

CLAWAR

02 Oct - 04 Oct 2023



FLORIANÓPOLIS - BRAZIL

Technical Program



UNIVERSIDADE FEDERAL
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Welcome to CLAWAR 2023

It is our pleasure to welcome you all to the CLAWAR 2023 conference, held in Florianópolis, Santa Catarina, Brazil during 02 – 04 October 2023. CLAWAR 2023 is the 26th edition of the International Conference series on Climbing and Walking Robots and the Support Technologies for Mobile Machines and brings new developments and new research findings in robotics technologies within the framework of “Synergetic Cooperation between Robots and Humans”. The conference's technical programme includes three keynote presentations, given by well-known scientists in their fields of research, and 54 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 2023 will enable delegates to exchange research ideas and establish collaborative networks for the advancement of science and knowledge discovery in the field of robotics and associated technologies, for a sustainable future.

The CLAWAR 2023 proceedings are published by Springer in their book series in “Lecture Notes in Networks and Systems”, which is indexed in [Web of Science](#), [dblp](#), and [SCOPUS](#). This book is believed to be a source of inspiration and further innovation in research and development in the rapidly growing area of mobile service robotics.

We would like to thank members of the International Scientific Committee and National Organising Committee of CLAWAR 2023 for their efforts in reviewing the submitted articles, and for their support in the planning and organisation of the conference.

Ebrahim Samer El Youssef & M. Osman Tokhi
General Co-Chairs, CLAWAR 2023

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CLAWAR 2023 Technical Programme

Monday 02 October 2023

Time: 08:00 – 10:00 (GMT-3)	
08:00-09:00	Conference Registration
09:00-09:20	Opening Session

Keynote Address – 1 Session Chair: Mohammed Osman Tokhi Room: CC I			
Time: 09:20 – 10:20 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
09:20-10:20	KS1		BIPED WALKING WITH ROBOTS AND EXOSKELETONS: MARCHING TOWARDS BIONIC GAIT <i>Arturo Forner-Cordero</i>

10:20-10:40	Coffee break
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Session M1: Special Session: Robotics and Neurotechnologies for Healthcare Improvements I Session Chair: Arturo Forner-Cordero and Daniel Alejandro Ponce Saldias Room: CC I			
Time: 10:40-12:20 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
10:40-11:00	#11		FPGA-Based emulation of a muscle stretch reflex on an electric series elastic actuator <i>Oleksandr Sivak, Patrick Vonwirth and Karsten Berns</i>
11:00-11:20	#14		Neural Multimodal Control for Versatile Motion Generation and Continuous Transitions of a Lower-limb Exoskeleton <i>Chaicharn Akkawutvanich, Natchaya Sricom and Poramate Manoonpong</i>
11:20-11:40	#17		Positional Health Assessment of Collaborative Robots based on Long Short-Term Memory Auto-Encoder (LSTMAE) Network <i>Naimul Hasan, Louie Webb, Malarvizhi Kaniappan Chinanthai, Mohammad Al-Amin Hossain, Erkan Caner Ozkat, Osman M. Tokhi and Bugra Alkan</i>

11:40-12:00	#22	HUMAN-EXOSKELETON INTERACTION DURING KNEE FLEXION-EXTENSION UNDER DIFFERENT CONFIGURATIONS OF ROBOT ASSISTANCE-RESISTANCE <i>Denis Mosconi, Yecid Moreno and Adriano Siqueira</i>
12:00-12:20	#42	WALKING ON VIRTUAL SURFACE PATTERNS CHANGES MUSCULAR ACTIVITY <i>Maximilian Stasica, Kai Streiling, Celine Honekamp, Alexandra Schneider, Alexandros Exarchos, Saskia Henschke, Suat Pirincoglu, Melike Polat, Neele Scholz, Carina Stähler, Emma Syring, Loes van Dam and André Seyfarth</i>

12:20-13:30	Lunch	
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Session M2: Special Session: Robotics and Neurotechnologies for Healthcare Improvements II			
Session Chair: Daniel Alejandro Ponce Saldias			
Room: CC I			
Time: 13:30– 14:30 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
13:30-13:50	#51		TOWARDS A GAIT PLANNING TRAINING STRATEGY USING LOKOMAT <i>Thayse de Albuquerque, Lucas da Costa, Ericka da Silva, Geovana Rocha, André Felipe Dantas, Caroline Santos and Denis Rodriguez</i>
13:50-14:10	#59		EXPLORING BEHAVIOURS FOR SOCIAL ROBOTS <i>Joana Sá and João Silva Sequeira</i>
14:10-14:30	#68		ASSISTIVE WALKER WHICH STABILIZES THE USER'S POSTURE AND PREVENT FALLS THROUGH ABNORMAL GAIT PATTERN RECOGNITION <i>Daisuke Chugo, Yao Li, Satoshi Muramatsu, Sho Yokota, Jin-Hua She and Hiroshi Hashimoto</i>

Session M3: Simulation and Digital-Twins in Robotics Applications			
Session Chair: Manuel F. Silva			
Room: CC I			
Time: 14:30 – 15:30 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
14:30-14:50	#20		A SOLUTION ARCHITECTURE FOR ENERGY MONITORING AND VISUALISATION IN SMART FACTORIES WITH ROBOTIC AUTOMATION <i>Louie Webb, Osman M Tokhi and Bugra Alkan</i>

14:50-15:10	#31		LOCOSIM: AN OPEN-SOURCE CROSS-PLATFORM ROBOTICS FRAMEWORK <i>Michele Focchi, Francesco Roscia and Claudio Semini</i>
15:10-15:30	#53		A LOCOMOTION ALGORITHM FOR AN APODAL ROBOT TO CLIMB AND DESCEND STEPS <i>Vitor Hugo Prado Gomes, Thiago de Deus Lima Rocha, Carla Maria Chagas E Cavalcante Koike and Dianne Magalhães Viana</i>

15:30-15:50	Coffee break		
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Session M4: Special Session: Hybrid and Convertible Unmanned Aerial Vehicles			
Session Chair: Guilherme Vianna Raffo			
Room: CC I			
Time: 15:50-18:10 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
15:50-16:10	#33		SINGLE-SEGMENT ANALYSIS FOR THE PERFORMANCE OPTIMIZATION OF A TILT-ROTOR ALL-ELECTRIC RPAS. PROVANT EMERGENTIA PROJECT <i>Álvaro Martínez, Sergio Esteban and Antonio Franco</i>
16:10-16:30	#35		PARAMETRIC AERODYNAMIC STUDY OF A CONVERTIBLE AIRCRAFT USING CFD TOOLS. PROVANT EMERGENTIA PROJECT. <i>Samuel Torres and Sergio Esteban</i>
16:30-16:50	#36		WIND TUNNEL STUDY OF A VTOL-UAV AND ITS V-TAIL FOR ITS LONGITUDINAL AND DIRECTIONAL AERODYNAMIC CHARACTERISATION. PROVANT EMERGENTIA PROJECT <i>Paula Callejo-Hernando, Claudia Pérez-Rus and Sergio Esteban</i>
16:50-17:10	#40		JOINT STATE-PARAMETER OBSERVER-BASED ROBUST CONTROL OF A UAV FOR HEAVY LOAD TRANSPORTATION <i>Brenner S. Rego, Daniel N. Cardoso, Marco H. Terra and Guilherme V. Raffo</i>
17:10-17:30	#41		A ROBUST NONLINEAR FLIGHT CONTROL IN THE WEIGHTED SOBOLEV SPACE FOR A QUADTILTROTOR UAV <i>Jonatan M. Campos, Daniel N. Cardoso and Guilherme V. Raffo</i>

17:30-17:50	#62	<p>PROTOTYPING OF A SEALING CAP FOR A HYBRID UNMANNED AERIAL UNDERWATER VEHICLE WITH ONBOARD INSTRUMENTATION</p> <p><i>Adir Junior, Andressa Cavalcante da Silva, Matheus Gonçalves, Ricardo Grando, Guilherme Oliveira, Pedro Corçaque, Thássio Silva and Paulo Drews</i></p>
17:50-18:10	#64	<p>VISUAL SENSORS BENCHMARK FOR DEVELOPMENT OF A AUTONOMOUS NAVIGATION SETUP FOR A HYBRID UNMANNED AERIAL UNDERWATER VEHICLE.</p> <p><i>Matheus Gonçalves, Pedro Corçaque, Adir Junior, Andressa Silva, Guilherme Oliveira, Gustavo Almeida, Thássio Silva, Rodrigo Guerra and Paulo Drews</i></p>

Tuesday 03 October 2023

Time: 08:00 – 09:00 (GMT-3)	
08:00-09:00	Conference Registration

Keynote Address – 2
Session Chair: Bryan Bridge
Room: CC I

Time: 09:00 – 10:00 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
09:00-10:00	KS2		HUMAN-LIKE BIPEDAL LOCOMOTION <i>Karsten Berns</i>

10:00-10:20	Coffee break
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Session – T1: Special Session: Robotic navigation
Session Chair: André Gustavo Scolari Conceição
Room: CC I

Time: 10:20 – 12:20 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
10:20-10:40	#19		A COOPERATIVE APPROACH TO TELEOPERATION THROUGH GESTURES FOR MULTI-ROBOT SYSTEMS <i>Dieisson Martinelli, Jonathan Cerbaro, Marco Teixeira, Vivian Kalempa, Vitor Monteiro and André Oliveira</i>
10:40-11:00	#38		NAVPI: AN ADAPTIVE LOCAL PATH-PLANNING PIPELINE FOR 3D NAVIGATION IN DIFFICULT TERRAIN <i>Marvin Grosse Besselmann, Arne Roennau and Ruediger Dillmann</i>
11:00-11:20	#43		INDOOR LOCALISATION OF MOBILE ROBOTS WITH ULTRA WIDEBAND USING EXPERIMENTAL TDOA <i>Ousmane Abdoulaye Oumar, Mohammad Osman Tokhi, Tariq P Sattar, Sidik Haroune Ibrahim and Shwan Dyllon</i>
11:20-11:40	#50		AUTONOMOUS HUMAN-ROBOT PROXEMICS: SOCIALLY AWARE NAVIGATION BASED ON INTERACTION <i>Giovane Moreira, Anderson Leite, José Díaz-Amado, Cleia Libarino and João Marques</i>

11:40-12:00	#61	COMPARATIVE ANALYSIS OF LIDAR SLAM TECHNIQUES IN SIMULATED ENVIRONMENTS IN ROS GAZEBO <i>Marcelo E. C. de Carvalho, Tiago Trindade Ribeiro and Andre Gustavo Scolari Conceicao</i>
12:00-12:20	#65	INSTANCE SEGMENTATION TO PATH PLANNING IN A SIMULATED INDUSTRIAL ENVIRONMENT <i>Danilo G. Schneider and Marcelo R. Stemmer</i>

12:20-13:30	Lunch
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Session – T2: Special Session: Legged Robots: From foundations to current challenges and perspectives I

Session Chair: Thiago Boaventura

Room: CC I

Time: 13:30 – 15:30 (GMT-3)

Time	Paper ID	Proc Page	Presentation
13:30-13:50	#8		WALKING MOTION GENERATION OF BIPEDAL ROBOT BASED ON PLANAR COVARIATION USING DEEP REINFORCEMENT LEARNING <i>Junsei Yamano, Masaki Kurokawa, Yuki Sakai and Kenji Hashimoto</i>
13:50-14:10	#9		LEG MECHANISM OF A QUADRUPED WHEELED ROBOT WITH A 4-DOF SPHERICAL PARALLEL LINK MECHANISM <i>Taisei Suzuki, Hayato Ota, Hiroki Takenaka, Takayuki Tanaka, Yuta Ishizawa and Kenji Hashimoto</i>
14:10-14:30	#10		THREE-RIGID-BODY MODEL BASED NMPC FOR BOUNDING OF A QUADRUPED WITH TWO SPINAL JOINTS <i>Songrui Huang, Wenhan Cai and Mingguo Zhao</i>
14:30-14:50	#16		ACTIVELY VARIABLE TRANSMISSION ROBOTIC LEG <i>Giorgio Valsecchi, Fabian Tischhauser, Jonas Junger, Yann Bernarnd and Marco Hutter</i>
14:50-15:10	#23		FREELANDER: A VERSATILE, MODULAR, MULTI-LEGGED ROBOT PLATFORM FOR COMPLEX TERRAINS <i>Thirawat Chuthong, Jettanan Homchanthanakul, Binggwong Leung, Suppachai Pewkliang and Poramate Manoonpong</i>

15:10-15:30	#44		A TWO-LEGGED ROBOT FOR CLIMBING VERTICAL SURFACES BASED ON PRESSURE-SENSITIVE ADHESION AND PEELING <i>Mani Sankar Kadali, Anugrah Ak and Atul Thakur</i>
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15:30-15:50	Coffee break		
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Session – T3: Special Session: Legged Robots: From foundations to current challenges and perspectives II

Session Chair: Victor Barasuol

Room: CC I

Time: 15:50 – 16:50 (GMT-3)

Time	Paper ID	Proc Page	Presentation
15:50-16:10	#54		PLANAR MOTION CONTROL OF A QUADRUPED ROBOT <i>Gabriel Duarte Gonçalves Pedro, Thiago Boaventura Cunha, Pedro Américo Almeida Magalhães Júnior and Gustavo Medeiros Freitas</i>
16:10-16:30	#66		STAIR-CLIMBING CHARTS: ON THE OPTIMAL BODY HEIGHT FOR QUADRUPED ROBOTS TO WALK ON STAIRS <i>Victor Barasuol, Sinan Emre and Claudio Semini</i>
16:30-16:50	#67		IMPEDANCE CONTROL ANALYSIS FOR LEGGED LOCOMOTION IN OSCILLATING GROUND <i>Vivian Suzano Medeiros, Felix Mauricio Escalante, Marcelo Becker and Thiago Boaventura</i>

Session – T4: Climbing and inspection robots

Session Chair: Tareq Sattar

Room: CC I

Time: 16:50 – 18:10 (GMT-3)

Time	Paper ID	Proc Page	Presentation
16:50-17:10	#12		ANALYSIS OF THE INFLUENCE OF HUMAN EXPOSURE TO RISK AND ESG AS MOTIVATORS FOR THE IMPLEMENTATION OF CLIMBING AND MOBILE ROBOTS <i>Doglas Negri, Amanda Fusinato, Felipe Faria, Valéria Luz, Thiago Moser, Ismael Secco and Luís Gonzaga Trabasso</i>

17:10-17:30	#24		MOBILITY STRATEGY OF MULTI-LIMBED CLIMBING ROBOTS FOR ASTEROID EXPLORATION <i>Warley F. R. Ribeiro, Kentaro Uno, Masazumi Imai, Koki Murase, Barış Can Yalçın, Matteo El Hariry, Miguel A. Olivares-Mendez and Kazuya Yoshida</i>
17:30-17:50	#48		LOW-COST PROTOTYPE FOR ANALYSIS AND MONITORING OF UNDERWATER STRUCTURES <i>Guilherme Oliveira, Paulo Evald, Matheus Mateus, Pedro Corçaque, Adir Pedrosa-Jr, Andressa Silva, Gustavo Almeida, Thássio Silva, Paulo Drews-Jr and Jorge Arigony-Neto</i>
17:50-18:10	#60		HYBRID OMNIDIRECTIONAL WHEELED CLIMBING ROBOT WITH AN ELECTROMAGNET FOR INSPECTION <i>Kanut Tarapongnivat, Run Junna, Worameth Nantareekurn, Wasuthorn Ausrivong, Arthicha Srisuchinnawong, Naris Asawalertsak, Suppachai Pewkliang and Poramate Manoonpong</i>

Session – T5: Kind Humanoid Session Chair: Christoph Kohstall Room: CC I			
Time: 18:10 – 18:30 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
18:10-18:30	#SP1		KIND HUMANOID <i>Christoph Kohstall</i>

Workshop - T1: Legged Robots: From Foundations to Current Challenges and Perspectives Session Chair: Thiago Boaventura Room: CC II			
Time: 10:20 – 12:20 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
10:20-10:50	#WS1		WELCOME + INTRO: LEGGED ROBOTICS IN BRAZIL <i>Thiago Boaventura</i>
10:50-11:20	#WS2		LEGGED ROBOTS CONTROL <i>Vivian Suzano Medeiros</i>

11:20-11:50	#WS2		QUADRUPED ROBOTS: FROM MECHANICAL DESIGN TO THE USE OF ARTIFICIAL INTELLIGENCE <i>Victor Barasuol</i>
11:50-12:20	#RT1		ROUND TABLE: GUIDED DISCUSSION + Q&A

20:00-23:00	Dinner Banquet – Majestic Palace Hotel Address: Avenida Beira Mar Norte, 2746		
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Wednesday 04 October 2023

Time: 08:00 – 09:00 (GMT-3)	
08:00-09:00	Conference Registration

Keynote Address – 3 Session Chair: Ebrahim Samer El Youssef Room: CC I

Time: 09:00 – 10:00 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
09:00-10:00	KS3		MULTIBODY DYNAMICS WITH CONTACT-IMPACT EVENTS: ROOTS, MODELS AND APPLICATIONS <i>Paulo Flores</i>

10:00-10:20	Coffee break
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Session – Session W1: Planning and control Session Chair: Leonardo Mejia Rincon Room: CC I

Time: 10:20 – 12:40 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
10:20-10:40	#1		BIPEDAL WALKING ROBOT CONTROL USING PMTG ARCHITECTURE <i>Vladimir Danilov, Konstantin Klimov, Dmitrii Kapytov and Sekou Diane</i>
10:40-11:00	#3		ADAPTIVE SUSPENSION SYSTEM POSITION-FORCE CONTROL OF WHEELED WALL-PRESSED IN-PIPE CLIMBING ROBOT <i>Sergey Jatsun and Andrei Malchikov</i>
11:00-11:20	#13		OBERVER-BASED CONTROL MODEL TEST IN BIPED ROBOT <i>João Carvalho and Mauricio Eiji Nakai</i>
11:20-11:40	#29		NONLINEAR MODEL PREDICTIVE CONTROL AND REINFORCEMENT LEARNING FOR CAPSULE-TYPE ROBOT WITH AN OPPOSING SPRING <i>Nikita Syrykh and Armen Nunuparov</i>

11:40-12:00	#34	NEURAL CONTROL AND LEARNING OF A GECKO-INSPIRED ROBOT FOR AERIAL SELF-RIGHTING Leonard Chanfreau, Worasuchad Haomachai and Poramate Manoonpong
12:00-12:20	#39	DOUBLE GRADIENT METHOD: A NEW OPTIMIZATION METHOD FOR THE TRAJECTORY OPTIMIZATION PROBLEM. <i>Alam Rosato Macêdo, Ebrahim Samer El Youssef and Marcus V. Americano da Costa</i>
12:20-12:40	#49	FORMATION TRACKING CONTROL OF MULTIPLE UAVS IN THE PRESENCE OF COMMUNICATION FAULTS <i>Thamiris Lima Costa, Ebrahim El'Youssef and Edson De Pieri</i>

12:40-13:50	Lunch
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Session – Session W2: Special Session: Multibody Systems and Mechanism Design in Robotics			
Session Chair: Estevan Hideki Murai			
Room: CC I			
Time: 13:50 – 16:10 (GMT-3)			
Time	Paper ID	Proc Page	Presentation
13:50-14:10	#4		EFFICIENCY OPTIMIZATION OF THE GEAR REDUCER OF AN OVERHEAD POWER LINE INSPECTION ROBOT <i>Marina Baldissera de Souza, Gustavo Queiroz Fernandes, Luís Paulo Laus, Andrea Piga Carboni and Daniel Martins</i>
14:10-14:30	#15		A NEW METHOD OF CLIMBING ON A HIGH PLACE BY ELASTICITY-EMBEDDED ROCKER-BOGIE VEHICLE WITH DYNAMIC MOTIONS <i>Ryunosuke Takahashi, Ikuo Mizuuchi and Kimikage Kanno</i>
14:30-14:50	#18		MULTIDIMENSIONAL MAP: A CONCEPTUAL DESIGN TOOL TO DEVELOP ROBOTS FOR POWER LINES <i>Estevan Hideki Murai, Anderson José Balbino, Lauro Cesar Nicolazzi, Thaís Muraro, Daniel Martins, Roberto Kinceler and Alessandro Pedro Dadam</i>
14:50-15:10	#21		TENSEGRITY APPROACHES FOR FLEXIBLE ROBOTS: A REVIEW <i>Juan C. Guacheta-Alba, Angie J. Valencia-Castaneda, Max Suell Dutra, Mauricio Mauledoux and Oscar F. Aviles</i>

15:10-15:30	#47		ROBOTIC ARM DEVELOPMENT FOR A QUADRUPED ROBOT <i>Maria Lopes, Antonio P. Moreira, Filipe Santos and Manuel Silva</i>
15:30-15:50	#55		WALKING ROBOT APPLIED TO THE TUBE INSPECTION ACTIVITY <i>Esdras S. da Silva, Fernando V. Morlin, Leonardo G. da S. Adami, Lucas J. Imanisi, Leonardo M. Rincon and Daniel Martins</i>
15:50-16:10	#63		WRENCH CAPABILITY ANALYSIS OF A SERIAL-PARALLEL HYBRID LEG OF A DISNEY'S BIPEDAL ROBOT <i>Gustavo Queiroz Fernandes, Marina Baldissera de Souza, Leonardo Mejia Rincon and Daniel Martins</i>

16:10-16:30	Coffee break		
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Session – Session W3: Education in Robotics and Robotics in Education
Session Chair: Daniel Alejandro Ponce Saldias
Room: CC I

Time: 16:30 – 17:30 (GMT-3)

Time	Paper ID	Proc Page	Presentation
16:30-16:50	#6		A DIDACTIC APPROACH TO ENERGY-BASED DYNAMIC MODELING PART 1: LEAST ACTION, D’ALEMBERT PRINCIPLE AND EULERLAGRANGE FORMALISM <i>Claudio Ernesto Ponce Saldias and Daniel Alejandro Ponce Saldias</i>
16:50-17:10	#45		ENERGY EFFICIENCY ANALYSIS OF DIFFERENTIAL AND OMNIDIRECTIONAL ROBOTIC PLATFORMS: A COMPARATIVE STUDY <i>João Braun, Arezki Chellal, Luciano Bonzatto, Milena Pinto, Rebeca Kalbermatter, Vinicius Grilo, Paulo Costa and José Lima</i>
17:10-17:30	#46		DESIGN AND DEVELOPMENT OF AN OMNIDIRECTIONAL MECANUM PLATFORM FOR THE ROBOTATFACTORY 4.0 COMPETITION <i>João Braun, Kais Beide, Luciano Bonzatto, Guido Berger, Milena Pinto, Rebeca Kalbermatter, Luan Klein, Ana Pereira, Paulo Costa and José Lima</i>

17:30-17:50	CLAWAR 2024		
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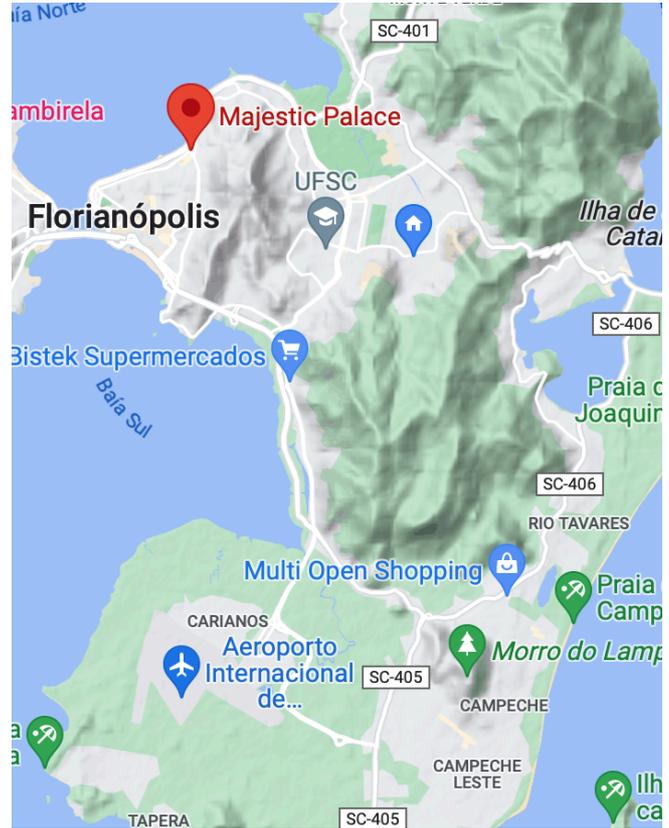
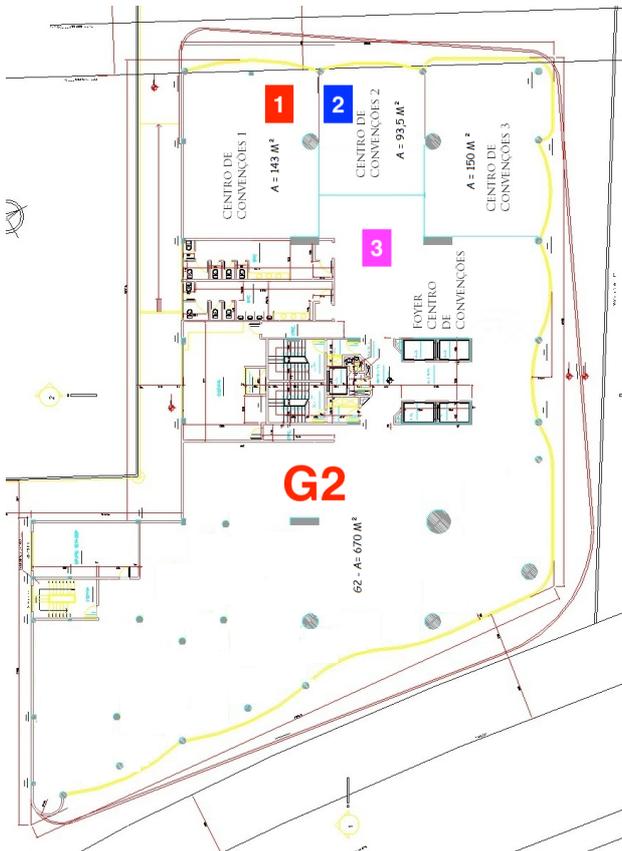
17:50-18:10

Closing Session

Majestic Palace Hotel Map

Entrance – Avenida Beira Mar Norte, 2746

Conference Venue at Centro de Convenção I (CC I) e Centro de Convenção II (CC II) - G2 Floor



- 1** ROOM CC1
- 2** ROOM CC2
- 3** REGISTRATION RECEPTION AND COFFEE BREAK (Foyer)

G2 SECOND FLOOR OF HOTEL LOBBY - ELEVATOR ACCESS

E LUNCH WILL BE SERVED ON FLOOR E, WHICH IS JUST ABOVE FLOOR G2