malchikov, Andrey Yatsun, Andres Santiago Martinez Leon and Khalil Al Manji</i>
15:45-16:00	#30		DEVELOPMENT OF A NEGATIVE-PRESSURE-DRIVEN SOFT LINEAR ACTUATOR FOR FIXATION PART OF WEARABLE ASSISTIVE DEVICES <i>Manabu Okui, Ryuto Enjo, Daisuke Inoue, Yasuyuki Yamada and Taro Nakamura</i>
16:00-16:15	#38		ONLINE ADAPTIVE RESISTANCE CONTROL OF AN ARM EXERCISE EXOSKELETON <i>Xiaofeng Xiong and Poramate Manoonpong</i>
16:15-16:30	#55		THE EXPERIMENTAL INVESTIGATION OF THE SENSITIVITY IN THE EXOSKELETON CONTROL LOOP <i>Valery Gradetsky, Ivan Ermolov, Maxim Knyazkov, Eugeny Semenov and Artem Sukhanov</i>
16:30-16:45	#65		STANDING ASSISTANCE WHICH REALIZES VOLUNTARY MOVEMENTS OF THE PATIENT WITHIN A SAFETY MOTION TOLERANCE <i>Daisuke Chugo, Yu Suzuki, Masahiro Yokota, Satoshi Muramatsu, Sho Yokota, Jin-Hua She, Hiroshi Hashimoto, Takahiro Katayama, Yasuhide Mizuta and Atsushi Koujina</i>

Tuesday 25 August 2020

Time: 08:00 - 09:00 (UTC)	
08:00-09:00	Conference Registration

Session – Tm1: Flying and aerial robots			
Session Chair: Giovanni Muscato			
Time: 09:00-10:00 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
09:00-09:15	#8		DYNAMICS MODELING AND CONTROL OF A QUADROTOR SUBJECTED TO A VARIABLE LOAD <i>Deyka Garcia, Marcelo Coronado and Antony Garcia</i>
09:15-09:30	#12		COMPARATIVE ANALYSIS OF ROS-BASED CENTRALIZED METHODS FOR CONDUCTING COLLABORATIVE MONOCULAR VISUAL SLAM USING GROUP OF UAVS <i>Bulat Abbyasov, Roman Lavrenov and Evgeni Magid</i>
09:30-09:45	#46		3D RECONSTRUCTION OF HISTORICAL SITES USING AN UAV <i>Pedro Silva, André Dias, Ana Pires, Tiago Santos, Alexandre Amaral, Paulo Rodrigues, Jose Almeida and Eduardo Silva</i>
09:45-10:00	#52		SURVEY OF APPROACHES FOR EMERGENCY LANDING SPOT DETECTION WITH UNMANNED AERIAL VEHICLES <i>Gabriel Loureiro, André Dias and Alfredo Martins</i>

Session – Tm2: Legged locomotion			
Session Chair: Karsten Berns			
Time: 10:15-11:45 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
10:15-10:30	#9		ADAPTIVE GAIT PARAMETERS ADJUSTMENT STRATEGY FOR A HEXAPOD ROBOT WALKING ON STAIRS BASED ON 3D TERRAIN PERCEPTION <i>Yue Zhao, Feng Gao, Yuan Tian and Liheng Mao</i>
10:30-10:45	#17		PROPOSAL OF WALKING METHOD TO AVOID FALLING DOWN USING VIBRATION ON LOOSE GROUND WITH SLOPE <i>Tomohiro Watanabe and Kojiro Iizuka</i>

10:45-11:00	#42		A WALKING ROBOT WITH THERMOMECHANICAL ACTUATORS FOR THE INSPECTION OF PHOTO-ELECTRIC CELLS OF SOLAR ARRAYS FOR SPACECRAFT <i>Andrei Zhukov, Nikolay Bolotnik and Vladislav Chashchukhin</i>
11:00-11:15	#56		THE DLS QUADRUPED PROPRIOCEPTIVE SENSOR DATASET <i>Geoff Fink and Claudio Semini</i>
11:15-11:30	#58		EVALUATING DEEP REINFORCEMENT LEARNING ALGORITHMS FOR QUADRUPEDAL SLOPE HANDLING <i>Athanasios Mastrogeorgiou, Yehia Elbahrawy, Konstantinos Machairas and Evangelos Papadopoulos</i>
11:30-11:45	#62		ON THE INFLUENCE OF BODY VELOCITY IN FOOTHOLD ADAPTATION FOR DYNAMIC LEGGED LOCOMOTION VIA CNNs <i>Domingo Esteban, Octavio Villarreal, Victor Barasuol, Shamel Fahmi and Claudio Semini</i>

Keynote Address – 2
Session Chair: Gurvinder S. Virk

Time: 13:00-14:00 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
13.00 - 14.00	PL2		ANIMAL-INSPIRED ROBOTS THAT CRAWL, WALK, RUN CLIMB AND FLY AND SYNTHETIC NERVOUS SYSTEMS FOR THEIR CONTROL <i>Roger D. Quinn</i>

Session – Ta1: Underwater and sea robotics
Session Chair: Manuel F. Silva

Time: 14:15 – 15:15 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
14:15-14:30	#36		SOME PROBLEMS OF CONTROLLING THE CABLE PROPULSION DEVICES OF MOBILE ROBOTS <i>Eugene Briskin, Nikolay Sharonov, Ivan Penshin, Vasily Gulevsky and Mihail Efimov</i>
14:30-14:45	#53		ON THE STABILITY OF MOBILE ROBOTS MOVEMENT WITH CABLE PROPULSION DEVICES <i>Vitaly Platonov, Nikolay Sharonov and Eugene Briskin</i>

14:45-15:00	#54		<p>PROPELLERLESS AQUATIC ROBOTS</p> <p><i>Anton Klekovkin, Ivan Mamaev, Evgeny Vetchanin, Valentin Tenenev and Yury Karavaev</i></p>
15:00-15:15	#59		<p>ON DETERMINING THE OPTIMAL LIFTING LAW OF THE WALKING PROPULSION DEVICE FOOT OF AN UNDERWATER ROBOT FROM THE BOTTOM</p> <p><i>Eugene Briskin, Yaroslav Kalinin and Liliya Smirnaya</i></p>

Session – Ta2: Agricultural and space robots

Session Chair: Dimitris Chrysostomou

Time: 15:30-16:30 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
15:30-15:45	#27		<p>SIMULATION OF SPACECRAFT BERTHING WITH A ROBOTIC ARM</p> <p><i>Yury F. Golubev and Andrey. V. Yaskevich</i></p>
15:45-16:00	#28		<p>TRIMOD MODULAR FORMATION ASSEMBLY USING "MARS" MODULAR ROBOTIC DEVICES</p> <p><i>Nikita Pavliuk, Petr Smirnov and Anton Saveliev</i></p>
16:00-16:15	#40		<p>DEVELOPMENT OF METHODS FOR THE AUTOMATIC CONTROL OF THE MANIPULATOR DRIVES OF A MOBILE WEEDING ROBOT WITH A PARALLEL-SERIAL STRUCTURE</p> <p><i>Aleksey G. Ivanov, Natalia S. Vorob'yeva, Viktor V. Zhoga, Vladimir E. Pavlovsky and Evgenij V. Pavlovsky</i></p>
16:15-16:30	#44		<p>AGRICULTURAL ROBOTICS: A STATE OF THE ART SURVEY</p> <p><i>Luiz F. P. Oliveira, Manuel F. Silva and António P. Moreira</i></p>

Wednesday 26 August 2020

Time: 08:00 - 09:00 (UTC)	
08:00-09:00	Conference Registration

Keynote Address – 3			
Session Chair: Osman Tokhi			
Time: 09:00 - 10:00 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
09:00 - 10:00	PL3		ROBOTICS ASSISTANCE TO PREDICT, PREVENT, DETECT, MEASURE, PROTECT, MANAGE IMPROVISED CBE RISKS <i>Manuel Armada</i>

Session – Wm1: Modelling and simulation of CLAWAR			
Session Chair: Seungbin Moon			
Time: 10:15 – 11:45 (UTC)			
Time (UTC)	Paper ID	Proc Page	Presentation
10:15-10:30	#14		INSECTOMORPHIC CARGO-CARRYING ROBOT ON A RAFT <i>Yury F. Golubev and Victor V. Koryanov</i>
10:30-10:45	#18		DYNAMIC EQUILIBRIUM OF CLIMBING ROBOTS BASED ON STABILITY POLYHEDRON FOR GRAVITO-INERTIAL ACCELERATION <i>Warley F. R. Ribeiro, Kentaro Uno, Kenji Nagaoka and Kazuya Yoshida</i>
10:45-11:00	#21		SYNTHESIS OF NONLINEAR CHARACTERISTICS FOR THE MOBILE ROBOT CONTROL SYSTEM <i>Vasiliy Berdnikov and Valeriy Lokhin</i>
11:00-11:15	#23		DEVELOPMENT OF SYNTHESIS METHOD OF FUNCTIONAL DIAGNOSTIC SYSTEM FOR THRUSTERS OF UNDERWATER VEHICLES <i>Aleksander Zuev and Alexey Zhirabok</i>
11:15-11:30	#41		SIMULATIONS AND EXPERIMENTS OF HIGH-SPEED STEALTH WALKING BASED ON A REALISTIC CONTROL APPROACH <i>Fumihiko Asano, Masatsugu Nishihara and Masashi Kawazoe</i>

11:30-11:45	#57		ON THE OPTIMAL MODES OF CONTROLLED TRANSFER OF WALKING PROPULSION DEVICES <i>Maria V. Miroshkina and Eugeny S. Briskin</i>
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Session – Wa1: Planning, Navigation & Localisation

Session Chair: Maxim Knyazkov

Time: 13:00 – 14:00 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
13:00-13:15	#19		INCREASING THE FLEXIBILITY OF THE NAVIGATION ALGORITHM FOR INERTIAL PEDESTRIAN SYSTEMS BY CLASSIFYING MOTION TYPE WITH SUPPORT VECTOR MACHINES <i>Georgy Volosnyh, Gennady Kalach and Sekou Diane</i>
13:15-13:30	#20		A CONTROL STRATEGY OF A MOBILE ROBOT IN A LIMITED SPACE USING A LASER RANGEFINDER <i>Sergey Jatsun, Oksana Emelyanova, Peter Bezmen, Andres Santiago Martinez Leon, Luis Miguel Mosquera Morochoco and Dmitry Afonin</i>
13:30-13:45	#32		RFID-BASED WAREHOUSE MANAGEMENT SYSTEM PROTOTYPING USING A HETEROGENEOUS GROUP OF ROBOTS <i>Artur Khazetdinov, Andrey Aleksandrov, Aufar Zakiev, Evgeni Magid and Kuo-Hsien Hsia</i>
13:45-14:00	#49		COLLABORATIVE LOCALIZATION USING DYNAMIC NOISE COVARIANCE AND ROBOT MOTION MODEL FOR UNKNOWN AREA EXPLORATION <i>Dibyendu Ghosh, Vinayak Honkote and Karthik Narayanan</i>

Session – Wa2: Inspection

Session Chair: Tariq Sattar

Time: 14:15 – 15:00 (UTC)

Time (UTC)	Paper ID	Proc Page	Presentation
14:15-14:30	#39		AUTOMATED INSPECTION OF SUBSEA STRUCTURE: A CASE STUDY <i>Aman Kaur, Richard Anvo and Osman Tokhi</i>
14:30-14:45	#43		A COMPACT LASER SHEAROGRAPHY SYSTEM INTEGRATED WITH ROBOTIC CLIMBER FOR ON-SITE INSPECTION OF WIND TURBINE BLADES <i>Zhiyao Li, M. Osman Tokhi, Jianxin Gao, Haitao Zheng and Zhanfang Zhao</i>

14:45-15:00	#51	<p>SIRCAUR: SAFE INSPECTION OF REINFORCED CONCRETE STRUCTURES BY AUTONOMOUS ROBOT</p> <p><i>Gabriela Gallegos Garrido, Mahesh Dissanayake, Tariq Sattar, Angelos Plastropoulos and Muntasir Hashim</i></p>
15:15-16:00	Awards Ceremony	
16:00-16:15	Closing Session	