

7th International Conference on

# Climbing and Walking Robots

and the Support Technologies for Mobile Machines

September 22-24, 2004  
MADRID - SPAIN

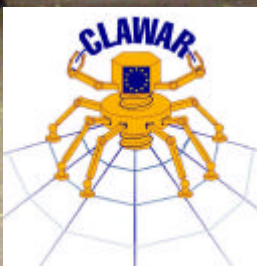
## Final Programme

Organised by the

Industrial Automation Institute of the  
Spanish Council for Scientific Research

on behalf of the

EC GROWTH Thematic Network CLAWAR



## Welcome by the Conference Chairmen



Y Baudoin  
CLAWAR'98  
(Brussels)

G S Virk  
CLAWAR'99  
(Portsmouth)

M A Armada  
CLAWAR'00  
CLAWAR'04  
(Madrid)

K Berns  
CLAWAR'01  
(Karlsruhe)

P Bidaud  
CLAWAR'02  
(Paris)

G Muscato  
CLAWAR'03  
(Catania)

After the very successful Conferences of CLAWAR'98 (Brussels), CLAWAR'99 (Portsmouth), CLAWAR'00 (Madrid), CLAWAR'01 (Karlsruhe), CLAWAR'02 (Paris) and CLAWAR'03 (Catania) we are now, on behalf of the EC GROWTH Thematic Network CLAWAR, in charge of organising CLAWAR'04, that will be held in Madrid (Spain) from 22-24 September 2004, hosted by the Industrial Automation Institute of the Spanish Council for Scientific Research (IA-CSIC). Our conference is the seventh of a series of conferences sponsored by the European Commission in the framework of a European Network on Climbing and Walking Robots (CLAWAR), where most of research groups and industries in Europe dealing with these subjects are working together.

The interest in climbing and walking robots has remarkably augmented over recent years. Novel solutions for complex and very diverse application fields (exploration/intervention in severe environments, personal services, emergency rescue operations, transportation, entertainment, medical, etc.), has been anticipated by means of a large progress in this area of robotics. Moreover, the amalgamation of original ideas and related innovations, the search for new potential applications and the use of state of the art supporting technologies permit to foresee an important step forward and a significant socio-economic impact of advanced robot technology in the forthcoming years. In response to the technical challenges in the development of these sophisticated machines, a significant research and development effort has to be undertaken. It concerns embedded technologies (for power sources, actuators, sensors, information systems), new design methods, adapted control techniques for highly redundant systems, as well as operational and decisional autonomy and human/robot co-existence.

The European Commission is funding the CLAWAR Network. However, our aim as scientists and industrialists in this exciting field of robotics, is not only to promote the knowledge and applications of the complex mechatronic devices under development inside the EU and to show how they can contribute to a competitive and sustainable growth in our countries, but to disseminate our technology outside Europe and to be very receptive of what is being done all around the world. Confirming this situation greatest interest has been received for CLAWAR'04, and after a careful reviewing procedure the conference finally accommodates 118 papers of high quality, where the number of authors goes over 250. Papers and Members of International Organising Committee account 26 countries, pointing out the high level of international activity in this field that is continuously growing and where many new research groups are being set up throughout the world.

As a summary of the conference it can be said that includes both state of the art and more practical presentations dealing with implementation problems, support technologies and future applications. A growing interest in passive locomotion is reflected by a very interesting number of contributions, and some outstanding new climbing and walking robots are also included. The conference is going together with a robot exhibition and the traditional climbing robot

competition. Best Paper Award will be offered by *Emerald: Industrial Robot: An international Journal*, and special issues of some of the foremost scientific journals on robotics will be published after the conference (for more information please refer to the CLAWAR'04 web site (<http://www.iai.csic.es/clawar04>)). Of major relevance is the commitment with our new editors, Springer Verlag, that are in charge of the Conference Proceedings edition. In this occasion the Proceedings will be mailed to the registered participants after the Conference.

We would like to take this opportunity to thank all those involved in organising CLAWAR'04. To the Plenary Speakers, to the International and National Organising Committees, to the Sponsoring Organisations, and to the Authorities our acknowledgement for their invaluable help and kind assistance. CLAWAR Network partners have been very supportive with their extensive work in the backstage, promoting, widening and rationalising the CLAWAR technology, filling existing gaps, defining new concepts and expanding the applications horizon of climbing and walking robots. Their work has been fundamental for the preparation of this 7th Conference. Special thanks are for the IAI-CSIC colleagues, for its Technical and Administrative Staff and for the members of the Automatic Control Department, because without their invaluable assistance CLAWAR'04 would never been a sound reality.

We would like to welcome you to CLAWAR'04 and wish you a fruitful scientific conference and a nice stay in Madrid.

We are looking forward to meet you next year in London for CLAWAR'05.

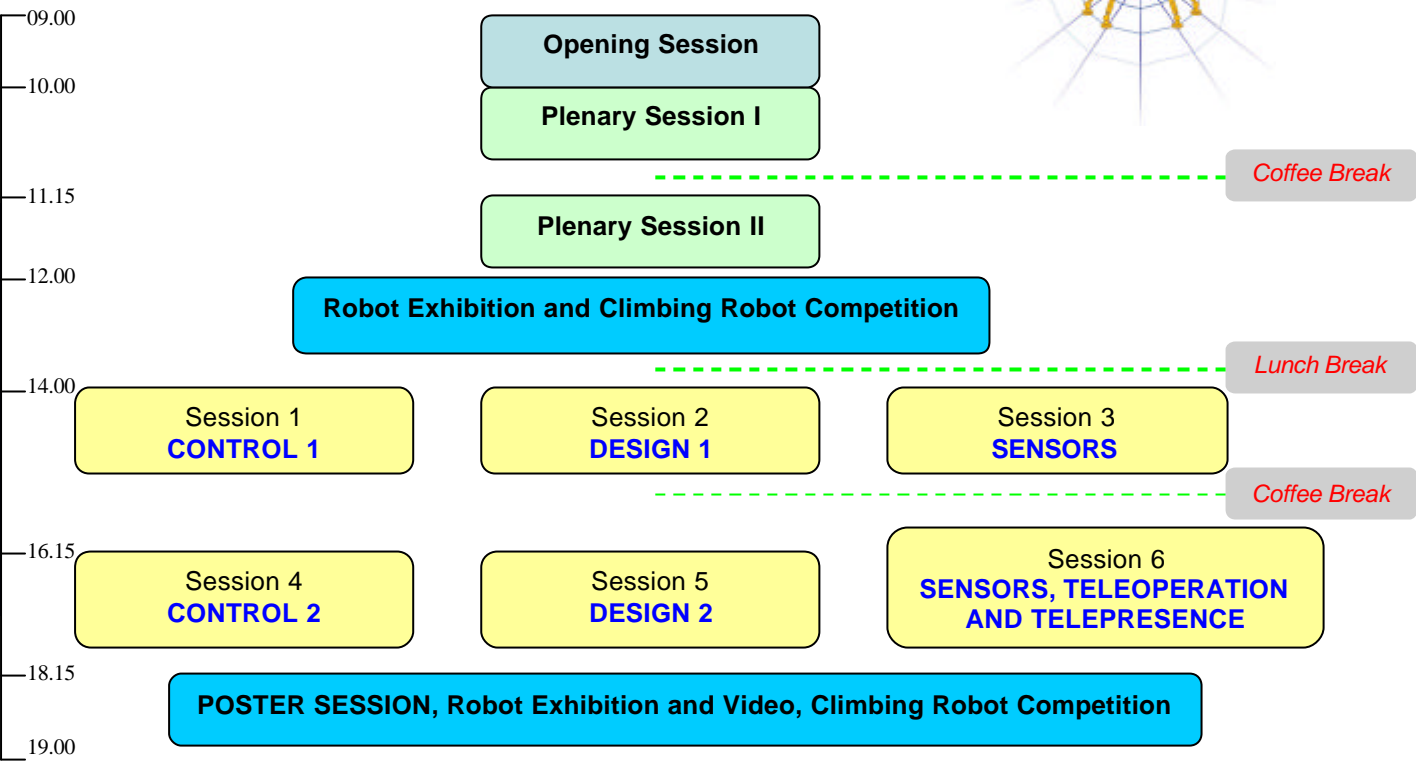
Yours sincerely,

Yvan Baudoin  
Gurvinder S Virk  
Manuel Armada  
Karsten Berns  
Philippe Bidaud  
Giovanni Muscato

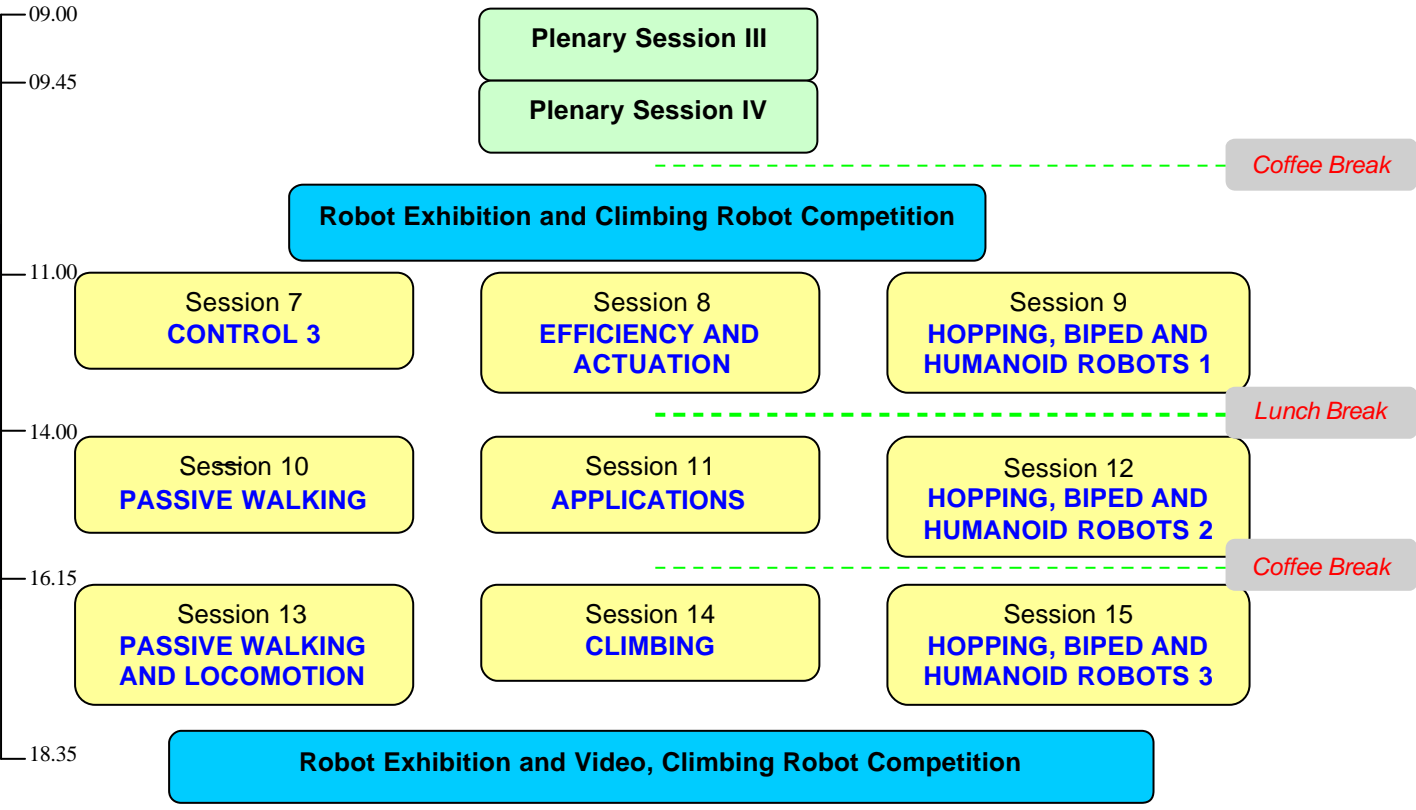
# CLAWAR'04 ROADMAP



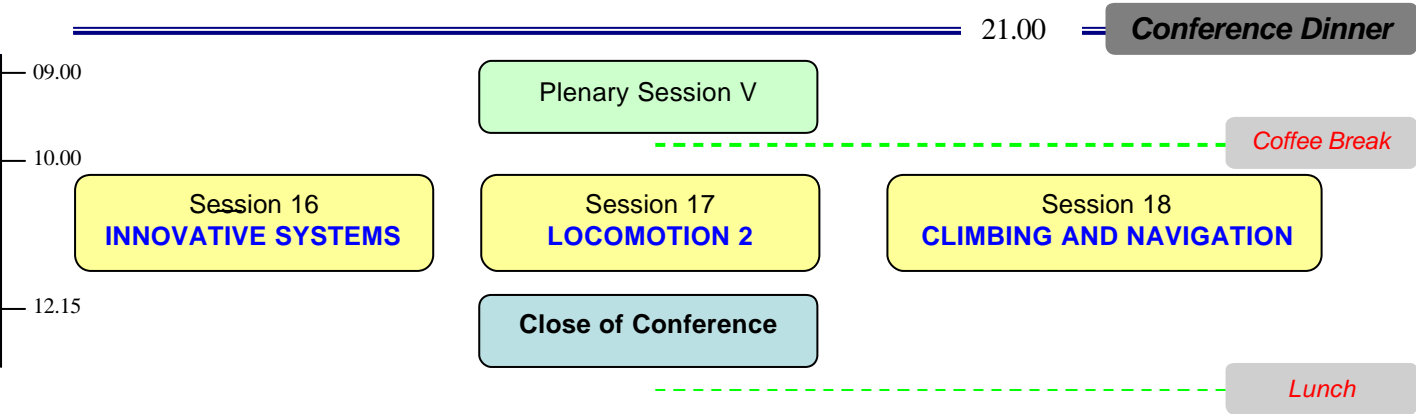
**WEDNESDAY 22**



**THURSDAY 23**



**FRIDAY 24**



21.00 — **Conference Dinner**

## CLAWAR'04 CONFERENCE TIMETABLE

<b>Tuesday 21 September 2004</b>			
17.00	19.30	Conference registration desk opening and exhibition set-up	
<b>Wednesday 22 September 2004</b>			
08.15	08.45	Conference registration	
<b>Room A</b>		Salón de Actos del CSIC. CSIC Headquarters Main Building	
09.00	10.00	<b>Opening Session</b>	
10.00	10.45	Plenary Session I	<b>Prof. R. DILLMANN</b> <i>BIOLOGICALLY MOTIVATED CONTROL OF WALKING MACHINES</i>
10.45	11.15	<i>Coffee Break</i>	
11.15	12.00	Plenary Session II	<b>Prof. R. MCNEILL ALEXANDER</b> <i>PROBLEMS OF SCALE FOR WALKING AND CLIMBING ANIMALS</i>
12.00	13.00	Robot Exhibition and Climbing Robot Competition	
13.00	14.00	<i>Lunch Break</i>	
		<b>Room A</b>	<b>Room B</b>
14.00	16.00	Session 1	Session 2
16.00	16.15	<i>Coffee Break</i>	
16.15	18.15	Session 4	Session 5
18.15	19.00	Poster Session, Robot Exhibition and Video, Climbing Robot Competition	
<b>Thursday 23 September 2004</b>			
<b>Room A</b>		Salón de Actos del CSIC. CSIC Headquarters Main Building	
09.00	09.45	Plenary Session III	<b>Prof. D A WINTER</b> <i>WHAT BIPEDAL HUMAN LOCOMOTION CAN TEACH US ABOUT MOTOR CONTROL SYNERGIES FOR SAFE ROBOTIC LOCOMOTION</i>
09.45	10.30	Plenary Session IV	<b>Prof. A L RUINA</b> <i>SOME MECHANICS PERSPECTIVES ON ROBOT LOCOMOTION</i>
10.30	11.00	<i>Coffee Break</i> + Robot Exhibition and Climbing Robot Competition	
		<b>Room A</b>	<b>Room B</b>
11.00	13.00	Session 7	Session 8
13.00	14.00	<i>Lunch Break</i>	
		<b>Room A</b>	<b>Room B</b>
14.00	16.00	Session 10	Session 11
16.00	16.15	<i>Coffee Break</i>	
16.15	18.35	Session 13	Session 14
18.35	19.15	Robot Exhibition and Video, Climbing Robot Competition	
	21.00	<i>Conference Dinner</i>	
<b>Friday 24 September 2004</b>			
<b>Room A</b>		Salón de Actos del CSIC. CSIC Headquarters Main Building	
09.00	09.45	Plenary Session 5	<b>Prof. M XIE</b> <i>ROBOT VISION: A HOLISTIC VIEW</i>
09.45	10.00	<i>Coffee Break</i>	
		<b>Room A</b>	<b>Room B</b>
10.00	12.00	Session 16	Session 17
<b>Room A</b>		Salón de Actos del CSIC. CSIC Headquarters Main Building	
12.15	13.00	<b>Close of Conference</b>	
13.00	14.00	<i>Lunch</i>	

## Scientific Programme

### Tuesday 21 September 2004

17.00 19.30 Conference registration desk opening and exhibition set-up

### Wednesday 22 September 2004

08.15 08.45 Conference registration

09.00 10.00 **Opening Session** *Chairman*  
J M F LABASTIDA  
VICE-PRESIDENT CSIC  
*Room A*

10.00 10.45 **Plenary Session I** *Chairman G S VIRK*  
*Room A*  
**Prof. R. DILLMANN**  
*BIOLOGICALLY MOTIVATED CONTROL OF WALKING MACHINES*

10.45 11.15 *Coffee Break*

11.15 12.00 **Plenary Session II** *Chairman P GONZALEZ*  
*Room A*  
**Prof. R. MCNEILL ALEXANDER**  
*PROBLEMS OF SCALE FOR WALKING AND CLIMBING ANIMALS*

12.00 13.00 Robot Exhibition and Climbing Robot Competition

13.00 14.00 *Lunch Break*

**Session 1 CONTROL 1** *Chairman J ESTREMER*  
*Room A*

14.00 14.20 **INTEGER VS. FRACTIONAL ORDER CONTROL OF A HEXAPOD ROBOT**  
*M F SILVA, J A TENREIRO MACHADO, A M LOPES*

14.20 14.40 **SYNCHRONOUS LANDING CONTROL OF A ROTATING 4-LEGGED ROBOT, PEOPLER, FOR STABLE DIRECTION CHANGE**  
*T OKADA, Y HIROKAWA, T SAKAI, K SHIBUYA*

14.40 15.00 **NEURO-CONTROLLERS FOR WALKING MACHINES - AN EVOLUTIONARY APPROACH TO ROBUST BEHAVIOR**  
*J FISCHER, F PASEMANN, P MANOONPONG*

15.00 15.20 **DECENTRALIZED DYNAMIC FORCE DISTRIBUTION FOR MULTI-LEGGED LOCOMOTION**  
*T ODASHIMA, Z W LUO*

15.20 15.40 **AN OUTDOOR VEHICLE CONTROL METHOD BASED BODY CONFIGURATION INFORMATION**  
*D CHUGO, K KAWABATA, H KAETSU, H ASAMA, T MISHIMA*

15.40 16.00 **IMPLEMENTATION OF A DRIVER LEVEL WITH ODOMETRY FOR THE LAURON III HEXAPOD ROBOT**  
*J L ALBARRAL, E CELAYA*

<b>Session 2</b>	<b>DESIGN 1</b>	<b>Chairman G S VIRK Room B</b>
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|-------|-------|--|
| 14.00 | 14.20 | <b>OPEN MODULAR DESIGN FOR ROBOTIC SYSTEMS</b><br><i>I CHOCHLIDAKIS, Y GATSOULIS, G S VIRK</i>   |
| 14.20 | 14.40 | <b>MECHANICAL DESIGN OPTIMIZATION OF A WALKING ROBOT LEG USING GENETIC ALGORITHM</b><br><i>C REYES, F GONZALEZ</i>   |
| 14.40 | 15.00 | <b>KINEMATICS OF A NEW STAIRCASE CLIMBING WHEELCHAIR</b><br><i>R MORALES, A GONZÁLEZ, V FELIU, P PINTADO</i>   |
| 15.00 | 15.20 | <b>DESIGN TOOLSET FOR REALISING ROBOTIC SYSTEMS</b><br><i>Y GATSOULIS, I CHOCHLIDAKIS, G S VIRK</i>  |
| 15.20 | 15.40 | <b>DESIGN, DYNAMIC SIMULATION AND EXPERIMENTAL TESTS OF LEG MECHANISM AND DRIVING SYSTEM FOR A HEXAPOD WALKING ROBOT</b><br><i>J ROCA, M NOGUES, S CARDONA</i> |
| 15.40 | 16.00 | <b>LIMB-MECHANISM ROBOT WITH WINCH MECHANISM</b><br><i>N FUJIKI, Y MAE, T UMETANI, T ARAI, T TAKUBO, K INOUE</i>   |

<b>Session 3</b>	<b>SENSORS</b>	<b>Chairman P BIDAUD Room C</b>
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| 14.00 | 14.20 | <b>INDUCTION MAGNETIC FIELD SENSOR AS AN ORGAN OF ROBOT VISION</b><br><i>R SKLYAR</i>  |
| 14.20 | 14.40 | <b>RESULTS OF APPLYING SENSOR FUSION TO A CONTROL SYSTEM USING OPTIC FLOW</b><br><i>G MARTINEZ, V BECERRA</i>  |
| 14.40 | 15.00 | <b>LEARNING ABOUT THE ENVIRONMENT BY ANALYZING ACOUSTIC INFORMATION - HOW TO ACHIEVE PREDICTABILITY IN UNKNOWN ENVIRONMENTS?</b><br><i>M DEUTSCHER, M KATZ, S KRÜGER</i> |
| 15.00 | 15.20 | <b>ULTRASOUND SENSOR SYSTEM WITH FUZZY DATA PROCESSING</b><br><i>J A MORGADO DE GOIS, M HILLER</i>   |
| 15.20 | 15.40 | <b>FINDING ODOURS ACROSS LARGE SEARCH SPACES: A PARTICLE SWARM-BASED APPROACH</b><br><i>L MARQUES, A T DE ALMEIDA</i>  |
| 15.40 | 16.00 | <b>VISION FEEDBACK IN CONTROL OF A GROUP OF MOBILE ROBOTS</b><br><i>P DUTKIEWICZ, M KIELCZEWSKI</i>  |

16.00	16.15	<i>Coffee Break</i>
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<b>Session 4</b>	<b>CONTROL 2</b>	<b>Chairman J L CORONADO Room A</b>
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| 16.15 | 16.35 | <b>LOCAL POSITIVE VELOCITY FEEDBACK (LPVF): GENERATING COMPLIANT MOTIONS IN A MULTI-JOINT LIMB</b><br><i>A SCHNEIDER, H CRUSE, J SCHMITZ</i>   |
| 16.35 | 16.55 | <b>MOTION CALCULATION FOR HUMAN LOWER EXTREMITIES BASED ON EMG-SIGNAL-PROCESSING AND SIMPLE BIOMECHANICAL MODEL</b><br><i>C FLEISCHER, K KONDAK, C REINICKE, G HOMMEL</i>                              |
| 16.55 | 17.15 | <b>BIFURCATING RECURSIVE PROCESSING ELEMENTS IN NEURAL ARCHITECTURES FOR APPLICATIONS IN MULTIDIMENSIONAL MOTOR CONTROL AND SENSORY FUSION IN NOISY / UNCERTAIN ENVIRONMENTS</b><br><i>E DEL MORAL</i> |

- 17.15 17.35 **THE EFFECTIVENESS OF ENERGY CONVERSION ELEMENT IN THE CONTROL OF POWERED ORTHOSES**  
*S C GHAROONI, M O TOKHI, G S VIRK*
- 17.35 17.55 **KINEMATICAL BEHAVIOR ANALYSIS AND WALKING PATTERN GENERATION OF A FIVE DEGREES OF FREEDOM PNEUMATIC ROBOTIC LEG**  
*G MUSCATO, G SPAMPINATO*
- 17.55 18.15 **TWO NEURAL APPROACHES FOR SOLVING REACHING TASKS WITH REDUNDANT ROBOTS**  
*J MOLINA-VILAPLANA, J L PEDREÑO-MOLINA, J LÓPEZ-CORONADO*

**Session 5****DESIGN 2****Chairman J ALBIEZ  
Room B**

- 16.15 16.35 **WALLWALKER: PROPOSAL OF LOCOMOTION MECHANISM CLEANING EVEN AT THE CORNER**  
*T MIYAKE, H ISHIHARA*
- 16.35 16.55 **WALKIE6.4: A NEW IMPROVED VERSION OF A RIGID FRAMES HEXAPOD ROVER**  
*N AMATI, B BONA, M CHIABERGE, G GENTA, M PADOVANI, R VOLPE*
- 16.55 17.15 **BIOLOGICAL INSPIRED WALKING - HOW MUCH NATURE DO WE NEED?**  
*J ALBIEZ, K BERNS*
- 17.15 17.35 **BEHAVIOUR NETWORKS FOR WALKING MACHINES - A DESIGN METHOD**  
*J ALBIEZ, R DILLMANN*
- 17.35 17.55 **EMBODIMENT IN TWO DIMENSIONS**  
*C R LINDER*
- 17.55 18.15 **LEGGED ROBOT WITH ARTICULATED BODY IN LOCOMOTION OVER COMPLEX TERRAIN**  
*F PALIS, V RUSIN, U SCHMUCKER, A SCHNEIDER, Y ZAVGORODNIY*

**Session 6****SENSORS, TELEOPERATION  
AND TELEPRESENCE****Chairman D HOWARD  
Room C**

- 16.15 16.35 **VISION COMPUTER TOOL TO IMPROVE THE DEPENDABILITY OF MOBILE ROBOTS FOR HUMAN ENVIRONMENTS**  
*C SALINAS, L PEDRAZA, M ARMADA*
- 16.35 16.55 **INTELLIGENT TECHNICAL AUDITION AND VISION SENSORS FOR WALKING ROBOT REALIZING TELEPRESENCE FUNCTIONS**  
*V E PAVLOVSKY, S A POLIVTSEEV, T S KHASHAN*
- 16.55 17.15 **VEHICLE TELEOPERATION WITH A MULTISENSORY DRIVING INTERFACE**  
*M MAZA, S BASELGA, J ORTIZ*
- 17.15 17.35 **APPROACHES TO THE GENERATION OF WHOLE BODY MOTION SENSATION IN TELEOPERATION**  
*M MAZA, S BASELGA, J ORTIZ*
- 17.35 17.55 **NOVEL METHOD FOR VIRTUAL IMAGE GENERATION FOR TELEOPERATION**  
*R CHELLALI, C MAAOUI, J-G FONTAINE*
- 17.55 18.15 **VIRTUAL PLATFORM FOR LAND-MINE DETECTION BASED ON WALKING ROBOTS**  
*A RAMIREZ, E GARCIA, P GONZALEZ DE SANTOS*
- 18.15 19.00 **Poster Session, Robot Exhibition and Video, Climbing Robot Competition**

**POSTER SESSION***Room: Exhibition Hall***CLAWAR MODULARITY – DESIGN TOOLS***G S VIRK***18.15 19.00****CLAWAR WP3 APPLICATIONS: NATURAL / OUTDOOR AND UNDERWATER ROBOTS***D LONGO, G MUSCATO***INTERACTION SPACE ANALYSIS FOR CLAWAR WP5 SOCIETAL NEEDS***M ARMADA, M PRIETO***CLAWAR WP 6 - ECONOMIC PROSPECTS, EXPLOITATION AND RISK ASSESSMENT OF MOBILE ROBOTIC SYSTEMS***H A WARREN*

## Thursday 23 September 2004

09.00 09.45	<p><b>Plenary Session III</b></p> <p><b>Prof. D A WINTER</b>  <i>WHAT BIPEDAL HUMAN LOCOMOTION CAN TEACH US ABOUT MOTOR CONTROL SYNERGIES FOR SAFE ROBOTIC LOCOMOTION</i></p>	<p><b>Chairman R CABALLERO</b>  <b>Room A</b></p>
09.45 10.30	<p><b>Plenary Session IV</b></p> <p><b>Prof. A L RUINA</b>  <i>SOME MECHANICS PERSPECTIVES ON ROBOT LOCOMOTION</i></p>	<p><b>Chairman G MUSCATO</b>  <b>Room A</b></p>
10.30 11.00	<p><i>Coffee Break + Robot Exhibition and Climbing Robot Competition</i></p>	

<b>Session 7</b>	<b>CONTROL 3</b>	<p><b>Chairman K KOZLOWSKI</b>  <b>Room A</b></p>
11.00 11.20	<p><b>ARTIFICIAL POTENTIAL BASED CONTROL FOR A LARGE SCALE FORMATION OF MOBILE ROBOTS</b>  <i>K KOZLOWSKI, W KOWALCZYK</i></p>	
11.20 11.40	<p><b>DESIGN AND IMPLEMENTATION OF FORCE SENSOR FOR ROBOCLIMBER</b>  <i>H MONTES, S NABULSI, M ARMADA, V SANCHEZ</i></p>	
11.40 12.00	<p><b>DETECTING ZERO-MOMENT POINT IN LEGGED ROBOT</b>  <i>H MONTES, S NABULSI, M ARMADA</i></p>	
12.00 12.20	<p><b>VISION FEEDBACK IN CONTROL OF A GROUP OF MOBILE ROBOTS</b>  <i>P DUTKIEWICZ, M KIELCZEWSKI</i></p>	
12.20 12.40	<p><b>PHYSICALLY VARIABLE COMPLIANCE IN RUNNING</b>  <i>J W HURST, A A RIZZI</i></p>	
12.40 13.00	<p><b>MOBILE MINI ROBOTS FOR MAS</b>  <i>M W HAN, P KOPACEK, B PUTZ, E SCHIERER, M WÜRZL</i></p>	

<b>Session 8</b>	<b>EFFICIENCY AND ACTUATION</b>	<p><b>Chairman M O TOKHI</b>  <b>Room B</b></p>
11.00 11.20	<p><b>THE DESIGN AND SIMULATED PERFORMANCE OF AN ENERGY EFFICIENT HYDRAULIC LEGGED ROBOT</b>  <i>S AL-KHARUSI, D HOWARD</i></p>	
11.20 11.40	<p><b>MASS DISTRIBUTION INFLUENCE ON POWER CONSUMPTION IN WALKING ROBOTS</b>  <i>T A GUARDABRAZO, P GONZALEZ DE SANTOS</i></p>	
11.40 12.00	<p><b>THE MODULARITY OF SUPER EMBEDDED REAL-TIME PC (SERPC)</b>  <i>A BASILE, N ABBATE, C GUASTELLA, M LO PRESTI, G MACINA</i></p>	
12.00 12.20	<p><b>TOWARD SPRINGY ROBOT WALK USING STRAND-MUSCLE ACTUATORS</b>  <i>M SUZUKI, A ICHIKAWA</i></p>	
12.20 12.40	<p><b>ACTUATOR SIZES IN BIO-ROBOTIC WALKING ORTHOSES</b>  <i>S C GHAROONI, G S VIRK, M O TOKHI</i></p>	
12.40 13.00	<p><b>DESIGN OF DUAL ACTUATOR FOR WALKING ROBOTS</b>  <i>T AKINFIEV, R FERNANDEZ, M ARMADA</i></p>	

**Session 9****HOPPING, BIPED AND HUMANOID ROBOTS 1****Chairman J-G FONTAINE  
Room C**

- 11.00 11.20 **CONTROL OF A 3-D HOPPING APPARATUS**  
*V B LARIN*
- 11.20 11.40 **LEARNING OF THE DYNAMIC WALK OF AN UNDERACTUATED BIPEDAL ROBOT: IMPROVEMENT OF THE ROBUSTNESS BY USING CMAC NEURAL NETWORKS**  
*C SABOURIN, O BRUNEAU, J-G FONTAINE*
- 11.40 12.00 **DYNAMIC STABILIZATION OF AN UNDER-ACTUATED ROBOT USING INERTIA OF THE TRANSFER LEG**  
*A DAVID, O BRUNEAU, J-G FONTAINE*
- 12.00 12.20 **KINEMATIC AND DYNAMIC ANALYSES OF A PANTOGRAPH-LEG FOR A BIPED WALKING MACHINE**  
*E OTTAVIANO, M CECCARELLI, C TAVOLIERI*
- 12.20 12.40 **GA OPTIMISATION OF THE PD COEFFICIENTS FOR THE LMBC OF A PLANAR BIPED**  
*D HARVEY, G S VIRK, D AZZI*
- 12.40 13.00 **PARALLEL MANIPULATOR HIP JOINT FOR A BIPEDAL ROBOT**  
*J HOFSCHULTE, M SEEBODE, W GERTH*
- 13.00 14.00 *Lunch Break*

**Session 10****PASSIVE WALKING****Chairman M WISSE  
Room A**

- 14.00 14.20 **STABLE WALKING AND RUNNING ROBOTS WITHOUT FEEDBACK**  
*K D MOMBAUR, H G BOCK, J P SCHLÖDER, R W LONGMAN*
- 14.20 14.40 **FROM PASSIVE TO ACTIVE DYNAMIC 3D BIPEDAL WALKING - AN EVOLUTIONARY APPROACH**  
*S WISCHMANN, F PASEMANN*
- 14.40 15.00 **FIRST STEPS IN PASSIVE DYNAMIC WALKING**  
*M WISSE, A L SCHWAB*
- 15.00 15.20 **CONTROLLING WALKING PERIOD OF A PNEUMATIC MUSCLE WALKER**  
*T TAKUMA, K HOSODA, M ASADA*
- 15.20 15.40 **EVOLUTIONARY DESIGN OF AN ADAPTIVE DYNAMIC WALKER**  
*J HAß, J M HERRMANN, T GEISEL*
- 15.40 16.00 **THE PASSIVITY PARADIGM IN THE CONTROL OF BIPEDAL ROBOTS**  
*M W SPONG*

<b>Session 11</b>	<b>APPLICATIONS</b>	<b>Chairman M P RIBEIRO Room B</b>
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|-------|-------|--|
| 14.00 | 14.20 | <b>ROBTANK INSPEC - IN SERVICE ROBOTIZED INSPECTION OF HAZARDOUS PRODUCTS STORAGE TANK</b><br><i>A CORREIA CRUZ, M SILVA RIBEIRO</i>   |
| 14.20 | 14.40 | <b>SIRIUSC - FAÇADE CLEANING ROBOT FOR SKYSCRAPER IN MUNICH, GERMANY</b><br><i>N ELKMANN, D KUNST, T KRUEGER, T BÖHME, T FELSCH, J SAENZ</i>   |
| 14.40 | 15.00 | <b>IN-PIPE MICROROBOT WITH INERTIAL MOOD OF MOTION</b><br><i>G G RIZZOTTO, M VEKLENKO, P AMATO, V GRADETSKY, S BASHKIROV<br/>M KNYAZKOV, V SOLOVTSOV</i>   |
| 15.00 | 15.20 | <b>THE LAYER CROSSING STRATEGY OF CURVED WALL CLEANING ROBOT</b><br><i>L RONG, H JIN, S LONG, Z GUANGHUA, Z HOUXIANG</i>   |
| 15.20 | 15.40 | <b>PNEUMATIC CLIMBING ROBOTS FOR GLASS WALL CLEANING</b><br><i>H ZHANG, J ZHANG</i>  |
| 15.40 | 16.00 | <b>DESIGN AND PROTOTYPING OF A HYBRID POLE CLIMBING AND MANIPULATING ROBOT WITH MINIMUM DOFS FOR CONSTRUCTION AND SERVICE APPLICATIONS</b><br><i>M TAVAKOLI, M R ZAKERZADEH, G R VOSOUGHI, S BAGHERI</i> |

<b>Session 12</b>	<b>HOPPING, BIPED AND HUMANOID ROBOTS 2</b>	<b>Chairman C BALAGUER Room C</b>
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| 14.00 | 14.20 | <b>THREE-DIMENSIONAL RUNNING IS UNSTABLE BUT EASILY STABILIZED</b><br><i>J E SEIPEL, P J HOLMES</i>  |
| 14.20 | 14.40 | <b>A BIOMIMETIC APPROACH FOR THE STABILITY OF BIPED ROBOTS</b><br><i>J DE LOPE, D MARAVALL</i>   |
| 14.40 | 15.00 | <b>GAITS STABILIZATION FOR PLANAR BIPED ROBOTS USING ENERGETIC REGULATION</b><br><i>N K M'SIRDI, N KHRAIEF, O LICER</i>  |
| 15.00 | 15.20 | <b>DEVELOPMENT OF THE LIGHT-WEIGHT HUMAN SIZE HUMANOID ROBOT RH-0</b><br><i>L CABAS, S DE TORRE, I PRIETO, M ARBULU, C BALAGUER</i>                                      |
| 15.20 | 15.40 | <b>USER FRIENDLY GRAPHICAL ENVIRONMENT FOR GAIT OPTIMIZATION OF THE HUMANOID ROBOT RH-0</b><br><i>M ARBULU, I PRIETO, D GUTIERREZ, L CABAS, P STAROVEROV, C BALAGUER</i> |
| 15.40 | 16.00 | <b>HUMAN MACHINE INTERFACE FOR HUMANOID ROBOT RH-0</b><br><i>I PRIETO, C PÉREZ, C BALAGUER</i>   |

16.00	16.15	<i>Coffee Break</i>
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<b>Session 13</b>	<b>PASSIVE WALKING AND LOCOMOTION</b>	<b>Chairman M WISSE Room A</b>
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| 16.15 | 16.35 | <b>ANKLE JOINTS AND FLAT FEET IN DYNAMIC WALKING</b><br><i>D G E HOBBELEN, M WISSE</i>   |
| 16.35 | 16.55 | <b>THE TANGO OF A LOAD BALANCING BIPED</b><br><i>E D VAUGHAN, E DI PAOLO, I R HARVEY</i>   |
| 16.55 | 17.15 | <b>STABILIZING DYNAMIC WALKING WITH PHYSICAL TRICKS</b><br><i>N M MAYER, A A FOROUGH-NASSIRAEI, T CHRISTALLER</i>  |
| 17.15 | 17.35 | <b>STABILITY OF A SIMPLE 3D WALKING MODEL</b><br><i>J E SEIPEL</i>   |
| 17.35 | 17.55 | <b>LOCOMOTION MODES OF AN HYBRID WHEEL-LEGGED ROBOT</b><br><i>G BESSERON, C GRAND, F BENAMAR, F PLUMET, P BIDAUD</i>   |
| 17.55 | 18.15 | <b>ROBOTIC WALKING AIDS FOR DISABLED PERSONS</b><br><i>G S VIRK, S C GHAROONI, S K BAG, M O TOKHI, R I TYLOR, S BRADSHAW, F JAMIL, I D SWAIN, P H CHAPPLE, R A ALLEN</i> |

<b>Session 14</b>	<b>CLIMBING</b>	<b>Chairman K BERNS Room B</b>
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| 16.15 | 16.35 | <b>SIMULATION OF CLIMBING ROBOTS USING UNDERPRESSURE FOR ADHESION</b><br><i>C HILLENBRAND, J WETTACH, K BERNS</i>  |
| 16.35 | 16.55 | <b>INVERSE KINEMATIC AND DYNAMIC ANALYSIS OF A NEW 4- DOF HYBRID (SERIAL-PARALLEL) MANIPULATOR FOR POLE CLIMBING ROBOT</b><br><i>M TAVAKOLI, M R ZAKERZADEH, G R VOSOUGHI, S BAGHERI</i> |
| 16.55 | 17.15 | <b>CLIMBING WITHOUT A VACUUM PUMP</b><br><i>W BROCKMANN, F MÖSCH</i>   |
| 17.15 | 17.35 | <b>TOWARDS PENETRATION-BASED CLAWED CLIMBING</b><br><i>W R PROVANCHER, J E CLARK, B GEISLER, M R CUTKOSKY</i>  |
| 17.35 | 17.55 | <b>DEVELOPING CLIMBING ROBOTS FOR EDUCATION</b><br><i>K BERNS, T BRAUN, T LUKSCH</i>   |
| 17.55 | 18.15 | <b>ROBUST LOCALIZATION OF A CLIMBING PLATFORM</b><br><i>A MARTINS, L MARQUES, A T DE ALMEIDA</i>   |

<b>Session 15</b>	<b>HOPPING, BIPED AND HUMANOID ROBOTS 3</b>	<b>Chairman T AKINFIEV Room C</b>
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| 16.15 | 16.35 | <b>HEIGHT CONTROL OF A RESONANCE HOPPING ROBOT</b><br><i>R FERNANDEZ, T AKINFIEV, M ARMADA</i> |
| 16.35 | 16.55 | <b>ZERO MOMENT POINT MODELING USING HARMONIC BALANCE</b><br><i>R CABALLERO, M ARMADA</i>       |
| 16.55 | 17.15 | <b>HUMANOID ROBOT KINEMATICS MODELING USING LIE GROUPS</b><br><i>J M PARDOS, C BALAGUER</i>    |

- 17.15 17.35 CONTROL ARCHITECTURE OF LUCY, A BIPED WITH PNEUMATIC ARTIFICIAL MUSCLES**  
*B VANDERBORGHT, B VERRELST, R VAN HAM, J VERMEULEN, J NAUDET, D LEFEBER*
- 17.35 17.55 TRAJECTORY PLANNING FOR THE WALKING BIPED "LUCY"**  
*J VERMEULEN, D LEFEBER, B VERRELST, B VANDERBORGHT*
- 17.55 18.15 FORCE FEEDBACK CONTROL IMPLEMENTATION FOR SMART NON-LINEAR ACTUATOR**  
*H MONTES, L PEDRAZA, M ARMADA, T AKINFIEV*
- 18.15 18.35 AN INTRODUCTORY REVISION TO HUMANOID ROBOT HANDS**  
*D ALBA, M ARMADA, R PONTICELLI*
- 18.35 19.15** Robot Exhibition and Video, Climbing Robot Competition
- 21.00** *Conference Dinner*



## Friday 24 September 2004

### Plenary Session V

**Chairman P BIDAUD**  
**Room A**

09.00 09.45

**Prof. M XIE**  
*ROBOT VISION: A HOLISTIC VIEW*

09.45 10.00

*Coffee Break*

**Session 16**

### INNOVATIVE SYSTEMS

**Chairman A T ALMEIDA**  
**Room A**

10.00 10.20

**ROBUST PLATFORM FOR HUMANITARIAN DEMINING**  
*L MARQUES, S LARIONOVA, A T DE ALMEIDA*

10.20 10.40

**DESIGN AND CONTROL OF A MANIPULATOR FOR LANDMINE DETECTION**  
*E GARCIA, P GONZALEZ DE SANTOS*

10.40 11.00

**INTERACTIONS BETWEEN HUMAN AND ROBOT – CASE STUDY:  
WORKPARTNER-ROBOT IN THE ISR 2004 EXHIBITION**  
*S YLÖNEN, M HEIKKILÄ, P VIREKOSKI*

11.00 11.20

**SIT TO STAND TRANSFER ASSISTING BY AN INTELLIGENT WALKING-AID**  
*P MEDERIC, V PASQUI, F PLUMET, P BIDAUD*

11.20 11.40

**CO-OPERATIVE SMELL-BASED NAVIGATION FOR MOBILE ROBOTS**  
*C LYTRIDIS, G S VIRK, E E KADAR*

11.00 12.00

**A LOCALIZATION ALGORITHM FOR OUTDOOR TRAJECTORY TRACKING WITH  
LEGGED ROBOTS**  
*J A COBANO, J ESTREMER, P GONZALEZ DE SANTOS*

**Session 17**

### LOCOMOTION 2

**Chairman R D QUINN**  
**Room B**

10.00 10.20

**A CLAWAR THAT BENEFITS FROM ABSTRACTED COCKROACH LOCOMOTION  
PRINCIPLES**  
*T E WEI, R D QUINN, R E RITZMANN*

10.20 10.40

**ISPRAWL : AUTONOMY, AND THE EFFECTS OF POWER TRANSMISSION**  
*S KIM, J E CLARK, M R CUTKOSKY*

10.40 11.00

**LOCOMOTION OF A MODULAR WORM-LIKE ROBOT USING A FPGA-BASED  
EMBEDDED MICROBLAZE SOFT-PROCESSOR**  
*J GONZALEZ-GOMEZ, E AGUAYO, E BOEMO*

11.00 11.20

**LEGGED LOCOMOTION – WHAT CAN BE LEARNED FROM ROBOTICS?**  
*A SEYFARTH, H GEYER, F IIDA, J RUMMEL*

11.20 11.40

**EVOLUTIONARY DESIGN FOR STRUCTURE/CONTROL SYNTHESIS OF  
LOCOMOTION SYSTEMS**  
*N BRENER, P BIDAUD, O CHOCRON, F B AMAR*

11.00 12.00

**KINEMATIC MODEL AND ABSOLUTE GAIT SIMULATION OF A SIX-LEGGED  
WALKING ROBOT**  
*G FIGLIOLINI, V RIPA*

**Session 18****CLIMBING AND NAVIGATION****Chairman R MOLFINO  
Room C**

- 10.00 10.20 **ROBOCLIMBER: PROPOSAL FOR ON-LINE GAIT PLANNING**  
*M MORONTI, M SANGUINETI, M ZOPPI, R M MOLFINO*
- 10.20 10.40 **ADHESION CONTROL FOR THE ALICIA3 CLIMBING ROBOT**  
*D LONGO, G MUSCATO*
- 10.40 11.00 **ROBOCLIMBER: CONTROL SYSTEM ARCHITECTURE**  
*S NABULSI, H MONTES, M ARMADA*
- 11.00 11.20 **TECHNIQUE FOR A SIX-LEGGED WALKER CLIMBING A HIGH SHELF BY USING A VERTICAL COLUMN**  
*Y F GOLUBEV, V V KORIANOV*
- 11.20 11.40 **NAVIGATION OF WALKING ROBOTS: LOCALIZATION BY ODOMETRY**  
*B GABMANN, J M ZÖLLNER, R DILLMANN*
- 11.00 12.00 **MOTION PLANNING FOR A LEGGED VEHICLE BASED ON OPTICAL SENSOR INFORMATION**  
*R BADE, ANDRÉ HERMS, T IHME*

12.15 13.00

**Close of Conference****Chairman G S VIRK  
Room A**13.00 14.00 *Lunch*