



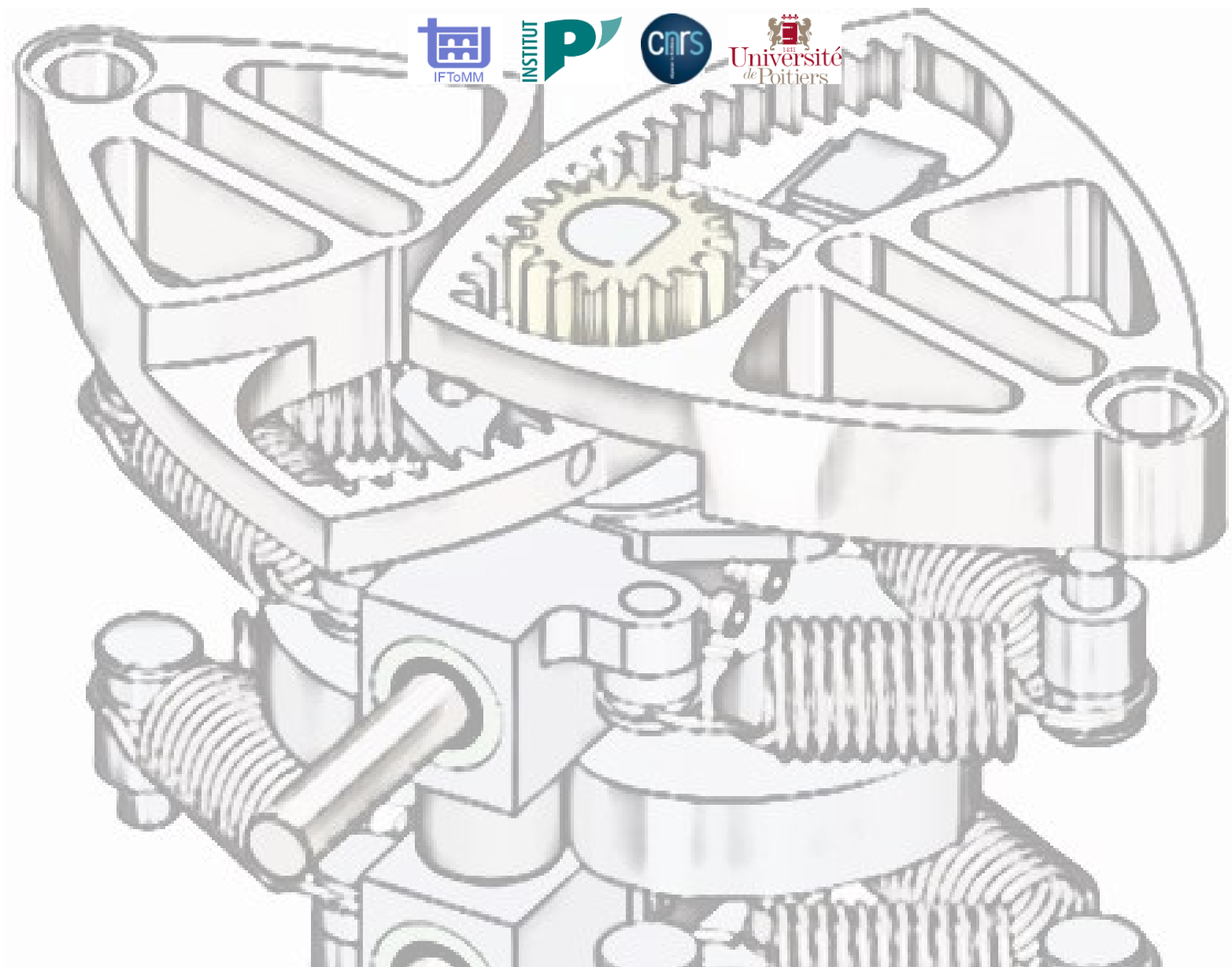
MeTrApp 2023

THE 6TH IFToMM INTERNATIONAL CONFERENCE ON **MECHANISMS, TRANSMISSIONS, AND APPLICATIONS**

FUTUROSCOPE-POITIERS, FRANCE, MAY 24-26, 2023

PROGRAMME

PRACTICAL INFORMATION



CONFERENCE INFORMATION

The sixth Conference on Mechanisms, Transmissions and Applications, MeTrApp 2023, was organized by the CoBRA (Cobotics, Bio-Engineering & Robotics for Assistance) Team of the Pprime Institute of the University of Poitiers, and was held at the Futuroscope Technopole, the CNAM-IFMI building, in the city of Poitiers, France, during the period 24–26 May 2023.

This conference constitutes the continuation of the MeTrApp conference tradition, which was held for the first time in Timisoara, Romania in 2011; the second time in Bilbao, Spain in 2013; the third time in Aachen, Germany in 2015; the fourth time in Trabzon, Turkey in 2017; and the fifth time in Dalian, China in 2019.

CONFERENCE CHAIRMAN

Med Amine Laribi (France)

CONFERENCE CO-CHAIRMEN

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Marco Ceccarelli (Italy)

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LOCAL ORGANISING COMMITTEE

Marc Arsicault

Laurence Artus

Catherine De Saint Martin

Estelle Ferdinand

Juan Sandoval

REGISTRATION DESK

A registration desk will be available during the conference at the hall of the IFMI building.

PROCEEDINGS

The proceedings book is included in the registration fee. The proceedings will be published in the Springer book: **New Advances in Mechanisms, Transmissions and Applications - Proceedings of the Sixth MeTrApp Conference 2023**



CONFERENCE BADGE

All registrants for MeTrApp2013 and Technical staff members will receive a conference badge.

Everybody is asked to wear this badge at all sessions and social events.

WIRELESS NETWORK

Wi-Fi network access will be available during the conference.

COFFEE BREAKS AND LUNCHES

Coffee breaks and lunches are included in the registration fee and will be served at IFMI 02-03-04 Rooms.

ORAL PRESENTATIONS

In preparing your presentations, the authors should take into account the following points:

- Presentations must be delivered in English, the official language of MeTrApp2013.
- Presenters will be given a maximum of 15 minutes for the presentation plus 3 minutes for questions and answers and 2 minutes for transition to the next speaker.
- Oral presentation must be given as a PowerPoint, a PDF or PREZI. All graphics and text must be in English.
- Presenters should provide their presentation before the start of their session.
- An LCD projector, PC and microphone will be provided in the conference sessions.

CONFERENCE SCHEDULE

The MeTrApp 2023 schedule is available at:

<https://metrapp2023.sciencesconf.org/resource/page/id/12>



METRAPP 2023, PROGRAM OVERVIEW

The 6th IFToMM International Conference on Mechanisms, Transmissions, and Applications
MeTrApp2023

Program

Hour		Wednesday 24/05/2023	Thursday 25/05/2023	Friday 26/05/2023
8:30				
9:00	9:20			
9:20	10:10	Opening	Keynote Lecture <i>Eduardo Castillo-Castaneda</i>	Keynote Lecture <i>Frédéric Boyer</i>
10:10	10:40	Keynote Lecture <i>Marco Ceccarelli</i>		
10:40	12:40	Coffee-break		
12:40	14:00	S1: Dynamics of mechanisms ID: 3, 5, 8, 33, 34	S5: Cobots and human-robot Interaction ID: 1, 10, 20, 22, 23, 28	S7: Mechanism and machine design II ID: 2, 12, 17 S8: Mechanical transmissions ID: 4, 6, 25, 32
14:00	15:20	Meeting of the MeTrApp ISC	Lunch	
15:20	15:40	S2 :Medical applications of mechanisms and robots ID: 14, 16, 19, 35	S6: Computational and experimental methods ID: 7, 13, 21, 36, 39	S9: Parallel manipulators II ID: 30, 31, 38
15:40	17:00	Coffee-break	Closing session	
17:00	17:20	S3: Mechanism and machine design I ID: 18, 26, 27, 29	Visit to the futuroscope	
17:20	18:40	Coffee-break		
18:40	20:00	S4: Parallel manipulators I ID: 9, 11, 15, 24	Gala dinner & Awards Futuroscope night show	
		Welcome Reception <i>La Petite France</i>		

MeTrAPP 2023, DETAILED PROGRAM

WEDNESDAY 24.05.2023

9:20 – 10:10 ■ KEYNOTE LECTURE:

CHAIRER BY: ZEGHLOUL SAÏD

MECHANISM DESIGN FOR ROBOT IN ITALY: HISTORICAL BACKGROUNDS, ACHIEVEMENTS, AND CHALLENGES
CECCARELLI MARCO

10:40 – 12:20 ■ SESSION 1: DYNAMICS OF MECHANISMS

CHAIRER BY: CASTILLO-CASTANEDA EDUARDO

- 3** **A FAMILY OF FUNCTIONS FOR DWELL-RISE-DWELL MOTIONS**
BÄSEL UWE
- 5** **RESONANT OSCILLATIONS OF A NONIDEAL GYROSCOPIC ROTOR SYSTEM WITH NONLINEAR RESTORING AND DAMPING CHARACTERISTICS**
ISKAKOV ZHARILKASSIN, JAMALOV NUTPULLA, ABDURAIMOV AZIZBEK, KALYBAEVA AKMARAL
- 8** **DYNAMIC SIMULATION OF GYROSCOPIC RIGID ROTOR WITH ANISOTROPY OF ELASTIC SUPPORT RESTORING AND DAMPING CHARACTERISTICS**
ISKAKOV ZHARILKASSIN, ABDURAIMOV AZIZBEK, KAMAL AZIZ
- 33** **PRINCIPAL VECTORS FOR SPATIAL DYNAMICAL ANALYSIS BY FISCHER**
STUTZMANN SVENJA, VAN DER WIJK VOLKERT
- 34** **DYNAMIC MODELLING OF A GEOMETRICALLY NON-UNIFORM ELASTIC BEAM TO MIMIC SNAKE SWIMMING UNDULATION**
GAUTREAU ELIE, BONNET XAVIER, ARSICAULT MARC, LARIBI MED AMINE

14:00 – 15:20 ■ SESSION 2: MEDICAL APPLICATIONS OF MECHANISMS AND ROBOTS

CHAIRER BY: LARIBI MED AMINE

- 14** **KINEMATICS AND DESIGN OF A NEW LEG EXOSKELETON FOR HUMAN MOTION ASSISTANCE**
IONUT GEONEA, DUMITRU NICOLAE, COPILUSI CRISTIAN, GRIGORIE LAURA, TARNITA DANIELA
- 16** **DEVELOPMENT A MEASUREMENT DEVICE FOR EACH FINGER FORCE BASED ON A JAMAR HAND DYNAMOMETER**
MAKINO KOJI, ASAHARA ZENTARO, ZHAO LU, TERADA HIDETSUGU
- 19** **DEVELOPMENT OF A RECONFIGURABLE PLANAR CABLE-DRIVEN PARALLEL ROBOT COMBINED WITH A VISUAL SERVOING MODULE FOR UPPER LIMB REHABILITATION**
MISSINEO GIANNI, ENNAIEM FERDAWS, SANDOVAL JUAN, CARBONE GIUSEPPE, LARIBI MED AMINE
- 35** **LATERAL SUPPORT MECHANISMS FOR SMART WALKERS TO PREVENT SIDEWAYS ROLLOVER**
BILGIN NURDAN, TUTKAN TOLGA ER, YILMAZ CAN, NAYIR EMRE

15:40 – 17:00 ■ SESSION 3: MECHANISM AND MACHINE DESIGN I

CHAIRER BY: RUSSO MATTEO

- 18** **STRUCTURAL-PARAMETRIC SYNTHESIS OF THE PLANAR FOUR-BAR AND SIX-BAR FUNCTION GENERATORS WITH REVOLUTE JOINTS**
BAIGUNCHEKOV ZHUMADIL, MUSTAFA AZAMAT, CARBONE GIUSEPPE, LARIBI MED AMINE
- 26** **DESIGN AND MODELISATION OF A 6 DEGREE OF FREEDOM INTERFACE WITH REPOSITIONABLE CENTRE OF ROTATION**
KOSZULINSKI ALIZÉE, SANDOVAL JUAN, LARIBI MED AMINE
- 27** **USE OF SERIAL PLANAR LINKAGES FOR AN AUGMENTED R-CUBE MECHANISM WITH SIX DEGREES OF FREEDOM**
ESSOMBA TERENCE, WU WEN-YU, LARIBI MED AMINE
- 29** **FUNCTIONAL DESIGN OF AN ARTICULATED RECONFIGURABLE MECHANISM FOR ELECTRONIC PARKING BRAKE SYSTEMS**
QUAGLIA GIUSEPPE, FORTUNATO PEPE, COLUCCI GIOVANNI

17:20 – 18:40 ■ SESSION 4: PARALLEL MANIPULATORS I

CHAIRER BY: MAO KEN

- 9** **CONCEPTUAL DESIGN AND KINEMATIC ANALYSIS OF A 1T2R PARALLEL MANIPULATOR**
JOHN ISAAC, SUDHEER A.P., MOHAN SANTHAKUMAR

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- 11 **SIMULATION-BASED COMPARATIVE STUDY AND SELECTION OF REAL-TIME CONTROLLER FOR 3-PRRR CARTESIAN PARALLEL MANIPULATOR**
THOMAS MERVIN, MOHAN SANTHAKUMAR, RYBAK LARISA
- 15 **STIFFNESS PERFORMANCE ANALYSIS OF A DELTA ROBOT WITH VARIABLE-STIFFNESS JOINTS**
NELSON CARL, NOUAILLE LAURENCE, POISSON GERARD
- 24 **VELOCITY ANALYSIS OF A 5-DOF HYBRID MANIPULATOR**
ANTONOV ANTON, FOMIN ALEXEY

THURSDAY 25.05.2023

9:20 – 10:10 ■ KEYNOTE LECTURE:

CHAIRER BY: NELSON CARL

CURRENT DEVELOPMENTS AND CHALLENGES IN ASSISTANCE ROBOTICS
CASTILLO-CASTANEDA EDUARDO

10:40 – 12:40 ■ SESSION 5: COBOTS AND HUMAN-ROBOT INTERACTION

CHAIRER BY: SANDOVAL JUAN

- 1 **TORSO MOTION MONITORING WITH AN IMU SET-UP**
CECCARELLI MARCO, RUSSO MATTEO, GARROSA MARÍA, CAFOLLA DANIELE, SGROSSO MICHELA
- 10 **A KINEMATIC ANALYSIS OF A NEW LARMBOT TORSO DESIGN**
GAO WENSHUO, RUSSO MATTEO, CECCARELLI MARCO
- 20 **KINEMATIC MODEL AND NUMERICAL EVALUATION OF AN ORIGAMI-INSPIRED SOFT PNEUMATIC ACTUATOR**
GARCIA-MORALES DITZIA S. , SANDOVAL YAMILE, CASTILLO EDUARDO, RAATZ ANNIKA, VELAZQUEZ-FLORES KARINA G.
- 22 **THROWING CAPABILITIES OF MANIPULATORS**
GALLANT ANDRE, GOSSELIN CLÉMENT
- 23 **INCREASING THE PAYLOAD OF A 7DOF COBOT**
DOIRON NIKOS, GALLANT ANDRE
- 28 **KINEMATIC AND STATIC MODELLING OF A NEW TWO-DEGREE-OF-FREEDOM CABLE OPERATED JOINT**
JOHN ISAAC, MOHAN SANTHAKUMAR, WENGER PHILIPPE

14:00 – 15:40 ■ SESSION 6: COMPUTATIONAL AND EXPERIMENTAL METHODS

CHAIRER BY: GALLANT ANDRE

- 7 **DESIGN AND PERFORMANCE CHARACTERIZATION OF A GRIPPER END-EFFECTOR FOR A SPACE BERTHING MANIPULATOR**
TITOV ALEXANDER, CECCARELLI MARCO
- 13 **ANALYSIS OF FRACTIONAL-ORDER ON THE NONLINEAR CHARACTERISTIC OF ROTATING MODULE**
XIE JIN, SUN JIAN-HUA, LIU ZHUHAI
- 21 **EXPERIMENTAL VALIDATION OF A VARIABLE STIFFNESS JOINT WITH ANTAGONISTIC SPRINGS**
CONTRERAS CALDERON MARÍA GUADALUPE, SANDOVAL JUAN, ARSICAULT MARC, CASTILLO EDUARDO, LARIBI MED AMINE
- 36 **ANALYSIS AND DESIGN OF A NEW MOTION TRACKING DEVICE FOR LAPAROSCOPIC SURGERY**
BOUZID SIWAR, CHAKER ABDELBAZIÄ, ARSICAULT MARC, BENNOUR SAMI, LARIBI MED AMINE
- 39 **DEVELOPMENT OF A VIRTUAL REALITY SIMULATOR FOR ROBOTIC ASSISTED SURGERY**
COVACIU FLORIN, ANDRAS IULIA, GHERMAN BOGDAN, PISLA ADRIAN, VAIDA CALIN, AL HAJJAR NADIM, PISLA DOINA

FRIDAY 26.05.2023

9:20 – 10:10 ■ KEYNOTE LECTURE:

CHAIRER BY: NELSON CARL

THE MODEL OF COSSERAT RODS: A STANDARD FOR MODELLING SOFT AND CONTINUUM ROBOTS
BOYER FRÉDÉRIC

10:40 – 11:40 ■ SESSION 7: MECHANISM AND MACHINE DESIGN II

CHAIRER BY: ESSOMBA TÉRENCE

- 2** **NOVEL DESIGN OF AN ORTHOGONAL-AXIS TYPE PRECESSION MOTION BALL REDUCER**
TERADA HIDETSUGU, MAKINO KOJI, SUN XIAO, ISHIDA KAZUYOSHI, WADA YUMA, NAGAI MANABU
- 12** **COMPARISON OF METHODS OF FINITE ELEMENT ANALYSIS IN THE DESIGN OF MOBILE ROBOT MODULES**
RYBAK LARISA, GAPONENKOLINE ELENA, PEREVUZHNIK VICTORIA, ARTEM VOLOSHKIN
- 17** **MODELLING OF A TUBULAR KIRIGAMI (RC-KIRI) WITH OUTSIDE LAMINA EMERGENT TORSIONAL JOINTS**
YE SIYUAN, ZHAO PENGYUAN, LI SHIYAO, KAVOUSHI FATEMEH, HAO GUANGBO

11:40 – 13:00 ■ SESSION 8: MECHANICAL TRANSMISSIONS

CHAIRER BY: BÄSEL UWE

- 4** **PERFORMANCE ANALYSIS OF A MECHANISM-DRIVEN JOINT**
ARAQUE ISIDRO, JORGE ENRIQUE, CECCARELLI MARCO, CAFOLLA DANIELE
- 6** **HELICAL GEAR CONTACT SIMULATIONS AND THEIR APPLICATIONS IN AUTOMOTIVE TRANSMISSION SYSTEMS**
MAO KEN
- 25** **A NOVEL ADJUSTABLE CONSTANT-FORCE MECHANISM BASED ON SPRING AND GEAR TRANSMISSION**
NGUYEN VU LINH
- 32** **DESIGN PROPOSAL FOR THUMB REHABILITATOR USING CAMS**
ZAPATERO-GUTIÉRREZ ARACELI, CASTILLO EDUARDO, LARIBI MED AMINE

14:00 – 15:00 ■ SESSION 9: PARALLEL MANIPULATORS II

CHAIRER BY: LOVASZ ERWIN-CHRISTIAN

- 30** **WORKING MODE STUDY OF A NEW SPHERICAL PARALLEL MANIPULATOR WITH AN UNLIMITED SELF-ROTATION CAPABILITY**
LAHDIRI CHAIMA, SAAFI HOUSSEM, MLIKA ABDELFAH
- 31** **DESIGN AND BALANCING OF A NOVEL 2R1T MANIPULATOR WITH REMOTE CENTER OF MOTION**
YILMAZ, TUĞRUL, GOKHAN KIPER
- 38** **KINEMATIC ANALYSIS OF THE 3-U(RPRGR)RU PARALLEL ROBOT**
OARCEA ALEXANDRU, TULCAN ELIDA-GABRIELA, LOVASZ ERWIN-CHRISTIAN

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