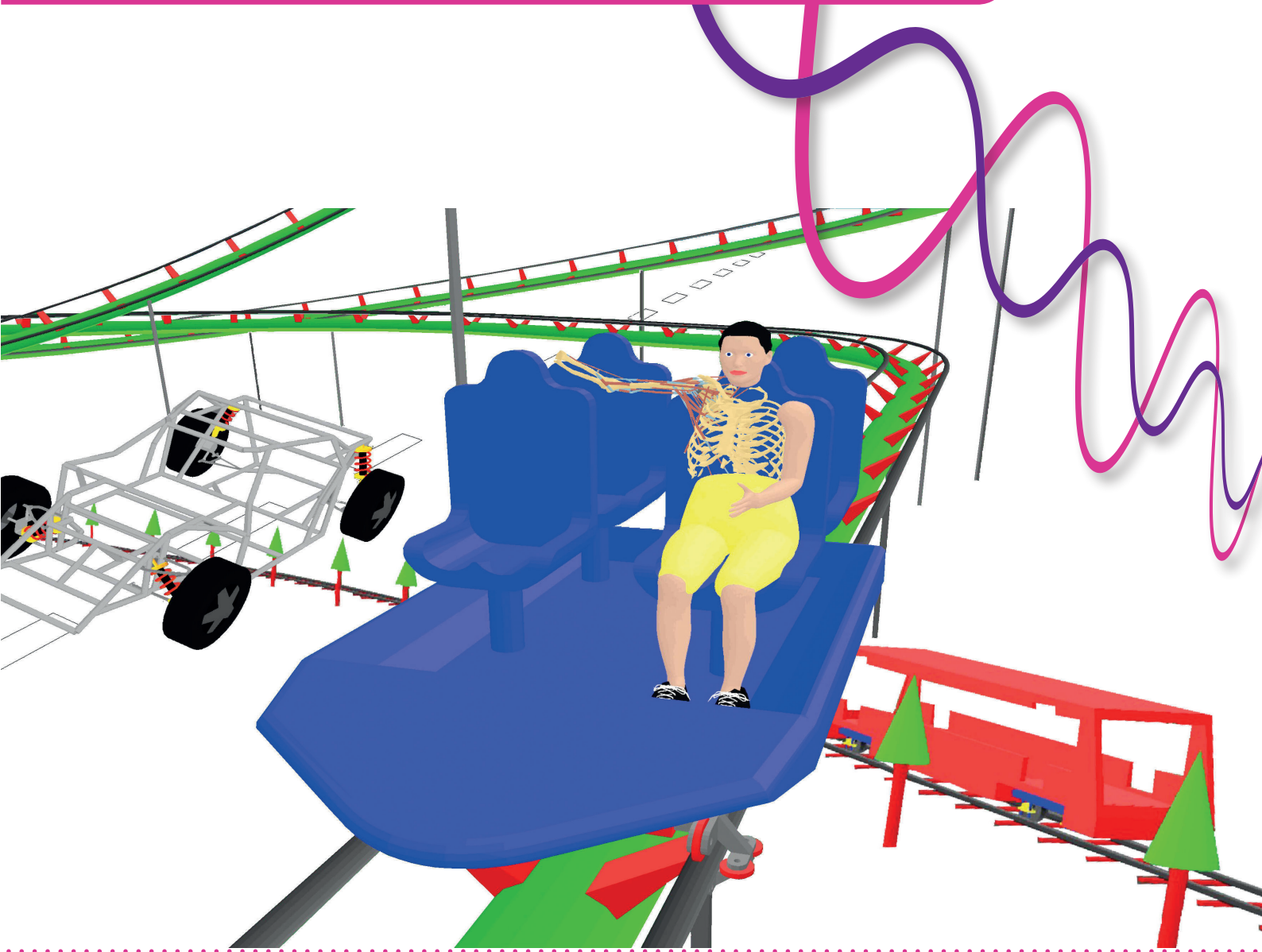


PROGRAMME



The 5th Joint International Conference on
Multibody System Dynamics

IMSD

Instituto Superior Técnico
Lisbon, Portugal,
June 24 - 28, 2018





The 5th : Joint International Conference on IMSD
: Multibody System Dynamics

Instituto Superior Técnico
Lisbon, Portugal,
June 24 - 28, 2018



PROGRAMME

Edited by
Jorge A.C. Ambrósio

Title

Programme

***The Fifth Joint International Conference on Multibody
System Dynamics***

Edited by

Jorge A.C. Ambrósio

First edition, June 2018

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IDMEC - Instituto de Engenharia Mecânica

Instituto Superior Técnico, Avenida Rovisco Pais 1, 1049-001 LISBOA

Graphic Design

Luís Barros

luisbarrosdesign@gmail.com

Welcome Message

The Joint International Conference on Multibody System Dynamics, serves as a meeting point for the international multibody community and provides an opportunity to exchange high-level, current information on the theory and applications of multibody systems. In line with the International Association for Multibody System Dynamics, IMSD, the Joint Conference aims at fostering research on the dynamics of multibody systems and related fields; and to promote international cooperation between scientists and engineers in industry.

The **IMSD2018** is the fifth of a series of Joint Conferences, organized every other Year, which started in 2010 in Lappeenranta, Finland, and continued in 2012 in Stuttgart, Germany, then in 2014 in Busan, Korea and, the preceding one, in 2016 in Montréal, Canada. This series of Joint Conferences has been endorsed by IUTAM (International Union of Theoretical and Applied Mechanics), to which IMSD is associated as an affiliated organization, and by IFToMM (International Federation for the Promotion of Mechanism and Machine Science) and has the support of APMTAC (Portuguese Association of Theoretical, Applied and Computational Mechanics).

The **IMSD2018** gathers more than 220 participants from all Continents and representing most of the active research groups in the World. The topics of the Conference include, but are not limited to: Benchmark Problems in Multibody System Dynamics, Biomechanics, Computational Methods and Real-Time Applications, Contact, Impact, and Constraints, Control, Mechatronics, and Robotics, Dynamics of Vehicles, Flexible Multibody Systems, Modeling, Formalisms, and Theoretical Methods, Multibody Kinematics, Multidisciplinary Methods, Applications and Optimization, Sensitivity Analysis, and Parameter Identification. Thematic sessions have been organized around these topics in order to better promote discussion and foster cooperation between participants. Due to the excellence of the research communicated in these technical sessions and on the State-of-Art findings discussed, a Thematic Issue of the international journal Multibody System Dynamics is being organized to include selected works, which will undergo a proper review and revision and a thorough scrutiny for acceptance.

We want to express our appreciation to all members of the Scientific Committees and organizers of the Thematic Sessions who were instrumental in promoting the Conference and ensuring that all relevant topics in, or associated to, Multibody Dynamics are addressed. To all staff members, colleagues and students that were fundamental in putting together the **IMSD2018** we thank for the dedicated work without which this organization would not be possible. We want to thank all the authors and presenters for sharing with all the participants their ideas and results and to all participants for making the 5th Joint Conference on Multibody System Dynamics possible. We invite all of you to be an active part of our Conference during this coming week.

We hope that you feel rewarded for your participation in **IMSD2018** and that it will be a reference in your scientific activities.

Welcome to Lisbon and to the 5th Joint Conference on Multibody System Dynamics.

Lisbon, June 2018.

Jorge Ambrósio

The 5th : Joint International Conference on IMSD : Multibody System Dynamics

Instituto Superior Técnico | Lisbon, Portugal | June 24 - 28, 2018

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About IMSD2018

Chairman

Jorge A. C. Ambrósio (Portugal)

Steering Committee

The Joint International Conference on Multibody System Dynamics is supervised by an International Steering Committee:

Alberto Cardona (Argentina)

Jin Hwan Choi (Korea)

Javier Cuadrado (Spain)

Peter Eberhard (Germany)

Paulo Flores (Portugal)

Sung-Soo Kim (Korea)

Subir Kumar Saha (India)

John McPhee (Canada)

Aki Mikkola (Finland)

Dan Negrut (USA)

Corina Sandu (USA)

Hiroyuki Sugiyama (USA)

Yoshiaki Terumichi (Japan)

Michael Valášek (Czech Republic)

Hao Wang (China)

Werner Schiehlen (*IUTAM Observer*)

Institutional Endorsement

- **IDMEC** - Instituto de Engenharia Mecânica
- **IST** - Instituto Superior Técnico
- **IUTAM** (International Union of Theoretical and Applied Mechanics)
- **IFTToMM** (International Federation for the Promotion of Mechanism and Machine Science)
- **APMTAC** (Portuguese Association of Theoretical, Applied and Computational Mechanics)
- **KSME** (Korean Society of Mechanical Engineers)
- **JSME** (Japan Society of Mechanical Engineers)

Supporting Journal

Multibody System Dynamics

General Information

Conference Venue

The Fifth Joint International Conference on Multibody System Dynamics takes place in Instituto Superior Técnico (IST) Congress Center, situated at the Civil Engineering Building (Pavilhão de Civil) with the address:

Congress Center

(Civil Engineering Building)
 Instituto Superior Técnico
 Av. Rovisco Pais 1
 1049-001 Lisboa

Secretariat Open Hours

- Sunday, June 24, 16:00 h -18:00 h
- Monday, June 25, 08:00 h -17:30 h
- Tuesday, June 26, 08:20 h -18:00 h
- Wednesday, June 27, 08:20 h -14:00 h
- Thursday, June 28, 08:30 h -13:00 h

Coffee-Breaks

The coffee-breaks will take place in the hall -2 (2nd Basement) of the conference center (see map of the conference center) and will be open to all participants. Kindly wear your Conference Badge.

Lunches

The Lunch tickets included in the package received during the registration will be accepted at the restaurants marked in the map below. The restaurants open at 12:30 h and offer a few choices for lunch in self-service with a daily vegetarian option. Note that the lunch tickets have different colors for the different days and are valid only for the day printed in the front.

1 - BUS DEPARTURE

Social Programme

Monday, June 25,

17:45 h - Welcome Reception

Wednesday, June 27,

14:30 h - Conference Tour

2 - Congress Center Building

Floor -1 (1st Basement)

3 - Restaurant 1

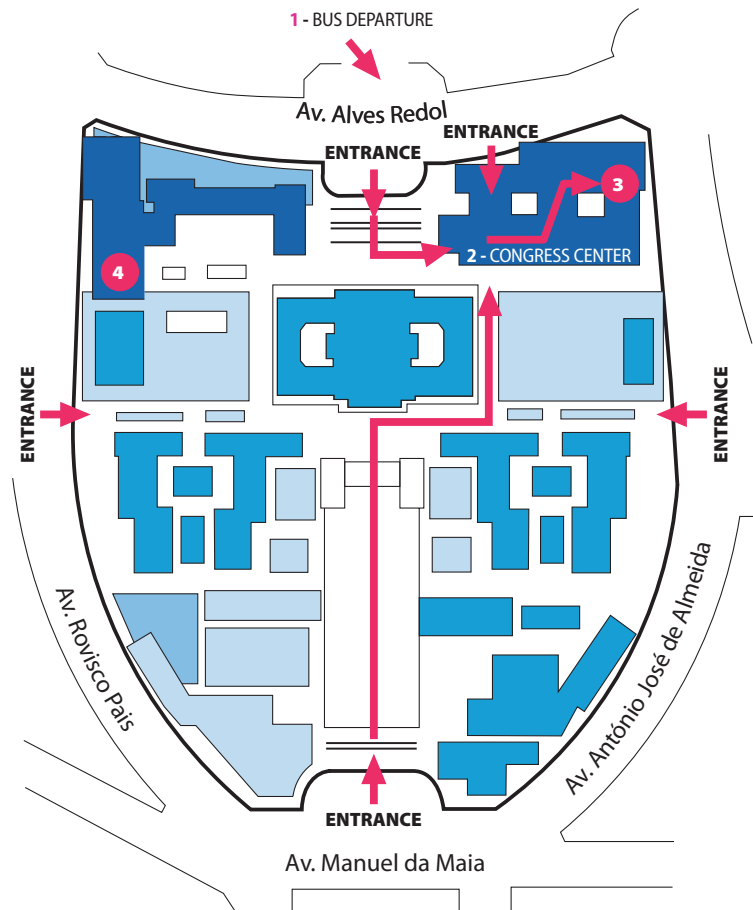
Congress Center Building

Floor 0 (Ground Floor)

4 - Restaurant 2

Post Graduation Building

Floor -1 (1st Basement)



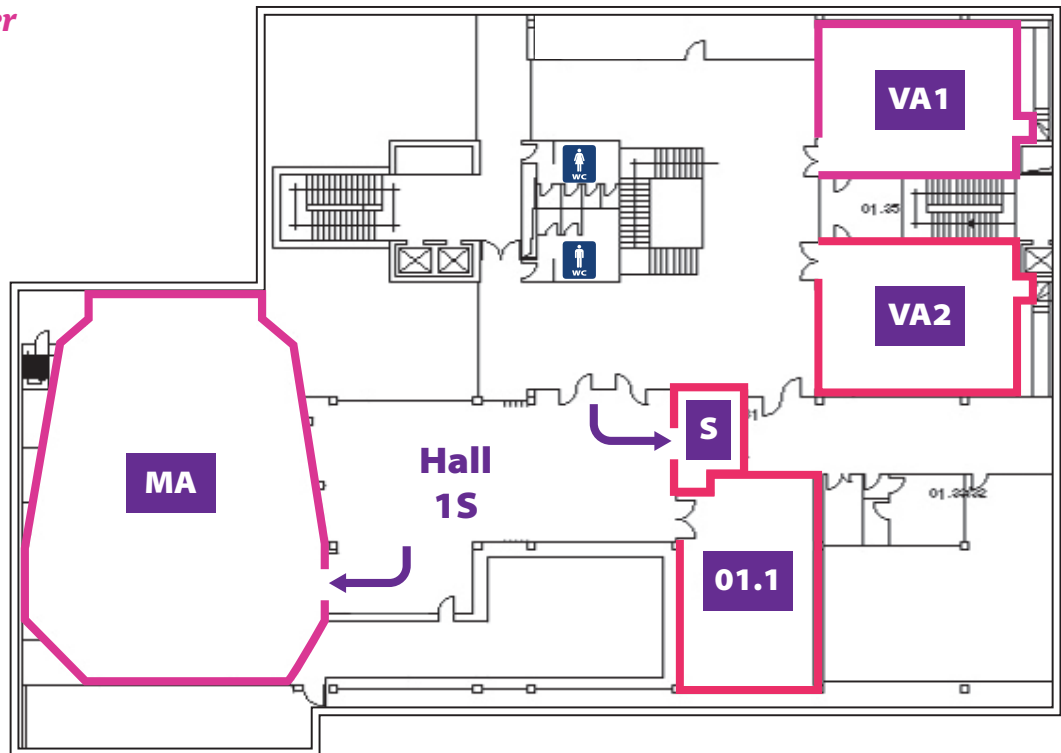
General Information

Congress Center Floor Plans

Congress Center

Floor -1

(1st Basement)

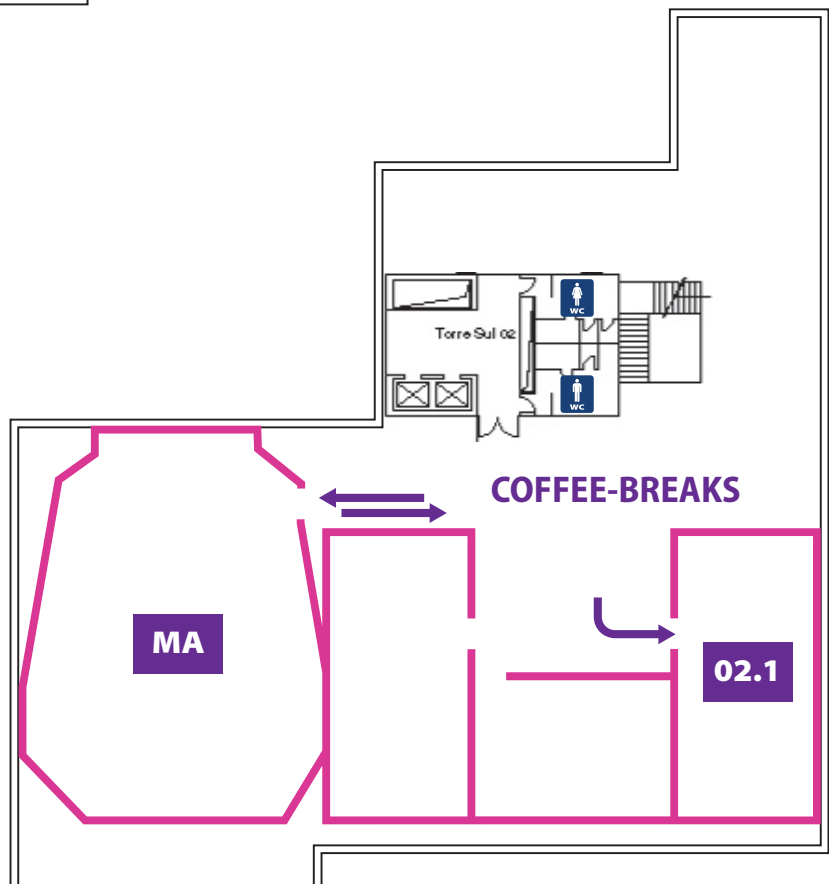


- MA** - Main Auditorium
- VA1** - Session Room
- VA2** - Session Room
- S** - Secretariat
- 01.1** - Lounge Room
- 02.1** - Session Room

Congress Center

Floor -2

(2nd Basement)



Social Programme

Welcome Reception – Monday, 25th June – 17:45 h

The welcome reception will take place a board of a recovered cacilheiro boat, providing a unique opportunity to appreciate the city from the riverside.

Buses will depart from IST (Rua Alves Redol) at 17:45 h. Please be there 10 minutes before the departure time and don't forget to bring your tour/dinner voucher. The river tour will take about two hours, boat will depart at 18:30h from the Doca do Espanhol (Porto de Lisboa) and returns around 20:30h. Near the boat stop point there are several restaurants by the river, participants may want to enjoy the rest of the evening around or find their own way back to the hotels. There will be no buses returning to IST.

Conference Tour and Dinner – Wednesday, 27th June – 14:30 h

Buses will depart from IST, avenue Alves Redol at 14:30 h. Please be there 10 minutes before the departure time and don't forget to bring your tour/dinner voucher. Buses will depart to Cape Roca, the western most point of Continental Europe along the coast line of Guincho, with its superb beach areas and cliffs. It continues to Sintra, a small delightful town in the forest covered Mountain of Sintra (Unesco World Heritage Site);



Being in Sintra, the dinner will take place at Penha Longa Monastery, (Quinta da Penha Longa, Estrada da Lagoa Azul, Sintra) at 19:00h and should end around 22:30 h. Buses will return to IST.

The Monastery was founded in 1355 by Friar Vasco Martins that introduced the St. Jeronimos Order in Portugal. In 1400 a church was built consecrated to Our Lady of Health. During the 15th and 16th centuries, Penha Longa was chosen by the Royal Family as a place for hunting, during the summer. Memories of strong presences, such as King D. Manuel (1496) and King D. Sebastião (1580) can be found. During this period, a Palace to host the Kings and their guests, fountains and gardens, oratories and watermills were built.





Getting to Lisbon by air

Direct flights from most of European cities, North or South America and Africa land at the Portela Airport, terminal 1. A taxi ride from the airport to IST is about 4-5 km that takes 10-15 min, depending on traffic, and should cost around 8€. To downtown the taxi ride is about 7 km and should cost around 10€. 1.60€ is charged for the transportation of luggage or animals. A sure option is the “Taxi Voucher” a prepaid taxi service starting at 16.40€, on sale at the “Information Desk” in the arrival terminal. Lisbon Airport has its own Metro Station, Aeroporto - red line (see map of Lisbon with subway lines). Other options are the AeroBus and the Aeroshuttle (3,5€).

Getting to Lisbon by car

Drivers can use highway A1 when coming from the North, highway A2, through the 25 de Abril bridge, when coming from the South, and highway A12, through Vasco da Gama bridge, when coming from the Northeast.

Getting to Lisbon by train

The St. Apolónia station is the terminal for trains arriving from the North of Portugal. Another option is to use the train station Oriente. From the South of Portugal an option is to use the train station Oriente. Connections to the metro lines exist at both stations (St. Apolónia - blue line, Oriente - red line).

Moving around

Taxi:

Lisbon is served by an extensive network of public transportation that can take you anywhere in the city and to its surroundings. Taxis (black and green or beige) are cheap when comparing to most of the European countries. They can be called by phone, picked-up on taxi plazas or stopped on the street. The fare on the taxi meter should start at 3.25€ (daytime pick-up) or 3,90€ (nighttime). Outside the city limits, city fares are charged per kilometer. 1.60€ is charged for

the transportation of luggage or animals. Before taking a taxi, inquire about the fare.

Metro:

The Lisbon Metro is a very comfortable and easy way to reach most of the city, from 6:30 to 1:00. The Metro lines reach most of the city being the Metro stations close to IST:

- Alameda (red and green line)
- Saldanha (red and yellow line)

Bus

The bus routes cover all Lisbon and extend to its outskirts. The tickets can be pre-paid, at the counters of Carris, the surface transportation operator for Lisbon, or bought aboard the bus, electric cars or funiculars.

For IST hop off on one of the following bus stops:

- Av. Manuel da Maia
- Av. Rovisco Pais
- Arco do Cego

Metro and Bus Fares:

- Reusable card – 0.50 €
- METRO/CARRIS – 1.45 €
- CARRIS Bus – 1.80 € (on board fare)
- Tram – 2.85 € (on board fare)

Trains

Suburban trains to Estoril and Cascais depart from the Cais do Sodré train station, to the south of the river cities from Roma-Areeiro (Entrecampos) while to Sintra the trains depart from Rossio train station or Oriente (Entrecampos). The ride to Cascais or to Sintra should take about 35-45 min, each way. The train ride to south of the river is a highlight as the train will cross the 25 de Abril bridge with magnificent views of Lisbon.

For IST the nearby train stations are:

- Roma-Areeiro
- Entrecampos

Other general information

- National emergency number: 112
- Time zone: GMT +1 summer time
- Electricity: 220V, 50 Hz with standard European power sockets
- Temperature: Average high 29°C, Average low 17°C
- Currency: Euro (€)
- Banks: working hours are 08:30 h – 15:00 h (*Monday-Friday*)
- Pharmacies: 09:00 h – 19:00 h
- Shops: 09:00 – 19:00h
- Shopping Malls: 10:00 – 23:00 h



Main Museums in Lisbon:

- **Centro de Arte Moderna**
(*Modern Art Museum*)
- **Museu do Oriente**
(*Oriente Museum*)
- **Museu Calouste Gulbenkian**
(*Calouste Gulbenkian Museum*)
- **Museu dos Coches**
(*Coach Museum*)
- **Museu Nacional de Arte Antiga**
(*National Museum for Ancient Art*)
- **Colecção Berardo**
(*The Berardo Collection*)
- **Museu do Azulejo**
(*Tile Museum*)

Main Monuments in Lisbon:

- **Aqueduto das Águas Livres**
(*Águas Livres' Aqueduct*)
- **Basilica da Estrela**
(*Estrela Basilica*)
- **Castelo de São Jorge**
(*Saint George's Castle*)
- **Sé Patriarcal**
(*Patriarchal Church*)
- **Mosteiro dos Jerónimos**
(*Jerónimos Monastery*)
- **Padrão dos Descobrimentos**
(*Monument to the Overseas Discoveries*)
- **Torre de Belém**
(*Belém Tower*)

Map of Lisbon



 linha Azul
Blue line

 linha Amarela
Yellow line

 linha Verde
Green line

 linha Vermelha
Red line



The 5th : Joint International Conference on IMSD
: Multibody System Dynamics

Instituto Superior Técnico
Lisbon, Portugal,
June 24 - 28, 2018



Scientific Programme

Keynote Lectures

- Hiroyuki Sugiyama**, University of Iowa, USA
Jin-Hwan Choi, Kyung Hee University, Korea
Katja Mombaur, University of Heidelberg, Germany
Martin Arnold, University Halle-Wittenberg, Germany
Paulo Flores, University of Minho, Portugal
Zdravko Terze, University of Zagreb, Croatia

Session Organizers

Sessions	Organizers
Applications, Multidisciplinary Methods, and Other Topics	Werner Schiehlen , University of Stuttgart, Germany Hiroyuki Sugiyama , University of Iowa, USA
Benchmark Problems in Multibody System Dynamics	Olivier Bauchau , University of Maryland, USA Ramin Masoudi , American University in Dubai, UAE
Biomechanics	Josep Font-Llagunes , Universidad Politécnica de Cataluña, Spain Miguel Silva , University of Lisbon, Portugal Maxime Raison , École Polytechnique de Montréal, Canada
Computational Methods and Real-Time Applications	Javier Cuadrado , Universidad de La Coruña, Spain Jin-Hwan Choi , Kyung Hee University, Korea Dan Negrut , University of Wisconsin-Madison, USA
Contact, Impact, and Constraints	Hamid Lankarani , Wichita State University, USA Paulo Flores , University of Minho, Portugal
Control, Mechatronics, and Robotics	Andrés Kecskemethy , Duisburg University, Germany Sung-Soo Kim , Chungnam National University, Korea Subir Kumar Saha , IIT Delhi, India
Dynamics of Vehicles	João Pombo , Heriot-Watt University, UK Corina Sandu , Virginia Polytechnic Institute, USA Yoshihiro Suda , University of Tokyo, Japan
Flexible Multibody Systems	Aki Mikkola , Lappeenranta Univ. of Technology, Finland Ahmed Shabana , University of Illinois at Chicago, USA Alberto Cardona , CIMEC-INTEC, Argentina
Modelling, Formalisms and Theoretical Methods	Martin Arnold , University Halle-Wittenberg, Germany Daesung Bae , Hanyang University, Korea
Multibody Kinematics	Jorge Angeles , McGill University, Canada Andreas Mueller , Johannes Kepler University, Austria Hao Wang , Shanghai Jiao Tong University, China
Optimization, Sensitivity Analysis and Parameter Identification	John McPhee , University of Waterloo, Canada Peter Eberhard , University of Stuttgart, Germany Jinyang Liu , Shanghai Jiao Tong University, China



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 : Multibody System Dynamics

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 Lisbon, Portugal,
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Sessions		Monday, June 25			
08:20	Opening Ceremony				
08:30	Keynote 1 <i>Martin Arnold</i>				
09:10	Topic 05 <i>Session 01</i> ROOM MA Contact, Impact and Constraints	Topic 01 <i>Session 01</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 02 <i>Session 01</i> ROOM VA.2 Biomechanics	Topic 08 <i>Session 01</i> ROOM 02.1 Flexible Multibody Systems	
10:40	Coffee Break				
11:00	Topic 05 <i>Session 02</i> ROOM MA Contact, Impact, and Constraints	Topic 01 <i>Session 02</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 02 <i>Session 02</i> ROOM VA.2 Biomechanics	Topic 08 <i>Session 02</i> ROOM 02.1 Flexible Multibody Systems	
12:30	Lunch				
14:00	Keynote 2 <i>Jin-Hwan Choi</i>				
14:40	Topic 05 <i>Session 03</i> ROOM MA Contact, Impact and Constraints	Topic 11 <i>Session 01</i> ROOM VA.1 Optimization, Sensitivity Analysis and Parameter Identification	Topic 04 <i>Session 01</i> ROOM VA.2 Computational Methods and Real-Time Applications	Topic 09 <i>Session 01</i> ROOM 02.1 Modelling, Formalisms and Theoretical Methods	
16:10	Coffee Break				
16:30	Topic 05 <i>Session 04</i> ROOM MA Contact, Impact and Constraints	Topic 11 <i>Session 02</i> ROOM VA.1 Optimization, Sensitivity Analysis and Parameter Identification	Topic 04 <i>Session 02</i> ROOM VA.2 Computational Methods and Real-Time Applications	Topic 09 <i>Session 02</i> ROOM 02.1 Modelling, Formalisms and Theoretical Methods	
17:45	Conference Reception <i>Scenic Boat Tour on The Tagus River</i>				
20:30	Free night <i>(find your way around town and enjoy)</i>				

Sessions				Tuesday, June 26			
08:30	Keynote 3 <i>Katja Mombaur</i>						
09:10	Topic 07 <i>Session 01</i> ROOM MA Dynamics of Vehicles	Topic 01 <i>Session 03</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 02 <i>Session 03</i> ROOM VA.2 Biomechanics	Topic 09 <i>Session 03</i> ROOM 02.1 Modelling, Formalisms and Theoretical Methods			
10:40	Coffee Break						
11:00	Topic 07 <i>Session 02</i> ROOM MA Dynamics of Vehicles	Topic 01 <i>Session 04</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 02 <i>Session 04</i> ROOM VA.2 Biomechanics	Topic 09 <i>Session 04</i> ROOM 02.1 Modelling, Formalisms and Theoretical Methods			
12:30	Lunch						
14:00	Keynote 4 <i>Paulo Flores</i>						
14:40	Topic 05 <i>Session 05</i> ROOM MA Contact, Impact and Constraints	Topic 11 <i>Session 03</i> ROOM VA.1 Optimization, Sensitivity Analysis and Parameter Identification	Topic 06 <i>Session 01</i> ROOM VA.2 Control, Mechatronics and Robotics	Topic 08 <i>Session 03</i> ROOM 02.1 Flexible Multibody Systems			
16:10	Coffee Break						
16:30	Topic 05 <i>Session 06</i> ROOM MA Contact, Impact and Constraints	Topic 10 <i>Session 01</i> ROOM VA.1 Multibody Kinematics	Topic 06 <i>Session 02</i> ROOM VA.2 Control, Mechatronics, and Robotics	Topic 08 <i>Session 04</i> ROOM 02.1 Flexible Multibody Systems			

Sessions				Wednesday, June 27			
08:30	Keynote 5 <i>Hiroiyuki Sugiyama</i>						
09:10	Topic 05 <i>Session 07</i> ROOM MA Contact, Impact, and Constraints	Topic 01 <i>Session 05</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 04 <i>Session 03</i> ROOM VA.2 Computational Methods and Real-Time Applications				
10:40	Coffee Break						
11:00	Topic 05 <i>Session 08</i> ROOM MA Contact, Impact, and Constraints	Topic 01 <i>Session 06</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 04 <i>Session 04</i> ROOM VA.2 Computational Methods and Real-Time Applications	Topic 02 <i>Session 05</i> ROOM 02.1 Biomechanics			
12:30	Lunch						
14:30	Conference Tour <i>Sintra - Cabo da Roca</i>						
19:30	Conference Banquet <i>Quinta da Penha Longa, Sintra</i>						

Sessions				Thursday, June 28			
08:30	Keynote 6 <i>Zdravko Terze</i>						
09:10	Topic 07 <i>Session 03</i> ROOM MA Dynamics of Vehicles	Topic 01 <i>Session 07</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 06 <i>Session 03</i> ROOM VA.2 Control, Mechatronics and Robotics	Topic 08 <i>Session 05</i> ROOM 02.1 Flexible Multibody Systems			
10:40	Coffee Break						
11:00	Topic 07 <i>Session 04</i> ROOM MA Dynamics of Vehicles	Topic 01 <i>Session 08</i> ROOM VA.1 Applications and Multidisciplinary Methods	Topic 04 <i>Session 05</i> ROOM VA.2 Computational Methods and Real-Time Applications	Topic 08 <i>Session 06</i> ROOM 02.1 Flexible Multibody Systems			
12:30	Closing Ceremony Lunch						

Sessions

Monday, **June 25** | 08:30 h - 10:40 h

08:20 – 08:30	Main Auditorium	Opening Ceremony		
08:30 – 09:10	Main Auditorium	Keynote Lecture	Constrained systems in multibody dynamics	<i>Martin Arnold</i>

Main Auditorium	Topic 05 Session 01	Contact, Impact, and Constraints	Chairs: <i>H. Lankarani</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	105	A planar impact model for rocking block systems	<i>Zhen Zhao and Caishan Liu</i>	<i>Caishan Liu</i>
09:40 – 10:00	75	Solution of the general single contact frictional problem in multibody dynamics using b-geometry	<i>Sotirios Natsiavas and Elias Paraskevopoulos</i>	<i>Sotirios Natsiavas</i>
10:00 – 10:20	40	An improved LCP model of multiple contact problems with static friction	<i>Shuguang Ma, Tianshu Wang, Jingchen Hu, Qiang Yu and Dongbo Meng</i>	<i>Shuguang Ma</i>
10:20 – 10:40	103	Limitations of finite difference methods in the computation of coupling forces prescribed by the Reynolds equation	<i>Luboš Smolik, Jan Rendl, Martin Hartl and Pavel Polach</i>	<i>Pavel Polach</i>

Room VA.1	Topic 01 Session 01	Applications, Multidisciplinary Methods and Other Topics	Chairs: <i>W. Schiehlen</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	28	A model-based corrector approach for explicit co-simulation using subspace identification	<i>Timo Haid, Georg Stettinger, Daniel Watzenig and Martin Benedikt</i>	<i>Timo Haid</i>
09:40 – 10:00	23	Analysis of the Computation Time of Co-Simulation Methods	<i>Jan Kraft, Tobias Meyer and Bernhard Schweizer</i>	<i>Jan Kraft</i>
10:00 – 10:20	185	Pantograph catenary dynamic interaction modeling based on advanced multibody and finite element co-simulation	<i>Philippe Constant, Arnaud Capitaine and Jean-Philippe Bianchi</i>	<i>Arnaud Capitaine</i>
10:20 – 10:40	239	Dynamic Analysis of Pantograph-Catenary Interaction in Curved Railway Tracks	<i>Pedro Antunes, Jorge Ambrósio and João Pombo</i>	<i>Pedro Antunes</i>

Room VA.2	Topic 02 Session 01	Biomechanics	Chairs: <i>J. Font-Llagunes</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	98	Validation of a multi-objective optimisation for the estimation of the musculo-tendon, ligament, and joint contact forces during gait	<i>Raphael Dumas, Laurence Cheze and Florent Moissenet</i>	<i>Raphael Dumas</i>
09:40 – 10:00	230	Analysis of the musculotendon dynamics influence on the shoulder muscle force sharing problem using a fully inverse dynamics approach	<i>Carlos Quental, Margarida Azevedo, Jorge Ambrósio, Sérgio Gonçalves and João Folgado</i>	<i>Carlos Quental</i>
10:00 – 10:20	181	Influence of Ligament Modelling on Knee Joint Kinematics with respect to Multibody Optimisation	<i>Evelyn Winter, Ingomar Schröder, Rainer Bader and Christoph Woernle</i>	<i>Evelyn Winter</i>
10:20 – 10:40	78	A Novel Muscle Element based on Arbitrary Lagrange-Euler (ALE) Description	<i>Jianqiao Guo, Hongshi Huang, Kangjia Fu, Yingfang Ao and Gexue Ren</i>	<i>Jianqiao Guo</i>

Room 02.1	Topic 08 Session 01	Flexible Multibody Systems	Chairs: <i>A. Mikkola</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	158	Formulations of Viscoelastic Constitutive Laws for Beams in Flexible Multibody Dynamics	<i>Olivier Bauchau and Nishant Nemani</i>	<i>Olivier Bauchau</i>
09:40 – 10:00	96	The use of higher order beam element based on the absolute nodal coordinate formulation in dynamic analysis of rotating shafts	<i>Babak Bozorgmehri, Vesa-Ville Hurskainen, Marko Matikainen and Aki Mikkola</i>	<i>Babak Bozorgmehri</i>
10:00 – 10:20	184	A dimensional reduction algorithm and software for acyclically dependent constraints	<i>Pedro Areias</i>	<i>Pedro Areias</i>
10:20 – 10:40	72	Acceleration-based strain estimation in a beam-like structure	<i>Johannes Luthe, Andreas Schulze, Roman Rachholz, János Zierath and Christoph Woernle</i>	<i>Johannes Luthe</i>

10:40 - 11:00

Coffee Break

Sessions

Monday, **June 25** | 11:00 h - 12:40 h

Main Auditorium	Topic 05 Session 02	Contact, Impact, and Constraints	Chairs: <i>P. Flores</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	74	Terramechanics and Impact Modelling of a Spherical Hybrid Ground-Aerial Vehicle	<i>Sahand Sabet, Ali Agha and Parviz Nikravesh</i>	<i>Sahand Sabet</i>
11:20 – 11:40	108	Hybrid OpenMP - MPI Simulation for Large-Scale Granular Dynamics in Chrono	<i>Nicholas Olsen, Radu Serban, Alessandro Tasora and Dan Negrut</i>	<i>Nicholas Olsen</i>
11:40 – 12:00	115	Influence of soft and rigid contact models on granular dynamics	<i>Arman Pazouki, Michał Kwarda, Radu Serban and Dan Negrut</i>	<i>Arman Pazouki</i>
12:00 – 12:20	213	Coupling Multibody and Granular Dynamics: Experimental Validation	<i>Olivier Lantsoght, Paul Fiset, Frédéric Dubois, Olivier Brûls and Nicolas Doquier</i>	<i>Olivier Lantsoght</i>

Room VA.1	Topic 01 Session 02	Applications, Multidisciplinary Methods, and Other Topics	Chairs: <i>Y. Sugiyama</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	161	A Consistent Treatment of Boundary Conditions for Fluid-Solid Interaction Problems	<i>Zubin Lal, Milad Rakhsha and Dan Negrut</i>	<i>Zubin Lal</i>
11:20 – 11:40	4	Fully Coupled Multibody-CFD Co-simulation of a Transport Aircraft High-Lift System	<i>Alessandro Lurgo</i>	<i>Alessandro Lurgo</i>
11:40 – 12:00	227	Reduced order multibody models for the stable co-simulation of multiphysics systems	<i>Albert Peiret, Francisco Gonzalez, Jozsef Kovacs and Marek Teichmann</i>	<i>Francisco Gonzalez</i>
12:00 – 12:20	112	Chrono: An Open-Source Multi-physics Simulation Package	<i>Radu Serban, Alessandro Tasora and Dan Negrut</i>	<i>Radu Serban</i>

Room VA.2	Topic 02 Session 02	Biomechanics	Chairs: <i>M. Silva</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	8	Estimation of muscle energy expenditure in a spinal-cord-injured subject during crutch-assisted gait	<i>Florian Michaud, Urbano Luján, Javier Castro and Javier Cuadrado</i>	<i>Javier Cuadrado</i>
11:20 – 11:40	91	Exact Workspace Synthesis of RCCR Spatial Mechanism for Task-Based Knee Rehabilitation	<i>Visharath Adhikari, Yimesker Yihun and Hamid Lankarani</i>	<i>Hamid Lankarani</i>
11:40 – 12:00	42	Validation of a biomechanical model of the lower limb based on relevant actions for the control of knee rehabilitation parallel robots	<i>Nidal Farhat, Álvaro Page, Vicente Mata, Ángel Valera, Miguel Díaz and Marina Vallés</i>	<i>Álvaro Page</i>
12:00 – 12:20	223	Towards the optimal design of a passive upper limb exoskeleton compensating gravity	<i>Laurent Blanchet, Samuel Lecours, Quentin Doquier, Olivier Barron, Sofiane Achiche and Maxime Raison</i>	<i>Laurent Blanchet</i>
12:20 – 12:40	186	Kinematic model of Savannah Monitor Locomotion	<i>Adam Klodowski, Miriam Febrer-Nafria, Albert Martinez-Silvestre, Josep M. Font-Llagunes and Josep Fortuny Terricabras</i>	<i>Adam Klodowski</i>

Room 02.1	Topic 08 Session 02	Flexible Multibody Systems	Chairs: <i>O. Bauchau</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	17	Superelements in a minimal coordinates floating frame of reference formulation	<i>Jurnan Schilder, Marcel Ellenbroek and André de Boer</i>	<i>Marcel Ellenbroek</i>
11:20 – 11:40	48	Selection of generalized component modes for modally reduced flexible multibody systems	<i>Andreas Zwölfer and Johannes Gerstmayr</i>	<i>Andreas Zwölfer</i>
11:40 – 12:00	143	A model order reduction method for the simulation of gear contacts based on Arbitrary Lagrangian Eulerian formulation	<i>Xuanbo Shu, Jiapeng Liu, Gexue Ren, Aki Mikkola, Hiroyuki Kanazawa and Kengo Imaoka</i>	<i>Xuanbo Shu</i>
12:00 – 12:20	210	A Modified Rayleigh-Ritz Method for Analyzing Flexible Multibody Systems and its Applications	<i>Sinwoo Jeong and Hong Hee Yoo</i>	<i>Sinwoo Jeong</i>
12:20 – 12:40	212	A non-invasive system-level model order reduction scheme for flexible multibody models	<i>Frank Naets, Alexander Humer and Johannes Gerstmayr</i>	<i>Frank Naets</i>

12:40 - 14:00	<i>Lunch</i>			
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Sessions

Monday, **June 25** | 14:00 h - 16:10 h

14:00 – 14:40	Main Auditorium	Keynote Lecture	The development & future of multibody dynamics in the aspects of industry requirements	<i>Jin-Hwan Choi</i>
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Main Auditorium	Topic 05 Session 03	Contact, Impact, and Constraints	Chairs: <i>C. Liu</i>	
	ID	Paper	Authors	Presenter
14:50 – 15:10	237	Implementation of a non-Hertzian Contact Model for Railway Dynamics	<i>Hugo Magalhães, Filipe Marques, Binbin Liu, João Pombo, Paulo Flores, Jorge Ambrósio and Stefano Bruni</i>	<i>Hugo Magalhães</i>
15:10 – 15:30	100	A new simplified approach to deal with conformal contact in railway dynamics	<i>Filipe Marques, Hugo Magalhães, Binbin Liu, João Pombo, Paulo Flores, Jorge Ambrósio and Stefano Bruni</i>	<i>Filipe Marques</i>
15:30 – 15:50	53	Development and validation of a wear model by means of innovative measuring instruments	<i>Elisa Butini, Lorenzo Marini, Enrico Meli, Andrea Rindi, Maria Cristina Valigi and Silvia Logazzo</i>	<i>Elisa Butini</i>
15:50 – 16:10	54	Wear and Rolling Contact Fatigue: development of an innovative tool for simultaneous wheel and rail damage evaluation	<i>Elisa Butini, Lorenzo Marini, Martina Meacci, Enrico Meli and Andrea Rindi</i>	<i>Lorenzo Marini</i>

Room VA.1	Topic 11 Session 01	Optimization, Sensitivity Analysis and Parameter Identification	Chairs: <i>J. Liu</i>	
	ID	Paper	Authors	Presenter
14:50 – 15:10	26	Towards Large-Scale Topology Optimization of Dynamically Loaded Components of Flexible Multibody Systems	<i>Ali Moghadasi, Alexander Held and Robert Seifried</i>	<i>Robert Seifried</i>
15:10 – 15:30	198	Sensitivity Analysis of Multibody System Dynamics Based on L-Stable Method	<i>Jieyu Ding, Bowen Li and Xiaoxiao Zhang</i>	<i>Jieyu Ding</i>
15:30 – 15:50	171	Efficient design optimization of beam cross-sections for flexible multibody dynamics	<i>Alfonso Callejo and Olivier A. Bauchau</i>	<i>Alfonso Callejo</i>
15:50 – 16:10	64	Identification of railway vehicle seating models for passive safety improvement	<i>Marta Carvalho, João Milho and Jorge Ambrósio</i>	<i>Marta Carvalho</i>

Room VA.2	Topic 04 Session 01	Computational Methods and Real-Time Applications	Chairs: <i>J.-H. Choi</i>	
	ID	Paper	Authors	Presenter
14:50 – 15:10	49	Stress calculation in worm gears using elastic multibody models	<i>Christian Pfister, Jens Pfister, Lorin Kazaz and Peter Eberhard</i>	<i>Christian Pfister</i>
15:10 – 15:30	193	Simulating Flexible Multibody Vehicle Models in Real-Time	<i>William Prescott</i>	<i>William Prescott</i>
15:30 – 15:50	134	An Efficient Formulation for Flexible Multibody Dynamics using Dynamic Condensation of Deformation Modal Coordinates	<i>Jong-Boo Han, Jin-Gyun Kim and Sung-Soo Kim</i>	<i>Jong-Boo Han</i>
15:50 – 16:10	168	Efficient multibody dynamics simulation based on Intel's Advanced Vector Extensions	<i>Johannes Gerstmayr and Stefan Holzinger</i>	<i>Johannes Gerstmayr</i>

Room 02.1	Topic 09 Session 01	Modelling, Formalisms and Theoretical Methods	Chairs: <i>M. Arnold</i>	
	ID	Paper	Authors	Presenter
14:50 – 15:10	195	Elimination Method for Parallelization of Flexible Multibody System Dynamics with Kinematical Loops	<i>Michael Valasek and Ladislav Mraz</i>	<i>Michael Valasek</i>
15:10 – 15:30	142	Time integration of multibody systems using nonlinear domain decomposition techniques with mixed interface conditions	<i>Eva-Maria Dewes and Daniel Rixen</i>	<i>Eva-Maria Dewes</i>
15:30 – 15:50	47	BLieDF2nd - a k-step BDF integrator for constrained mechanical systems on Lie groups	<i>Victoria Wieloch and Martin Arnold</i>	<i>Victoria Wieloch</i>
15:50 – 16:10	60	Modified Newmark formulas for the rotational equations of motion of a rigid body when using Euler parameter	<i>Karim Sherif, Wolfgang Steiner and Karin Nachbagaer</i>	<i>Karim Sherif</i>

16:10 - 16:30	Coffee Break			
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Sessions

Monday, **June 25** | 16:30 h - 17:30 h

Main Auditorium	Topic 05 Session 04	Contact, Impact, and Constraints	Chairs: <i>P. Flores</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	221	Kinematics Extraction of the ATD Head Impact Component Tester from Angular Rate Sensor and Accelerometer Data	<i>Robert Huculak, Jefferson Vieira and Hamid Lankarani</i>	<i>Jefferson Vieira</i>
16:50 – 17:10	140	Full-field Measurement of Contacts/Impacts in Multibody System Using Digital Image Correlation	<i>Jianyao Wang, Zhuyong Liu, Jiazhen Hong and Zhengyue Yu</i>	<i>Zhuyong Liu</i>
17:10 – 17:30	192	Dynamic modeling and analysis of contact interaction of a passive biped-walking robot	<i>Eduardo Corral, Filipe Marques, María Jesús Gómez García, Juan Carlos García-Prada and Paulo Flores</i>	<i>Eduardo Corral</i>

Room VA.1	Topic 11 Session 02	Optimization, Sensitivity Analysis and Parameter Identification	Chairs: <i>P. Eberhard</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	31	Time optimal control of multibody systems	<i>Stefan Oberpeilsteiner, Thomas Lauss, Philipp Eichmeir and Wolfgang Steiner</i>	<i>Stefan Oberpeilsteiner</i>
16:50 – 17:10	130	High Fidelity Dynamic Modeling and Parameter Identification of Autonomous Vehicle Based on Road Tests	<i>Matthew Van Gennip and John McPhee</i>	<i>Matthew Van Gennip</i>
17:10 – 17:30	33	Optimal Control of Flexible Multibody Systems using the Adjoint Method	<i>Karin Nachbagauer, Thomas Lauß and Stefan Oberpeilsteiner</i>	<i>Karin Nachbagauer</i>

Room VA.2	Topic 04 Session 02	Computational Methods and Real-Time Applications	Chairs: <i>J. Cuadrado</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	76	Iterative refinement implementation on semirecursive algorithm for vehicle dynamics	<i>Yongjun Pan and Yansong He</i>	<i>Yongjun Pan</i>
16:50 – 17:10	116	HHT Method with Velocity Constraints Violation Correction In Index 3 Equations of Motion for Multibody Systems	<i>Xiu Teng Ma and Shou Yong Xie</i>	<i>Xiu Teng Ma</i>
17:10 – 17:30	73	Numerical integration of a new set of equations of motion for a class of multibody systems using an augmented Lagrangian approach	<i>Elias Paraskevopoulos, Nikolaos Potosakis and Sotirios Natsiavas</i>	<i>Nikolaos Potosakis</i>

Room 02.1	Topic 09 Session 02	Modelling, Formalisms and Theoretical Methods	Chairs: <i>M. Valasek</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	20	partisval – Collision-based Particle and many-body Simulations on GPUs for Planetary Exploration Systems	<i>Roy Lichtenheldt, Simon Kerler, Andreas Angerer and Wolfgang Reif</i>	<i>Roy Lichtenheldt</i>
16:50 – 17:10	175	A DAE approach to an interaction problem between a sloshing and a structural vibration	<i>Kensuke Hara</i>	<i>Kensuke Hara</i>
17:10 – 17:30	113	Dynamic Modelling of Fluid Interactions for Typical Sports Utilities	<i>Rajesh Kumar, Jyotirmoy Ray and Subir Kumar Saha</i>	<i>Rajesh Kumar</i>

18:00 - 20:00 **Conference Reception: Scenic Boat Tour on The Tagus River (Bus departs from IST at 17:45)**

Sessions

Tuesday, June 26 | 08:30 h - 10:40 h

08:30 – 09:10	Main Auditorium	Keynote Lecture	Optimization of multibody systems for biomechanical applications	Katja Mombaur
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Main Auditorium	Topic 07 Session 01	Dynamics of Vehicles	Chairs: C. Sandu	
	ID	Paper	Authors	Presenter
09:20 – 09:40	9	Influence of Track Design and Health Conditions on the Vehicle-Track Interaction Loads	Naim Kuka, Caterina Ariaudo, João Pombo and Riccardo Verardi	Naim Kuka
09:40 – 10:00	22	Simplification of the Wheel-Rail Contact Constraints Using the Knife-Edge Contact Approach	Jose Escalona, Javier Aceituno, Pedro Urda and Sergio Muñoz	Jose Escalona
10:00 – 10:20	7	Development and validation of a new degraded adhesion model for railway vehicles	Martina Meacci, Enrico Boccini, Elisa Butini, Lorenzo Marini, Enrico Meli, Andrea Rindi and Zhiyong Shi	Martina Meacci
10:20 – 10:40	110	CAD Framework for Simulation of Railway Dynamics	Rajeevlochana Chittawadigi and Subir Kumar Saha	Rajeevlochana Chittawadigi

Room VA.1	Topic 01 Session 03	Applications, Multidisciplinary Methods and Other Topics	Chairs: R. Serban	
	ID	Paper	Authors	Presenter
09:20 – 09:40	66	Co-Simulation of MBD and FE Systems with The Large Mass Method	Jin Liu, Urs Becker and Abdel-Nasser Mohammed	Urs Becker
09:40 – 10:00	5	Two-dimensional optimal motions of a two-body system	Felix Chernousko	Felix Chernousko
10:00 – 10:20	129	Multi-body modelling and simulation of locomotion systems based on tensegrity structures	Simon Gast, Erik Gerlach, Valter Böhm and Klaus Zimmermann	Erik Gerlach
10:20 – 10:40	15	On the Validation of Human Body Models with a Driver-in-the-Loop Simulator	Fabian Kempter, Joerg Fehr, Norman Stutzig and Tobias Siebert	Joerg Fehr

Room VA.2	Topic 02 Session 03	Biomechanics	Chairs: M. Raison	
	ID	Paper	Authors	Presenter
09:20 – 09:40	147	Reduction of ground-foot impact intensity of a hopping leg model on slopes	Ambrus Zelei and Tamás Insuperger	Ambrus Zelei
09:40 – 10:00	11	Foot-ground contact modelling for computational prediction of human walking motion	Miriam Febrer-Nafria, Rosa Pàmies-Vilà and Josep M. Font-Llagunes	Miriam Febrer-Nafria
10:00 – 10:20	77	Asymmetric Trajectory Generation for the Biped Ascending Stairs	Lulu Gong, Zhongshu Xu, Weikang Zeng, Yungpeng Li, Xiaolu Tai, Lei Li, Yang Liu and Jingxin Pang	Lulu Gong
10:20 – 10:40	87	Implementation of an Extended Kalman Filter for optical motion capture with real-time 3D visualization	Urbano Lúgrís, Rubén Vilela, Emilio Sanjurjo, Francisco Mouzo and Florian Michaud	Urbano Lúgrís

Room 02.1	Topic 09 Session 03	Modelling, Formalisms and Theoretical Methods	Chairs: M. Arnold	
	ID	Paper	Authors	Presenter
09:20 – 09:40	225	An Adaptive Multiscale Method for Biomolecular Systems	Ashley Guy and Alan Bowling	Alan Bowling
09:40 – 10:00	52	A rigid body formulation with non-redundant unified local velocity coordinates	Stefan Holzinger, Johannes Gerstmayr and Joachim Schöberl	Stefan Holzinger
10:00 – 10:20	70	A novel method for the forced vibration of Duffing oscillator	Hai-En Du, Guo-Kang Er and Vai Pan Lu	Hai-En Du
10:20 – 10:40	71	Computing Inter-Body Constraint Forces in Recursive Multibody Dynamics	Abhinandan Jain	Abhinandan Jain

10:40 - 11:00	Coffee Break			
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Sessions

Tuesday, **June 26** | 11:00 h - 12:40 h

Main Auditorium	Topic 07 Session 02	Dynamics of Vehicles	Chairs: <i>J. Pombo</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	200	Assessment of the necessary width of a bicycle lane by means of multibody simulations on a bicycle-rider system	<i>A.L. Schwab and J.P. Meijaard</i>	<i>A.L. Schwab</i>
11:20 – 11:40	58	Analysis on the stability of a bicycle moving on a surface of revolution	<i>Jiaming Xiong, Nannan Wang and Caishan Liu</i>	<i>Jiaming Xiong</i>
11:40 – 12:00	101	Modeling of a Real Vehicle in MBSVT and Validation Effort using Experimental Data	<i>José Luis Bueno López, Sebastien Corner and Corina Sandu</i>	<i>Corina Sandu</i>
12:00 – 12:20	124	Tire-suspension HILS system with additional degree of freedom for heaving motion	<i>Taichi Shiiba, Tadashi Iwasaki and Tomohiro Hosono</i>	<i>Taichi Shiiba</i>
12:00 – 12:20	141	Development and experimental validation of a numerical multibody model for the dynamic analysis of a counterbalance forklift truck	<i>Leonardo Ventura, Giovanni Paolo Bonelli and Alberto Martini</i>	<i>Alberto Martini</i>

Room VA.1	Topic 01 Session 04	Applications, Multidisciplinary Methods, and Other Topics	Chairs: <i>J. Fehr</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	36	Particle Simulation Interacting with Moving Flexible Bodies through Standard Particle Interface	<i>Jaesung Park, Juhwan Choi and Jin Hwan Choi</i>	<i>Jaesung Park</i>
11:20 – 11:40	99	Vibration mitigation of a 3 MW wind turbine through passive structural control	<i>Andreas Schulze, János Zierath, Roman Rachholz, Christoph Woernle, Reik Bockhahn and Sven-Erik Rosenow</i>	<i>Andreas Schulze</i>
11:40 – 12:00	119	A Measurement and Signal Processing Concept for the Dynamic Analysis of Operating Wind Turbines	<i>János Zierath, Reik Bockhahn, Roman Rachholz, Sven-Erik Rosenow, Andreas Schulze, Johannes Luthe and Christoph Woernle</i>	<i>János Zierath</i>
12:00 – 12:20	93	ESA multibody tool for launchers and spacecrafts: lesson learnt and future challenges	<i>Mario Toso and Valerio Rossi</i>	<i>Mario Toso</i>

Room VA.2	Topic 02 Session 04	Biomechanics	Chairs: <i>M. Silva</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	218	Customized MBD models to contribute to answering clinical questions about the spine in motion	<i>Maxime Raison, Aubain Verlé, Gabriel Abedrabbo, Christine Detrembleur, Philippe Mahaudens and Paul Fisette</i>	<i>Maxime Raison</i>
11:20 – 11:40	217	Direct and Inverse Analysis of Human Spine for Helicopter Comfort Assessment	<i>Pierangelo Masarati and Andrea Zanoni</i>	<i>Andrea Zanoni</i>
11:40 – 12:00	24	Influence of different body pose reconstruction methods in the solution of the inverse dynamic problem during human gait without force plates	<i>Joaquín Ojeda, Juan Morales and Juana Mayo</i>	<i>Joaquín Ojeda</i>
12:00 – 12:20	89	Generating realistic trajectories for robotic hippotherapy from 3D captured horseback motion	<i>Jakob Ziegler, Hubert Gattringer, Alexander Reiter, Philip Hoermandinger and Andreas Mueller</i>	<i>Jakob Ziegler</i>
12:20 – 12:40	220	Power spectrum analysis of contact forces and force moments during normal and modified gait	<i>Carlos Rodrigues, Miguel Correia, João Abrantes, Jurandir Nadal and Marco Benedetti</i>	<i>Carlos Rodrigues</i>

Room 02.1	Topic 09 Session 04	Modelling, Formalisms and Theoretical Methods	Chairs: <i>R. Seifried</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	10	Model-based pre-step stabilization method for non-iterative co-simulation	<i>Simon Genser and Martin Benedikt</i>	<i>Simon Genser</i>
11:20 – 11:40	160	Higher – order Rodrigues dual vectors. Kinematic equations and tangent operator	<i>Daniel Condurache</i>	<i>Daniel Condurache</i>
11:40 – 12:00	197	The motions of the celt on a horizontal plane with viscous friction	<i>Maria Munitsyna</i>	<i>Maria Munitsyna</i>
12:00 – 12:20	50	Determination of Minimal Realizations in Multibody Systems	<i>Bruce Minaker and Francisco Gonzalez</i>	<i>Bruce Minaker</i>

12:40 - 14:00	<i>Lunch</i>			
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Sessions

Tuesday, June 26 | 14:00 h - 16:10 h

14:00 - 14:40	Main Auditorium	Keynote Lecture	Contact Mechanics for Multibody Dynamics	Paulo Flores
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Main Auditorium	Topic 05 Session 05	Contact, Impact, and Constraints	Chairs: O. Bruls	
	ID	Paper	Authors	Presenter
14:50 – 15:10	34	Gear drive simulations with friction and higher order ansatz functions using elastic multibody models	Peter Eberhard, Lorin Kazaz, Pascal Ziegler and Christian Pfister	Peter Eberhard
15:10 – 15:30	29	Formulation and Analysis of Sliding Joints with Clearances in Flexible Multibody Systems	Lingling Tang and Jinyang Liu	Jinyang Liu
15:30 – 15:50	12	A Methodology for Modeling and Simulating Frictional Translational Joint with a Flexible Slider and Clearance in Multibody Systems	Xudong Zheng and Qi Wang	Xudong Zheng
15:50 – 16:10	139	A Transient EHL contact model describing system-level spur gears dynamic behavior	Leoluca Scurria, Tommaso Tamarozzi, Pavel Jiranek and Dieter Fauconnier	Leoluca Scurria

Room VA.1	Topic 11 Session 03	Optimization, Sensitivity Analysis and Parameter Identification	Chairs: L. Liu	
	ID	Paper	Authors	Presenter
14:50 – 15:10	189	Multibody based topology optimization including manufacturing constraints	Karim Asrih, Francesco Cosco, Frank Naets and Wim Desmet	Karim Asrih
15:10 – 15:30	97	A system-level bushing joint parameter identification approach using flexible multibody models	Simon Vanpaemel, Frank Naets and Wim Desmet	Simon Vanpaemel
15:30 – 15:50	231	Sensitivity analysis of a full vehicle model using ALI3-P and Matrix-R formulations	Daniel Dopico Dopico, Alberto Luaces Fernández, Francisco González Varela and Mariano Saura Sánchez	Alberto Luaces Fernández

Room VA.2	Topic 06 Session 01	Control, Mechatronics, and Robotics	Chairs: S.S. Kim	
	ID	Paper	Authors	Presenter
14:50 – 15:10	209	Feedforward control of a crane manipulator	Michael Stoltmann, Pascal Froitzheim, Norman Fuchs and Christoph Woernle	Christoph Woernle
15:10 – 15:30	30	Stability-Limit Analysis of Time-Delayed Systems	Dominik Hamann and Peter Eberhard	Dominik Hamann
15:30 – 15:50	62	An Experimental Study on the Cooperative Transportation of a Load Using Swarm Robots	Ehsan Sharafian Ardakani, Henrik Ebel and Peter Eberhard	Ehsan Sharafian Ardakani
15:50 – 16:10	6	Modeling and Simulation of In-pipe Inspection Robot Behavior through Pipeline Fittings	Krešimir Osman and Zdenko Kovačić	Krešimir Osman

Room 02.1	Topic 08 Session 03	Flexible Multibody Systems	Chairs: A. Kłodowski	
	ID	Paper	Authors	Presenter
14:50 – 15:10	211	Nonlinear state estimation in flexible-link multibody systems through reduced-order models	Ilaria Palomba, Dario Richiedei and Alberto Trevisani	Ilaria Palomba
15:10 – 15:30	13	On FE Modeling of a Multibody Flexible System with Moving Parts acting as Controllers for Attenuation of Vibrations	Walerian Szyzkowski and Ehsan Sharbati	Walerian Szyzkowski
15:30 – 15:50	121	Application of ANCF Beams in Buckling Analysis	Jia Wang, Hongsheng Zhang, Marko K Matikainen and Aki M Mikkola	Jia Wang
15:50 – 16:10	46	Bifurcation analysis of landing gear shimmy using flexible multibody models	Camiel J. J. Beckers, A. Emre Öngüt, Bert Verbeek, Rob H. B. Fey, Yves Lemmens and Nathan van de Wouw	Emre Öngüt

16:10 - 16:30	Coffee Break			
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Sessions

Tuesday, **June 26** | 16:30 h - 18:10 h

Main Auditorium	Topic 05 Session 06	Contact, Impact, and Constraints	Chairs: <i>S. Natsiavas</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	128	Time integration of nonsmooth mechanical systems using constraints at position, velocity and acceleration levels	<i>Olivier Bruls, Vincent Acary and Alberto Cardona</i>	<i>Olivier Bruls</i>
16:50 – 17:10	132	Gauss principle of least constraints for nonsmooth multibody system	<i>Yao Wenli and Song Kewei</i>	<i>Yao Wenli</i>
17:10 – 17:30	3	Rigid Bodies in Continuum mechanics	<i>René Souchet-Daniel</i>	<i>René Souchet-Daniel</i>

Room VA.1	Topic 10 Session 01	Multibody Kinematics	Chairs: <i>H. Wang</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	159	Higher-order acceleration centers and kinematic invariants of rigid body	<i>Daniel Condurache</i>	<i>Daniel Condurache</i>
16:50 – 17:10	164	Kinematic calibration of a 2-DOF flexure-based manipulator	<i>Ronald Aarts</i>	<i>Ronald Aarts</i>
17:10 – 17:30	169	Comparison of motion representations for efficient numerical simulation of flexible multibody systems	<i>Valentin Sonneville and Olivier Bauchau</i>	<i>Valentin Sonneville</i>
17:30 – 17:50	190	Set-Based Design of Automobile Independent Suspension Linkages	<i>David Kline and Gregory Hulbert</i>	<i>David Kline</i>
17:50 – 18:10	236	Singularity-free non-redundant time integration of multibody systems models in absolute coordinate formulation	<i>Andreas Mueller, Zdravko Terze and Viktor Pandža</i>	<i>Andreas Mueller</i>

Room VA.2	Topic 06 Session 02	Control, Mechatronics, and Robotics	Chairs: <i>O. Verlinden</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	123	Active Multidimensional Vibration Absorbers for Light Robots	<i>Zbyněk Šika, Karel Kraus, Petr Beneš, Tomáš Vyhřídál and Michael Valášek</i>	<i>Zbyněk Šika</i>
16:50 – 17:10	135	Validation of the Velocity Planning Method for the Off-road Unmanned Ground Vehicle	<i>Hajun Song, Sung-Soo Kim, Mooncheol Won, Wan Suk Yoo, Jongho Shin and Dong Jun Kwak</i>	<i>Sung-Soo Kim</i>
17:10 – 17:30	57	TerRA: Terramechanics for Real-time Application	<i>Stefan Barthelmes</i>	<i>Stefan Barthelmes</i>
17:30 – 17:50	106	Obstacle Climbing Improvement of Wheeled Mobile Robots with Extendable Bodies	<i>Saeed Ebrahimi and Arman Mardani</i>	<i>Saeed Ebrahimi</i>
17:50 – 18:10	187	Inverse Kinematics for General 6R Manipulators in RoboAnalyzer	<i>Sasanka Sekhar Sinha, Rajeevlochana Chittawadigi and Subir Kumar Saha</i>	<i>Sasanka Sekhar Sinha</i>

Room 02.1	Topic 08 Session 04	Flexible Multibody Systems	Chairs: <i>F. Naets</i>	
	ID	Paper	Authors	Presenter
16:30 – 16:50	95	A study of contact descriptions in the framework of the absolute nodal coordinate formulation	<i>Xinxin Yu, Ajay B. Harish, Marko K. Matikainen, Babak Bozorgmehri and Aki Mikkola</i>	<i>Xinxin Yu</i>
16:50 – 17:10	144	Mathematical modelling of spatial linkages with clearance, friction and links' flexibility effects	<i>Krzysztof Augustynek and Andrzej Urbaś</i>	<i>Krzysztof Augustynek</i>
17:10 – 17:30	170	Oblique impact for flexible robotic finger system	<i>Jiongcan Yang and Yunian Shen</i>	<i>Jiongcan Yang</i>
17:30 – 17:50	80	Multibody models of railway vehicle and track with flexible wheelsets and rails	<i>Mustapha Afriad, Mohamed Rachik, Ludovic Cauvin, Danilo Sorrentino and Sönke Kraft</i>	<i>Mustapha Afriad</i>
17:50 – 18:10	82	A mixed finite beam element based on the absolute nodal coordinate formulation for nearly incompressible elasticity	<i>Shiva Adika, Ajay B Harish and Marko K Matikainen</i>	<i>Marko K Matikainen</i>

Sessions

Wednesday, June 27 | 08:30 h - 10:40 h

08:30 – 09:10	Main Auditorium	Keynote Lecture	Modeling of Wheel-Rail Contact Dynamics: From Contact Geometry to Damage Prediction	<i>Hiroyuki Sugiyama</i>
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Main Auditorium	Topic 05 Session 07	Contact, Impact, and Constraints	Chairs: <i>C. Liu</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	14	Using superposition of local soil flow fields to improve soil deformation in the DLR Soil Contact Model - SCM	<i>Fabian Buse</i>	<i>Fabian Buse</i>
09:40 – 10:00	18	Impacts in case of triple unilateral constraint system	<i>Krzysztof Lipinski</i>	<i>Krzysztof Lipinski</i>
10:00 – 10:20	224	Measuring the Error in Mixed Linear Complementarity Problem Formulations for Multibody Systems with Contact	<i>Andreas Enzenhöfer, Albert Peiret, Marek Teichmann and József Kövecses</i>	<i>Albert Peiret</i>

Room VA.1	Topic 01 Session 05	Applications, Multidisciplinary Methods and Other Topics	Chairs: <i>Y. Sugiyama</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	153	On the long History of MAGLEV Trains	<i>Werner Schiehlen and Reinhold Meisinger</i>	<i>Werner Schiehlen</i>
09:40 – 10:00	201	Specification Study of Railway Test Track with R33 Curve Section	<i>Shihpin Lin, Daiki Tamura and Yoahiro Suda</i>	<i>Shihpin Lin</i>
10:00 – 10:20	229	Dynamic behavior of a railway crossing: comparison of the results of multibody system dynamic and explicit FEM models	<i>Valeri Markine, Xiangming Liu and Yuewei Ma</i>	<i>Valeri Markine</i>
10:20 – 10:40	240	Application of time-frequency representations for the detection of railway track singularities	<i>Pablo Salvador, Ignacio Villalba, Pablo Martínez Fernández and Ricardo Insa</i>	<i>Pablo Salvador</i>

Room VA.2	Topic 04 Session 03	Computational Methods and Real-Time Applications	Chairs: <i>Z. Terze</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	122	A Computationally Efficient Approach for Monolithic Simulation of Multibody and Hydraulic Dynamics	<i>Jarkko Rahikainen, Aki Mikkola, Jussi Sopanen, Asko Rouvinen, Pasi Korkealaakso and Johannes Gerstmayr</i>	<i>Jarkko Rahikainen</i>
09:40 – 10:00	55	An Efficient High-precision Recursive Algorithm for Net Multibody Systems	<i>Jingchen Hu, Tianshu Wang, Shuguang Ma and Qiang Yu</i>	<i>Jingchen Hu</i>
10:00 – 10:20	214	Detailed Multibody Simulation in Real Time	<i>Naresh Khude and Michael Collingridge</i>	<i>Michael Collingridge</i>
10:20 – 10:40	226	Dynamic Analysis of Planar Multibody Systems with Fully Cartesian Coordinates	<i>Ivo Roupa, Sérgio Gonçalves and Miguel Tavares Da Silva</i>	<i>Ivo Roupa</i>

10:40 - 11:00	Coffee Break			
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Sessions

Wednesday, June 27 | 11:00 h - 12:40 h

Main Auditorium	Topic 05 Session 08	Contact, Impact, and Constraints	Chairs: <i>H. Lankarani</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	196	The Shimmy Phenomenon in Dynamics of Driven Rigid Castor Wheel	<i>Alexandra Zobova</i>	<i>Alexandra Zobova</i>
11:20 – 11:40	56	Modeling and numerical simulation for an asymmetric dimer on a vibrating plate	<i>Runsen Zhang and Qi Wang</i>	<i>Runsen Zhang</i>
11:40 – 12:00	86	How Automated Data-Collection Dynamics Embeds Bias into Dataset	<i>Daolin Ma and Alberto Rodriguez</i>	<i>Daolin Ma</i>
12:00 – 12:20	146	Verify the Performance Levels of Vehicle Restraint Systems with Multibody System Dynamics	<i>Detlef H.-J. F. Neuenhaus and Urs Joachim Gessler</i>	<i>Detlef H.-J. F. Neuenhaus</i>

Room VA.1	Topic 01 Session 06	Applications, Multidisciplinary Methods, and Other Topics	Chairs: <i>V. Markine</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	191	Thermomechanical Analysis of Interconnected Multibody Systems Using Floating Frame of Reference Formulation	<i>Hiroki Yamashita, Rohit Arora, Hiroyuki Kanazawa and Hiroyuki Sugiyama</i>	<i>Hiroyuki Sugiyama</i>
11:20 – 11:40	131	Development of Tire Test Mode under Circuit Driving Condition to Estimate Degradation of a Tire	<i>Sung Pil Jung, Hyun Seok Song, Sung Jin Choi and Tae Won Park</i>	<i>Sung Pil Jung</i>
11:40 – 12:00	133	Development jounce-support bumper assembly with increased energy absorption rate to improve vehicle driving performance	<i>Chulhyung Lee, Taewon Park, Myeongjae Han, Hyunseok Song, Sukjin Lee and Jeongsik Park</i>	<i>Chulhyung Lee</i>
12:00 – 12:20	136	Coupled Thermo-Mechanical FE Analysis of Brake Systems Considering a Temperature-Dependent Nonlinear Friction Coefficient	<i>Myeong Jae Han, Chul Hyung Lee, Tae Won Park and Kyung Seok Sim</i>	<i>Myeong Jae Han</i>

Room VA.2	Topic 04 Session 04	Computational Methods and Real-Time Applications	Chairs: <i>J. Gerstmayr</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	39	High Load Capacity Crane Analysis for Real-Time Applications Using Arbitrary Eulerian-Lagrangian Modal Approach	<i>Grzegorz Orzechowski, Aki M. Mikkola and José L. Escalona</i>	<i>Grzegorz Orzechowski</i>
11:20 – 11:40	180	Experimental and numerical validation of dynamic transmission error using advanced gear contact model in a multibody framework	<i>Shadi Shweiki, Ali Rezayat, Tommaso Tamarozzi and Domenico Mundo</i>	<i>Shadi Shweiki</i>
11:40 – 12:00	204	Data-Driven Model Order Reduction for real-time multibody simulations	<i>Andrea Angeli, Frank Naets and Wim Desmet</i>	<i>Andrea Angeli</i>
12:00 – 12:20	219	Shallow Water Dampers for Mitigation of Wind Turbine Tower Vibrations	<i>Thomas Juul, Peter Christian Jakobsen, Ole Balling, Zili Zhang and Philip van der Borch</i>	<i>Ole Balling</i>

Room 02.1	Topic 02 Session 05	Biomechanics	Chairs: <i>M. Silva</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	247	A Case Study on Human Gait CoP and GRF Progression During Single-Limb Support - Comparison between Experiment, Multi-Sphere and Continuous Rolling Surface Contact	<i>Lennart Caspers and Andrés Kecskeméthy</i>	<i>Andrés Kecskeméthy</i>
11:20 – 11:40	44	Fluid Pressure Distribution and Tonotopy in the Human Inner Ear	<i>Pascal Ziegler, Philipp Wahl and Peter Eberhard</i>	<i>Pascal Ziegler</i>
11:40 – 12:00	157	The effect of visual feedback during stick balancing	<i>Laszlo Bencsik, Dalma J. Nagy and Tamás Insuperger</i>	<i>Laszlo Bencsik</i>
12:00 – 12:20	208	Development of a Multibody-Based Methodology for Motion Simulation of Biomechanical Systems using Natural Coordinates	<i>Sérgio Gonçalves and Miguel Tavares Da Silva</i>	<i>Sérgio Gonçalves</i>
12:20 – 12:40	41	Comparison of different actuation modes of a biomechanical human arm model in an optimal control framework	<i>Marius Obentheuer, Michael Roller, Staffan Björkenstam, Karsten Berns and Joachim Linn</i>	<i>Marius Obentheuer</i>

12:40 -14:00	<i>Lunch</i>			
14:00 -19:30	Conference Tour: Cabo da Roca - Sintra (Bus departs from IST at 14:30)			
19:30 -23:00	Conference Banquet at Penha Longa, Sintra			

Sessions

Thursday, June 28 | 08:30 h - 10:40 h

08:30 – 09:10	Main Auditorium	Keynote Lecture	Dynamics of Multibody Systems in Fluid Flow: Geometric Formulations in Lie Group Setting	<i>Zdravko Terze</i>
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Main Auditorium	Topic 07 Session 03	Dynamics of Vehicles	Chairs: <i>C. Sandu</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	238	Validated Slab Track Models for Railway Vehicle Dynamics	<i>João Pombo, Denise Thölken, Bowen Hou and Enrico Meli</i>	<i>João Pombo</i>
09:40 – 10:00	120	A Combined Ride and Handling Model for Railway Vehicles	<i>S Vishnu, Subir K Saha and S P Singh</i>	<i>S Vishnu</i>
10:00 – 10:20	16	Roller coaster train dynamics: the effect of the zero-car location	<i>Jurnan Schilder</i>	<i>Jurnan Schilder</i>
10:20 – 10:40	232	Multibody dynamic modelling and analysis of roller coaster vehicles	<i>Jorge Ambrósio, Mario Viegas, Pedro Antunes and Hugo Magalhães</i>	<i>Jorge Ambrósio</i>

Room VA.1	Topic 01 Session 07	Applications, Multidisciplinary Methods and Other Topics	Chairs: <i>Z. Terze</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	107	Multibody modelling of a flexible 6-axis robot dedicated to robotic machining	<i>Hoai Nam Huynh, Edouard Rivière-Lorphèvre and Olivier Verlinden</i>	<i>Olivier Verlinden</i>
09:40 – 10:00	206	Modeling of machining operations based on the Virtual Machine Tool concept	<i>Frederic Cugnon, Luke Berglind, Denys Plakhotnik and Mikel Armendia</i>	<i>Frederic Cugnon</i>
10:00 – 10:20	111	Investigation of falling control rods in deformed guiding tubes in nuclear reactors using multibody approaches	<i>Radek Bulín, Michal Hajzman and Pavel Polach</i>	<i>Radek Bulín</i>
10:20 – 10:40	222	Geometric Modeling of Flapping Wing Dynamics in Lie Group Setting	<i>Zdravko Terze, Viktor Pandža and Dario Zlatar</i>	<i>Viktor Pandža</i>

Room VA.2	Topic 06 Session 03	Control, Mechatronics, and Robotics	Chairs: <i>A. Kecskemethy</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	127	Flexible models of a three degree of freedom serial elastic robot	<i>Arthur Lismonde, Hubert Gattringer and Olivier Brüls</i>	<i>Arthur Lismonde</i>
09:40 – 10:00	25	Analysis of Servo-constraints Solution Approaches for Underactuated Multibody Systems	<i>Svenja Otto and Robert Seifried</i>	<i>Svenja Otto</i>
10:00 – 10:20	68	A Space Soft Robot of Multi-joint Ring Structure	<i>Yuan Zhong, Jingchen Hu and Hexi Baoyin</i>	<i>Yuan Zhong</i>
10:20 – 10:40	84	Miniature Jumping Robot With Consecutive Jumping Ability	<i>Valentin Zaytsev, Uri Ben Hanan and Avi Weiss</i>	<i>Avi Weiss</i>

Room 02.1	Topic 08 Session 05	Flexible Multibody Systems	Chairs: <i>A.L. Schwab</i>	
	ID	Paper	Authors	Presenter
09:20 – 09:40	145	Strain-Based Formulation for Dynamic Analysis of Three-Dimensional Beams	<i>Eva Zupan and Dejan Zupan</i>	<i>Dejan Zupan</i>
09:40 – 10:00	152	Dynamics of Rigid-Flexible Spatial Four-Bar Mechanism	<i>Paramanand Vivekanand Nandihal and Subir Kumar Saha</i>	<i>Paramanand V. Nandihal</i>
10:00 – 10:20	109	High Order ANCF Beam Element: Integration with Computer Aided Design and Application in Leaf Spring Modeling	<i>Zuqing Yu and Peng Lan</i>	<i>Zuqing Yu</i>
10:20 – 10:40	202	Modelling and Parameter Identification of the Leg of an Ultralight Robotic System	<i>Arash Khodaparastsichani, Ryan Steindl, Pavan Sikka and Alberto Elfes</i>	<i>Arash Khodaparast-sichani</i>

10:40 - 11:00	Coffee Break			
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Sessions

Thursday, June 28 | 11:00 h - 12:40 h

Main Auditorium	Topic 07 Session 04	Dynamics of Vehicles	Chairs: <i>J. Pombo</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	85	Implementation of State Observers based on Multibody Dynamics on Automotive Platforms in Real-Time	<i>Antonio J. Rodriguez, Roland Pastorino, Alberto Luaces, Emilio Sanjurjo and Miguel Á. Naya</i>	<i>Antonio J. Rodríguez</i>
11:20 – 11:40	32	State and input observer for the multibody model of a car	<i>Emilio Sanjurjo, Daniel Dopico, Alberto Luaces and Miguel Ángel Naya</i>	<i>Emilio Sanjurjo</i>
11:40 – 12:00	61	Handling Quality Quantification of an Actively Controlled Narrow Track Vehicle	<i>Quentin Docquier and Paul Fiset</i>	<i>Quentin Docquier</i>
12:00 – 12:20	88	Novel nonlinear lumped parameter model for asymmetric rubber bushing components	<i>Rocco Adduci, Francesco Cosco, Tomas Keppens and Wim Desmet</i>	<i>Rocco Adduci</i>

Room VA.1	Topic 01 Session 08	Applications, Multidisciplinary Methods, and Other Topics	Chairs: <i>W. Schiehlen</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	125	Synchrono: A Multi-Agent Simulation Framework for Robotics and Autonomous Vehicle Applications	<i>Asher Elmquist, Dylan Hatch, Radu Serban and Dan Negrut</i>	<i>Asher Elmquist</i>
11:20 – 11:40	59	Dynamic simulation for rigid body system coupled with hydraulic system considering digging behavior of soil	<i>Etsujiro Imanishi</i>	<i>Etsujiro Imanishi</i>
11:40 – 12:00	92	Failure modes and optimal performance of a generic synchronizer	<i>Muhammad Irfan, Viktor Berbyuk and Håkan Johansson</i>	<i>Muhammad Irfan</i>
12:00 – 12:20	177	Improved Recursive Dynamics Simulator (ReDySim) for Multibody Systems	<i>Suril Shah, Venugopal Acche and Subir Kumar Saha</i>	<i>Suril Shah</i>

Room VA.2	Topic 04 Session 05	Computational Methods and Real-Time Applications	Chairs: <i>J. Cuadrado</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	37	Generating Driving Signals of a Virtual Test Rig for Replication of Physical Target Signals using RecurDyn/TSG Toolkit	<i>Ho-Young Cha, Yongwoo Jun, Juhwan Choi and Jin Hwan Choi</i>	<i>Ho-Young Cha</i>
11:20 – 11:40	51	Dynamic Load Balancing for Large Scale Particle Simulations	<i>Sebastian Eibl, Florian Schornbaum and Ulrich Rude</i>	<i>Sebastian Eibl</i>
11:40 – 12:00	69	Haptic Piano Key based on a Real-Time Multibody Model of the Double Escapement Grand Piano Action	<i>Sébastien Timmermans, Paul Fiset, Bruno Dehez and Anne-Emmanuelle Ceulemans</i>	<i>Sébastien Timmermans</i>

Room 02.1	Topic 08 Session 06	Flexible Multibody Systems	Chairs: <i>A. Mikkola</i>	
	ID	Paper	Authors	Presenter
11:00 – 11:20	102	Dynamic Behaviors of Composite Flexible Structure with Piezoelectric Actuators via Absolute Nodal Coordinate Formulation	<i>Haidong Yu, Canming Yi and Hao Wang</i>	<i>Haidong Yu</i>
11:20 – 11:40	151	Deployment Dynamics of Mesh Antennas with a Modeling Method of Tackling the Inherent Multiscale Problem	<i>Zhihua Zhao, Yun Peng, Jungang Yang and Yong Xiao</i>	<i>Zhihua Zhao</i>
11:40 – 12:00	156	Solar Sail Deployment Dynamics	<i>Behrad Vatankhahghadim and Christopher Damaren</i>	<i>Behrad Vatankhahghadim</i>
12:00 – 12:20	173	Flexible multibody dynamics using polygonal elements	<i>Arturo Cubas and Ivan F. M. Menezes</i>	<i>Arturo Cubas</i>

12:30 - 12:40	Main Auditorium	Closing Ceremony		
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12:40 - 14:00	Lunch			
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