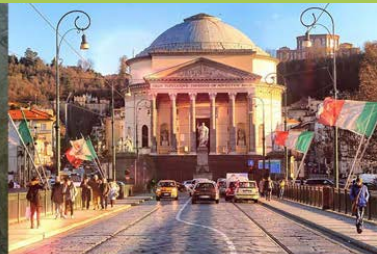


# ICCCM 2023

## 7<sup>th</sup> International Conference on Computational Contact Mechanics

5-7 July 2023, Torino - Italy



#### ORGANIZERS

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# **ICCCM 2023**

**VII International Conference  
on Computational Contact Mechanics**

**July 5 - 7, 2023 - Torino, Italy**

**General Info & Daily Program**



# **COMPUTATIONAL CONTACT MECHANICS**

Proceedings of the VII International Conference on  
Computational Contact Mechanics, held in Torino, Italy

**July 5 - 7, 2023**

Edited by

**Giorgio Zavarise**

*Politecnico di Torino, Torino, Italy*

**Alexander Popp**

*Universität der Bundeswehr München, Germany*

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# 1. PREFACE

In the last years, Computational Contact Mechanics has been a topic of broad interest and very intense research. The main effort has been devoted to the development of robust solution schemes and new discretization techniques, which can be applied to different classes of contact problems.

In such context, the aim of the VII International Conference on Computational Contact Mechanics is to provide an international forum for researchers, practitioners and for all the scientists who are concerned with modern computational techniques and applications in the field of Contact Mechanics.

Previous meetings in the ICCCM series were held in Lecce (2009, 2013 and 2017) and Hannover (2011, 2015 and 2019). All these meetings have been very successful and, together with the present one, they are becoming an established event in the field. Due to the covid pandemic, the 2021 edition, scheduled in Torino, has been postponed to 2023.

The organizers hope that this event will provide a platform for participants to discuss recent advances and identify future research directions in the field.

The Conference program is divided into twelve sessions related to specific topics. Four keynote lectures, presented by internationally recognized researchers in this field, will provide an overview on current research directions.

After the conference, it is planned to invite authors of selected contributions to submit a full paper, for inclusion in a special issue of an international journal or in another publication of international relevance.

Torino, July 2023

The Chairmen of ICCCM 2023

Giorgio Zavarise & Alexander Popp

## 2. PATRONAGES & SPONSORS

The conference organizers acknowledge the support towards the organization of the ICCCM 2023 to the following organizations:

 <p><b>Politecnico di Torino</b></p>	 <p><b>DISEG</b> Department of Structural, Geotechnical and Building Engineering</p>
 <p><b>UNIVERSITÀ DEL SALENTO</b></p>	 <p>Dipartimento di Matematica e Fisica <i>"Ennio De Giorgi"</i></p>
<p>der Bundeswehr <b>Universität München</b></p> 	 <p>Zentrum für Digitalisierungs- und Technologieforschung der Bundeswehr</p>
 <p>European Community on Computational Methods in Applied Sciences</p>	 <p>EnginSoft S.p.A.</p>



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### 3. CONFERENCE ORGANIZERS

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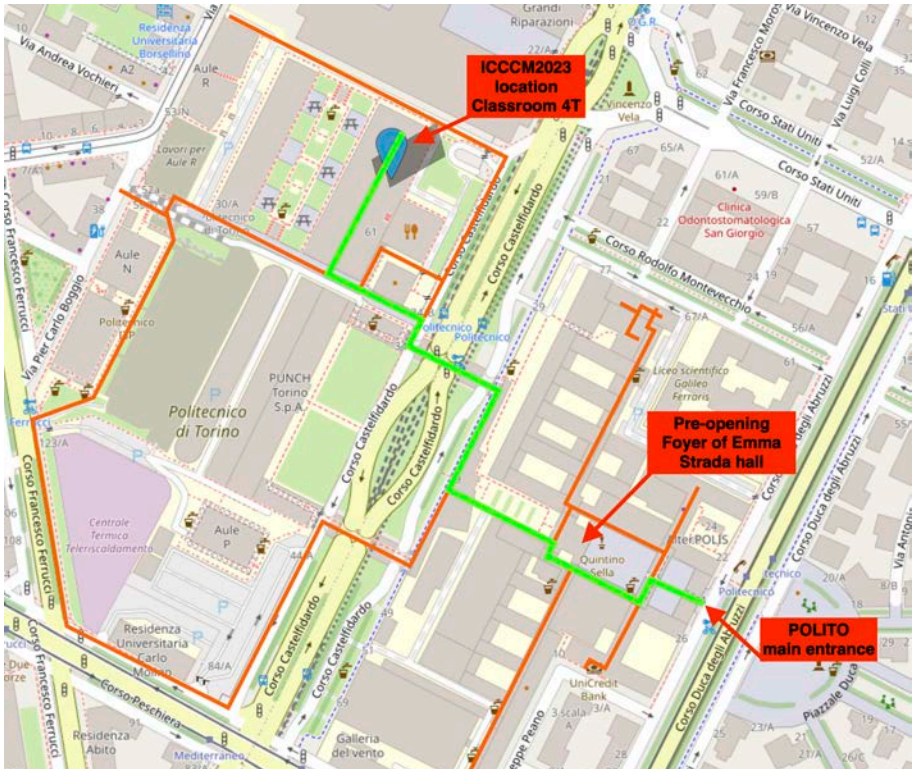
## 4. INTERNATIONAL SCIENTIFIC COMMITTEE

Vincent Acary	Institut National de Recherche en Sciences et Technologies du Numérique - INRIA, France
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Ilker Temizer	Bilkent University, Turkey
Manuel Tur	Universitat Politècnica de València, Spain
Peter Wriggers	Leibniz Universität Hannover, Germany
Vladislav Yastrebov	MINES Paris, PSL University, CNRS, France

## 5. KEYNOTE LECTURERS

	<p><b>Rolf Krause</b> Università della Svizzera italiana, Switzerland</p> <p><b>Multilevel Strategies for Contact Problems - from inner to outer approximations of the feasible set</b></p>
	<p><b>Mike Puso</b> Lawrence Livermore National Laboratory, USA</p> <p><b>Recent topics on immersed boundary methods, unbiased mortar contact and contact dynamics</b></p>
	<p><b>Loïc Salles</b> University of Liege, Belgique</p> <p><b>Computational methods in Tribomechadynamics</b></p>
	<p><b>Peter Wriggers</b> Leibniz Universität Hannover, Germany</p> <p><b>Contact of flexible polyhedra modelled by virtual elements</b></p>

## 6. VENUE



The conference takes place at the Politecnico di Torino, (address: Corso Duca degli Abruzzi 24, Torino). The lecture room is 4T.

Torino is the capital city of Piedmont region. The city was historically a major European political center. From 1563, it was the capital of the Duchy of Savoy, then of the Kingdom of Sardinia ruled by the House of Savoy, and the first capital of the Kingdom of Italy from 1861 to 1865.

Turin is part of the "industrial triangle" along with Milan and Genoa. It is ranked third in Italy, after Milan and Rome, for economic strength. The city has a rich culture and history, and it is known for its numerous art galleries, restaurants, churches, palaces, opera houses, piazzas, parks, gardens, theatres, libraries, museums and other venues. Turin is well known for its Baroque, Rococo, Neo-classical, and Art Nouveau architecture.

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## 7. CONFERENCE INFORMATION

### Pre-Registration

Conference registration will start on **Tuesday, July 4**, during the **Welcome Cocktail at Foyer of Emma Strada Hall** – Politecnico di Torino, (address: Corso Duca degli Abruzzi 24, Torino), between 6.00 – 8.00 p.m.

### Registration

You can register on-site and pick up the conference material at the Conference Registration Desk, outside Classroom 4T:

Wednesday July, 5 8:00 -17:00

Thursday July, 6 8:10 -18:00

Friday Jul7, 7 8:10 -16:00

The Registration Desk will also serve as Conference Office during the conference

### Presentations: Time & Equipment

Each regular presentation is allocated to 20 minutes, including questions.

Each keynote lecture presentation is allocated to 40 minutes, including questions.

If you wish to use your own PC, connection to the projector **must be tested** before the beginning of your session.

### WI-FI facilities

The EDUROAM wireless connection is available, then Eduroam users will have direct access. A temporary wireless access will be provided on request for all the other participants.

### Coffees & Lunches

A coffee break area will be available at the conference venue.

A lunch buffet is also offered to the participants.

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## 8. EVENTS & LOCATIONS

### TUESDAY, JULY 4

- **18:00 - 20:00 – Pre-registration & welcome cocktail**  
The event will take place at the foyer of Emma Strada Hall – Politecnico di Torino (main entrance), Corso Duca degli Abruzzi 24, Torino.

### WEDNESDAY, JULY 5

- **8:00 – Registration**
- **9:00 – 9:20 - Opening**  
The event will take place at the Conference location: Classroom 4T, Politecnico di Torino, Corso Duca degli Abruzzi 24, Torino.
- **17:40 – Guided tour of the Royal Palace - Piazzetta Reale 1**  
The Royal Palace is located just in the center of the town, address: Piazzetta Reale 1.

### THURSDAY, JULY, 6

- **8:10 – Registration**
- **19:30 – Guided tour of the historical center with touristic bus**
- **20:40 – Conference dinner**  
The dinner will take place at the restaurant of the “Società Canottieri Caprera”, address: Corso Moncalieri 22, Torino.

### FRIDAY, JULY 7

- **8:10 – Registration**
- **16:40 – Conference Closure**

## 9. SCIENTIFIC PROGRAM

Day		Time	Session	Track	Abs.
W e d n e s d a y	AM	10:00 11:00	1	Rolling contact	3
		11:20 13:20	2	Adhesion and debonding	3
	Delamination, fracture and failure processes			3	
PM	15:00 16:40	3	Solution algorithms and numerical efficiency	5	
T h u r s d a y	AM	9:20 11:00	4	Solution algorithms and numerical efficiency	5
		11:20 13:20	5	Solution algorithms and numerical efficiency	6
			5B	Modelling of friction joints under dynamical loading	2
				Multi-scale approaches	2
				Multifield problems with contact constraints	1
				Contact in biomechanics	1
	PM	14:20 16:20	6	Solution algorithms and numerical efficiency	4
			General papers	2	
		6B	Discrete element methods for contact	3	
			Constraints enforcement methods	3	
16:40 18:00	7	Friction and wear	4		
F r i d a y	AM	9:20 11:00	8	Contact detection algorithms	5
		11:20 13:20	9	Discretization techniques	6
	PM	14:20 16:20	10	General papers	6

## Tuesday, 4 July

<b>18:00</b>	<b>Pre-opening and welcome cocktail Politecnico di Torino, foyer of Emma Strada Hall</b>
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## Wednesday, 5 July

<b>8:00</b>	<b>Registration</b>
<b>9:00</b>	<b>Opening</b>
<b>9:20</b>	<b>Keynote 1</b>
	<b>Peter Wriggers</b> <b>Contact of flexible polyhedra modelled by virtual elements</b>
<b>10:00</b>	<b>Session 1</b>
	<b>Rolling contact</b>
10:00	A novel Boundary Element formulation for steady-state viscoelastic circular contacts <u>Santeramo M.</u> , Putignano C., Vorlaufer G., Krenn S., Carbone G.
10:20	Wear and power dissipation modelling in wheel-rail contact Myśliński A., Chudzikiewicz A.
10:40	Non-linear dependencies of filler-reinforced elastomers in rolling contact: An experimental and numerical investigation de Lorenzo Oliveira M., Le Tallec P., Bussetta P., Berger E., Nuytten S.
<b>11:00</b>	<b>Coffee break</b>
<b>11:20</b>	<b>Session 2</b>
	<b>A - Adhesion and Debonding</b>
11:20	A thermodynamic motivated RCCM damage interface model using explicit dynamics CD-Lagrange scheme <u>Larousse P.</u> , Dureisseix D., Gravouil A., Georges G.
11:40	Numerical simulation of adhesive contacts of an elastic quarter space with freely sliding side <u>Li Q.</u> , Popov V.L.
12:00	The effect of adhesion in viscoelastic contact mechanics <u>Mandriota C.</u> , Carbone G., Menga N.



<b>B - Delamination, fracture and failure processes</b>	
12:20	Numerical simulation for contact problems in crack growth with phase field approach <u>Takaishi T.</u> , Kimura M.
12.40	Extending non-smooth contact mechanics to cohesive zone modelling <u>Collins-Craft N.A.</u> , Bourrier F., Acary V.
13:00	Double peeling of thin viscoelastic tapes from rigid substrate <u>Ceglie M.</u> , Menga N., Carbone G.
<b>13:20</b>	<b>Lunch</b>
<b>14:20</b>	<b>Keynote 2</b>
	<b>Mike Puso</b> <b>Recent topics on immersed boundary methods, unbiased mortar contact and contact dynamics</b>
<b>15:00</b>	<b>Session 3</b>
<b>Solution algorithms and numerical efficiency – Section 1</b>	
15:00	Combination of adaptive mesh refinement and high performance computing for accurate solution of elastostatics contact mechanics problems <u>Epalle A.</u> , Ramière I., Latu G., Lebon F.
15:20	Efficient and accurate numerical time integration of arbitrary fine meshed small sliding contact via contact modes and hyper reduction <u>Witteveen W.</u> , Koller L.
15:40	Hybrid domain decomposition for huge contact problems <u>Dostal Z.</u> , Brzobohatý T., Horák D., Vlach O.
16:00	Stabilized FEM for contact problems <u>Gustafsson T.</u> , <u>Stenberg R.</u> , Videman J.
16:20	An adaptive quasistatic contact model based on IGA applied to impact analysis in flexible multibody systems <u>Rückwald T.</u> , Held A., Seifried R.
<b>16:40</b>	<b>Coffee break</b>
<b>17:00</b>	<b>Departure for the visit of the Royal Palace</b>

## Thursday, 6 July

**8:10** Registration

**8:40** Keynote 3

Rolf Krause

Multilevel Strategies for Contact Problems - from inner to outer approximations of the feasible set

**9:20** Session 4

### Solution algorithms and numerical efficiency – Section 2

9:20

A Novel Method for Multibody Dynamics Contact Represented by Linear Complementarity Problems  
Lou Q., Kovecses J.

9:40

Multiscale methods for substructuring multibody systems with contact  
Hutchison C., Hewlett J., Kövecses J.

10:00

Targeting a faster time-to-solution of mortar-based contact problems  
Steimer C., Mayr M. Popp A.

10:20

Model order reduction for the fatigue life prediction of wire ropes in tension and bending  
Guidault P.A., Zeka D., Néron D., Guiton M., Enchéry G.

10:40

Numerical analysis of a non-clamped dynamic thermoviscoelastic contact problem  
Bartman P., Bartosz K., Jureczka M., Szafraniec P.

**11:00** Coffee break

**11:20** Session 5 (parallel session)

### Solution algorithms and numerical efficiency – section 3

11:20

Error analysis of the Hybrid Hyper-Reduction method for frictionless contact problems.  
Le Berre S., Ramière I., Ryckelynck D.

11:40

Contact mechanics and inseparability: towards dictionary-based sparse approximations  
Kollepara K.S., Aguado J., Le Guennec Y., Silva L.

12:00

Parallel, High Performance Contact Solvers  
Dokken J., Richardson C., Roggendorf S., Wells G.N.

12:20	Energy conserving contact-impact algorithm using the method of Lagrange multipliers and the explicit central difference time integration scheme <u>Markovic D.</u> , Casadei F., Larcher M.
12:40	Interior point methods for computing frictional contact problems with hyperstaticity <u>Nguyen M.H.</u> , Acary V., Armand P.
13:00	A monolithic computational method for elasto-dynamics with plasticity and contact based on variational approach. <u>Acary V.</u> , Bourrier F., Viano B.
<b>11:20</b>	<b>Session 5B (parallel session)</b>
<b>A - Modelling of friction joints under dynamical loading</b>	
11:20	Variability of vibration response in friction-damped structures due to non-unique residual tractions: Computation of bounds <u>Ferhatoglu E.</u> , Groß J., Krack M.
11:40	Competing dry friction contact models for underplatform dampers <u>Gastaldi C.</u> , Gola M.
<b>B - Multi-scale approaches</b>	
12:00	Homogenization based two-scale modelling of fluid-saturated porous media with self-contact in micropores Rohan E., Heczko J.
12:20	Multi-scale analysis of contact of rough surfaces through FEM/BEM code coupling <u>Shaw R.</u> , Mayr M., Popp A.
<b>C - Multifield problems with contact constraints</b>	
12:40	A thermodynamically consistent computational framework for brittle crack propagation along contact interfaces <u>Athanasiadis I.</u> , Shvarts A., Lewandowski K., Pearce C., Kaczmarczyk L.
<b>D - Contact in biomechanics</b>	
13:00	An Embedded Approach for Fluid-Structure-Contact Interaction Problems and application to the aortic flow. Nestola M.G.C., Zulian P., Rossinelli D., Krause R.
<b>13:20</b>	<b>Lunch</b>

<b>14:20</b>	<b>Session 6 (parallel session)</b>	
	<b>A - Solution algorithms and numerical efficiency – Section 4</b>	
14:20	Rattle for mechanical systems with frictional unilateral constraints <u>Harsch J.</u> , Capobianco G., Eberhardt L., Eugster S.R., Leine R.I.	
14:40	An algebraic domain decomposition strategy for the solving contact problems <u>Kothari H.</u> , Zulian P., Krause R.	
15:00	Novel approach for accurate identification of the real contact area for numerical modelling of triboelectric nanogenerators <u>Shvarts A.G.</u> , McGinn T., Athanasiadis I., Kaczmarczyk L., Pearce C.J., Kumar C., Mulvihill D.M.	
15:20	Improving performance of augmented Lagrangians <u>Horak D.</u> , Dostal Z., Kruzik J., Vlach O.	
	<b>B - General papers – Section 1</b>	
15:40	Beam-inside-beam contact Magliulo M., Lengiewicz J., Zilian A., <u>Beex L.</u>	
16:00	Physics-informed neural networks for contact mechanics Sahin T., von Danwitz M., <u>Popp A.</u>	
<b>14:20</b>	<b>Session 6B (parallel session)</b>	
	<b>A - Discrete element methods for contact</b>	
14:20	Simulating tribocharging of flowing granular materials with patchy particles Preud'homme N., Opsomer E., <u>Lumay G.</u>	
14:40	An Improved Normal Compliance Method for Non-Smooth Contact Dynamics Abide S., Barboteu M., Dumont S., Nacry F., <u>Nguyen V.A.T.</u>	
15:00	Comparative analysis of experimental and numerical results for viscoelastic indentation of thin layers Mikayilov E., De Carolis S., Santeramo M., Carbone G., Putignano C.	
	<b>B - Constraints enforcement methods</b>	
15:20	Third-medium model for contact and pneumatic actuation <u>Faltus O.</u> , Rokoš O., Horák M., Doškář M.	

15:40	Nested objective functions for frictional contact Hurtado D.R., Beex L.
<b>C - Contact at the nanoscales</b>	
16:00	A coarse-grained molecular dynamics method for simulating fatigue crack propagation Niknafs S., Silani M., Concli F., Aghababaei R.
<b>16:20</b>	<b>Coffee break</b>
<b>16:40</b>	<b>Session 7</b>
<b>Friction and wear</b>	
16:40	Breakdown of Reye's theory in single-asperity wear <u>Garcia-Suarez J.</u> , Brink T., Molinari J.F.
17:00	Railway wheel wear calculation: comparison of local and global applications of Archard's law Bosso N., Magelli <u>M.</u> , Zampieri N.
17:20	A Novel Single Pass Unbiased Frictional Contact Algorithm Sahu I., Petrinic N.
17:40	Effect of frictional weakening in fretting wear <u>Yastrebov V.A.</u> , Basseville S.
<b>18:00</b>	<b>Session end</b>
<b>19:30</b>	<b>Guided tour of the town with touristic bus</b>
<b>20:40</b>	<b>Conference dinner at the restaurant of the "Società Canottieri Caprera"</b>

## Friday, 7 July

<b>8:10</b>	<b>Registration</b>	
<b>8:40</b>	<b>Keynote 4</b>	
	<b>Loïc Salles</b>	<b>Computational methods in Tribomechadynamics</b>
<b>9:20</b>	<b>Session 8</b>	
	<b>Contact detection algorithms</b>	
9:20	Novel framework for modelling contact of curved surfaces <u>Bignold S.</u> , de Frias G., Shelton T., Buche M., Wagman E., Miller S., Beckwith F., Manktelow K., Merewether M., Parmar K, Thomas J., Trageser J., Treweek B., Veilleux M.	
9:40	Strategy to address two-dimensional pointwise concave contact problems <u>da Silva L.</u> , Craveiro M.V., Gay Neto A.	
10:00	High-Fidelity Stress Fields in Contact Problems using Beam, Plates, and Shells Layer-Wise Models Saputo S., Petrolo M., Pagani A., Carrera E.	
10:20	Robust and generic contact detection strategy using tandem traversal of Bounding Volumes Hierarchies and spatio-temporal intersection <u>Motte A.</u> , Bovet C., Chiaruttini V., Jamond O., Prabel B.	
10:40	A refined algorithm for hierarchical face clustering and contact detection for segment-to-segment contact search between three-dimensional deformable bodies with irregular surface meshes <u>Chuo M.C.K.</u> , Izzuddin B.A.	
<b>11:00</b>	<b>Coffee break</b>	
<b>11:20</b>	<b>Session 9</b>	
	<b>Discretization techniques</b>	
11:20	Virtual element methods and higher order penalty-based Node-to-Segment contact <u>Moherdau T.F.</u> , Gay Neto A., Wriggers P.	
11:40	Use of nonsymmetric unilateral cinematic constraints to solve Coulomb contact/friction problem Verpeaux P., Breuzé M.	

12:00	Towards an Embedded Mesh Approach for Isogeometric Boundary Layers in Contact Mechanics <u>Loera Villeda E.G.</u> , Steinbrecher I., Popp A.
12:20	HHT- $\alpha$ and TR-BDF2 schemes for dynamic contact problems <u>Huang H.</u> , Pignet N., Drouet G., Chouly F.
12:40	Application of a posteriori analysis to contact problems <u>Fontana I.</u> , Di Pietro D.A., Kazymyrenko K.
13:00	An arbitrary order contact formulation using Lagrange multipliers from Raviart-Thomas space Kaczmarczyk L., Athanasiadis I., Shvarts A.G., Lewandowski K., Pearce C.J.
<b>13:20</b>	<b>Lunch</b>
<b>14:20</b>	<b>Session 10</b>
	<b>General papers – Section 2</b>
14:20	Tube/projectile interaction modeling using finite element simulation <u>Collas T.</u> , Lebon F., Rosu I., Ningre C.
14:40	Fast simulations of parametric problem with contact non-linearity <u>Pawar G.S.</u> , Kulkarni S.S.
15:00	Identification of contact traction and material parameters for soft bodies Lavigne T., Bordas S.P.A., <u>Lengiewicz J.</u>
15:20	Third Medium Contact Method for Topology Optimization <u>Frederiksen A.H.</u> , Sigmund O., Poullos K.
15:40	Beam lattice metamaterials with internal contact and instabilities <u>Horak M.</u> , La Malfa Ribolla E., Jirášek M.
16:00	Still on the shifted penalty method <u>Zavarise G.</u>
<b>16:20</b>	<b>Coffee break</b>
<b>16:40</b>	<b>Conference closure</b>

## 10. SOCIAL PROGRAM

### **Guided tour of the Royal Palace Wednesday, July 5, 17:40**

Participants will join a guided tour into the Royal Palace of Turin. They will be divided into small groups, and the tour will last about one hour.



The Royal Palace of Turin is placed in the heart of the city center of Turin, adjacent to Piazza Castello. It is an historic palace of the Savoy family, which ruled Turin until the late nineteenth century.

It was originally built in the 16<sup>th</sup> century and was renovated in the 17<sup>th</sup> century by Christine Marie of France with the help of the Baroque architect Filippo Juvarra.

The palace includes the Palazzo Chiabrese and the Chapel of the Holy Shroud. In addition, it includes the throne room, the dining and dance rooms, the tapestries that cover the walls of the rooms all with their authentic atmosphere.

The library contains a valuable self-portrait of Leonardo da Vinci, while the armory has one of the biggest collections of weapons of war in the world. If you're a military history enthusiast, this will be a special treat for you.



## Guided tour of the historical center with touristic bus Thursday, July 6, 19:30

Participants will join a sightseeing tour to visit the historical center and the most important monuments of Turin. The tour will last about one hour.



Placed in the Po Valley, Turin was the first capital of Italy, from 1861 to 1865, and it is the current capital of Piedmont region. Almost one million of people are living in the city, with a big student population which buzzes until night. It is considered a cultural hub, most notably because of its historic buildings. Among these are several palaces and homes of the storied Savoy dynasty, which ruled Turin until the late nineteenth century. Numerous iconic places are a must-see of the city for visitors, such as Mole Antonelliana, Egyptian Museum, Royal Palace, etc.

In addition to this, the town is characterized by large streets and elegant squares, such as Vittorio's square (in the picture). A lot of large green areas, such as Valentino's Park, can be found along the Po river. Moreover, Turin boasts a huge range of fantastic opportunities for dining out, tasting the flavors of the local Piedmontese cuisine.

## Conference Dinner Thursday, July 6, - 20:40

The Conference Dinner will take place in a nice restaurant, which is placed in one of the oldest rowing clubs in Italy, Società Canottieri Caprera, born in 1883.

Along the river Po, the place is surrounded by trees in a peaceful nature. This is the ideal place where you can taste local food of Piedmont, with a stunning view of the iconic Vittorio's square.



**Address:** Società Canottieri Caprera 1883  
Corso Moncalieri 22  
10131 Torino (TO) ITALY

**Tel:** +39 011 660 38 16

## 11. TURIN UNMISSABLE

This map shows the most important places to visit in Turin center.



**Palazzo Reale:** Piazzetta Reale 1, 10122, Turin

**Mole Antonelliana:** Via Montebello 20, 10124, Turin

**Museo Egizio:** Via Accademia delle Scienze 6, 10123, Turin

**Baratti & Milano:** Piazza Castello 27, 10123, Turin

**Guido Gobino:** Via Lagrange 1, 10123, Turin

## MOLE ANTONELLIANA

An architectural landmark of the city of Turin, it was initially conceived as a synagogue, before being bought by the Municipality of Turin and made into a monument to national unity. Planned and begun by architect Alessandro Antonelli in 1863, it was only completed in 1889. With a height of 167.5 metres, it was the tallest brick building in Europe at the time. The panoramic lift was inaugurated in 1961, during the celebrations for the centenary of the Italian Unification and it was renovated in 1999. Today it still allows visitors to go up to the panoramic terrace which is 85 metres high and take in the amazing views of the city and the surrounding Alps.



Open Monday to Sunday except on Tuesday, from 9:00 to 19:00  
Via Montebello, 20 – Torino  
Tel: +39 011 8138560 Web: <https://moleantonellianatorino.it/>

## NATIONAL MUSEUM OF CINEMA

One of the most exciting exhibitions about cinema you'll ever see: against a backdrop of sets, projections and light shows, the spectacular displays will bring your visit to life and immerse you in the magic of the cinema, just like when you're watching a movie. Discover first-hand the secrets of what goes on behind the camera and all the stages that go into making a film along a fun and interactive route: from shadow puppetry and early magic lanterns to the most spectacular special effects in modern cinema and virtual reality. The National Museum of Cinema is hosted in the Mole Antonelliana.



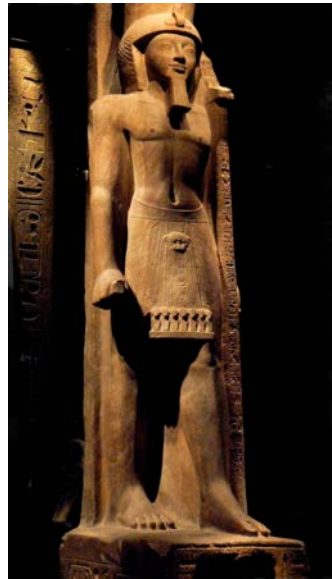
Open Monday to Sunday except on Tuesday, from 10:00 to 19.00

Via Montebello, 20 – Torino

Tel: +39 011 8138563 Web: <https://www.museocinema.it/en/contacts>

## EGYPTIAN MUSEUM

The Egyptian Museum is an archaeological museum in Turin, Italy, specializing in Egyptian archaeology and anthropology. It houses one of the largest collections of Egyptian antiquities, with more than 30,000 artifacts, and is considered the second most important Egyptology collection in the world, after the Egyptian Museum of Cairo. The collections of the museum, of great historical value, cover a period of more than 4000 years and make accessible to all the knowledge of the Egyptian civilization, one of the most fascinating of the past.



Open daily, from 9:00 to 18.30

Via Accademia delle Scienze, 6 – Torino

Tel: +39 011 5617776. Web: <https://www.museoegizio.it/en/>

## CHOCOLATE

Lovers of chocolate must come to Torino. Since 1678 a Royal Decree of the Madam Royal authorised its production and then, in 1802, there was a further boost: the transformation of liquid chocolate in hard, longer-tasting chocolate blocks. To overcome the shortage of raw materials caused by Napoleonic blockade, the chocolate makers mixed a minimum quantity of cocoa with the hazelnuts from the nearby Langhe, obtaining a paste which, in 1865, became the heart of the “bocconcino” or “cicca” created by Michele Prochet: this was the forerunner to the inverted boat-shaped chocolates wrapped in golden foils which became known as “**gianduiotti**” in 1867.



Traditional Gianduiotti and other chocolate sweets can be tasted in historical pastry shops:

**Pfatisch**, Via Sacchi, 42

**Baratti&Milano**, Piazza Castello, 27

**Guido Gobino**, Via Lagrange, 1

**Peyrano**, Corso Moncalieri, 47



## 12. AIRPORT CONNECTIONS

### TORINO AIRPORT CONNECTIONS

#### SHUTTLE BUS

Bus from the Torino airport to the Torino train stations Porta Susa and Porta Nuova

Bus company *Arriva Italia*. Races every 15-30 minutes, travel time about 45 min. Ticket prices: 8.50 Euro on board, 7.50 euro at the ticket office and machines. Timetables are available here:

<https://torino.arriva.it/en/airport-line-torino-city-center-torino-airport/>

#### TAXI

Price is about 36 euro, travel time about 30 min. Tel. +39 011 5730/37.





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## MILANO MALPENSA AIRPORT CONNECTIONS

### SHUTTLE BUS

**Bus from Terminal 1 and Terminal 2 of Malpensa airport to the Torino bus station in Corso Bolzano.**

The bus tickets are 22.00 Euro one way. Travel time about 2 hours. Tickets are nominative and subject to reservation, valid only for the booked journey. Timetables are available here: [www.autostradale.it](http://www.autostradale.it) or [www.airportbusexpress.it](http://www.airportbusexpress.it).

### TRAIN

**Train from Malpensa airport to Milano Centrale train station**

The timetable is available here: <https://www.malpensaexpress.it/en/lines-and-timetable/>

**Train from Milano Centrale to Torino Porta Susa and Porta Nuova**

About 1 hour with high speed train, several trains per day. Train timetables are available here: <http://www.trenitalia.com>.

## 13. TAXI SERVICE

Tel. +39 011 5730/37 Web: <https://www.taxitorino.it/>





