



Thirteenth International Symposium on

Turbulence and Shear Flow Phenomena

25th – 28th June, 2024

Montréal, Canada

PROGRAM



TOURISME /
MONTREAL

program overview

Monday June 24th

15h00 - 20h00 Registration at the Centre Mont-Royal

Tuesday June 25th

07h00 - 18h00	Registration	Foyer
08h00 - 08h20	Opening Ceremonies	Théâtre Symposium
08h20 - 09h10	Session 1: Kasagi Award Lecture	Théâtre Symposium
09h20 - 10h40	Session 2: Parallel Technical Talks	International I & II, Cartier I & II
10h40 - 11h00	Coffee break	Foyer
11h00 - 12h00	Session 3: Parallel Technical Talks	International I & II, Cartier I & II
12h00 - 13h50	Lunch break	
13h50 - 14h40	Session 4: Invited Lecture 1	Théâtre Symposium
14h50 - 16h10	Session 5: Parallel Technical Talks	International I & II, Cartier I & II
16h10 - 16h30	Coffee break	Foyer
16h30 - 17h30	Session 6: Parallel Technical Talks	International I & II, Cartier I & II
18h00 - 20h00	Welcome Reception and Poster Presentations	Foyer

Wednesday June 26th

07h00 - 18h00	Registration	Foyer
08h20 - 09h10	Session 7: Invited Lecture 2	Théâtre Symposium
09h20 - 10h40	Session 8: Parallel Technical Talks	International I & II, Cartier I & II
10h40 - 11h00	Coffee break	Foyer
11h00 - 12h00	Session 9: Parallel Technical Talks	International I & II, Cartier I & II
12h00 - 13h50	Lunch break	
13h50 - 14h40	Session 10: Invited Lecture 3	Théâtre Symposium
14h50 - 16h10	Session 11: Parallel Technical Talks	International I & II, Cartier I & II
16h10 - 16h30	Coffee break	Foyer
16h30 - 17h30	Session 12: Parallel Technical Talks	International I & II, Cartier I & II
18h00 - 21h30	TSFP Banquet	Marché Bonsecours
Buses leave Centre Mont-Royal at 18h00		

Thursday June 27th

07h00 - 18h00	Registration	Foyer
08h20 - 09h10	Session 13: Invited Lecture 4	Théâtre Symposium
09h20 - 10h40	Session 14: Parallel Technical Talks	International I & II, Cartier I & II
10h40 - 11h00	Coffee break	Foyer
11h00 - 12h00	Session 15: Parallel Technical Talks	International I & II, Cartier I & II
12h00 - 13h50	Lunch break	
13h50 - 14h40	Session 16: Invited Lecture 5	Théâtre Symposium
14h50 - 16h10	Session 17: Parallel Technical Talks	International I & II, Cartier I & II
16h10 - 16h30	Coffee break	Foyer
16h30 - 17h30	Session 18: Parallel Technical Talks	International I & II, Cartier I & II

Friday June 28th

08h20 - 09h40	Session 19: Parallel Technical Talks	International I & II, Cartier I & II
09h40 - 10h00	Coffee break	Foyer
10h00 - 11h00	Session 20: Parallel Technical Talks	International I & II, Cartier I & II
11h10 - 11h30	Closing Ceremonies	Théâtre Symposium

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sponsors

The local organizing committee is grateful for the financial support provided by the following

Tourisme /
Montreal



welcome

The Local Organizing Committee welcomes you to both the Thirteenth International Symposium on Turbulence and Shear Flow Phenomena (TSFP13) and Montréal, Quebec, Canada. The series of biennial TSFP Symposia is the principal venue for reporting and disseminating recent and ongoing research on turbulence and shear flow phenomena. Previous TSFP Symposia were held in Santa Barbara, U.S.A (1999), Stockholm, Sweden (2001), Sendai, Japan (2003), Williamsburg, U.S.A. (2005), Munich, Germany (2007), Seoul, Korea (2009), Ottawa, Canada (2011), Poitiers, France (2013), Melbourne, Australia (2015), Chicago, U.S.A. (2017), Southampton, U.K (2019), and Osaka, Japan (2022). The TSFP Symposia build upon the highly regarded series on Turbulent Shear Flows (TSF), which was inaugurated in 1977 and continued through 1997.

A total of 307 extended abstracts were submitted to TSFP13. These all underwent peer review by at least two independent reviewers from the TSFP Advisory Committee. Based on the reviewers' rankings, 194 papers were selected for oral presentation and another 28 for poster presentation. In addition to these 222 presentations, there are six invited lectures. The opening lecture will be given by the TSFP13 Kasagi Award winner: Ricardo Vinuesa (KTH Royal Institute of Technology, Sweden). The other five invited lectures will be delivered by: Karthik Duraisamy (University of Michigan, USA), Bettina Frohnäpfel (Karlsruhe Institute of Technology, Germany), Stéphane Moreau (Université de Sherbrooke, Canada), Joerg Schumacher (Technische Universität Ilmenau, Germany), and Chunxiao Xu, (Tsinghua University, China).

We hope that you will find ample interesting research in the field of turbulence and shear flow phenomena across the 20 sessions, and poster session. These promise to highlight a diverse spectrum of research in our field, including (but not limited to) Active flow control, Compressible flows, Data-driven modelling, Experimental techniques, Instabilities, Jets, Multiphase flows, Numerical methods, Rough-wall flows, Urban flows, Wakes, and Wall-bounded turbulent flows.

We graciously thank the members of the Executive and Advisory Committees for their service and guidance in all matters. Moreover, we are grateful for the support we have received from Tourisme Montréal and that of Concordia University, McGill University, and Polytechnique Montréal. And to the participants in TSFP13 from 20 countries, we wish you an enlightening and stimulating symposium, and a lovely stay in Montréal!

The TSFP 13 Local Organizing Committee

TSFP Nobuhide Kasagi Award

TSFP presents the Nobuhide Kasagi Award, with the following purpose:

“The TSFP Nobuhide Kasagi Award will recognise excellence and innovation for early career researchers* for contributions to an area relevant to the TSFP Symposia”

The TSFP Nobuhide Kasagi Award is graciously sponsored by the **International Journal of Heat and Fluid Flow**. The TSFP 13 award goes:

“To **Ricardo Vinuesa**, in recognition of his contributions to the understanding of complex turbulent flows through high-fidelity simulations, and his novel applications of machine learning to study, predict and control turbulent flows.”



TSFP committees

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Meng Wang
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Jerry Westerweel
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Serhiy Yarusevich
Xiaoqing Zheng
Wouter Bos

copyright status of TSFP submissions

TSFP accepts contributions for presentation based on at least two reviews of an extended abstract. Submissions selected for oral and poster presentation require authors to provide an (up to) six-page manuscript. The (up to) six-page manuscript is made available electronically to participants at the Symposium, and is subsequently posted on the TSFP website. The copyright of TSFP manuscripts remains with the authors, who are free to submit their work for publication in an archival journal, citing the TSFP manuscript as preliminary results. Archival journals may also invite selected authors of TSFP manuscript to submit their work for publication in special issues.

useful information

registration

Monday 24 th June:	15h00 - 20h00
Tuesday 25 th June:	07h00 - 17h00
Wednesday 26 th June:	07h00 - 17h00
Thursday 27 th June:	07h00 - 17h00

wifi

Internet will be provided for all symposium participants at the Centre Mont-Royal. Users can log in using the following information

Username: TSFP13

Password: Montreal2024

welcome reception & poster presentations

Centre Mont-Royal
Tuesday 25th June
18h00 - 20h00

Bring your conference badges

Selection of non-alcoholic and alcoholic beverages, and hot and cold hors d'oeuvres will be served during the reception.



Marché Bonsecours
333 Rue Commune
Wednesday 26th June
18h00 - 21h00

banquet

Buses depart: 18h00 from Centre Mont Royal

Return busses: 21h30 from Marché Bonsecours

Bring your conference badge and Banquet Ticket

instructions

speakers

1. Speakers should arrive early to their session and introduce themselves to the session chair.
2. Speakers have at most 17 minutes for their talk. This is followed by a 2-minute question and answer period, and then 1 minute for change-over to the next talk.
3. Invited lecture sessions are 40 minutes with 10 additional minutes for question and answer period, and then 10 minutes for change-over to the session tracks.
4. To ensure that the parallel sessions are coordinated, speakers must complete their talks within the allotted time. Timing equipment is provided to aid this process.
5. Speakers must use their personal computer for the presentation, including an AV adapter, if required*.
6. Due to the short period of change-over, please ensure:
 - Speakers arrive before the session starts, to test their presentation with the equipment in their designated room. Support will be available in the presentation room.
 - Please ensure that animations and equations in the presentation are displayed correctly. As noted above, presentations can be tested in the session room during coffee & lunch breaks.

**Please note that only fullsize HDMI connections are provided. Speakers should bring AV adapters suitable for their computers.*

session chairs

1. Chairs should arrive early to their respective sessions, locate the speakers and explain the timing.
2. Chairs are responsible for introducing the speakers, administering the question and answer period after each talk, and ensuring that the session proceeds on time.
3. If a speaker fails to appear or if a presentation has been withdrawn, the chair should suspend the session until the next scheduled presentation.
4. A laser pointer will be available in each room at the start of the session and should be left at the Speaker Table at the front of the room at the end of each session.
5. There will be support in each of the presentation rooms to assist you.

poster presentations

1. Posters can be mounted from 15:00 on Monday, June 24th and need to be on display from 17:00 Tuesday June 25th until Friday morning, June 28th.
2. The poster display area is in the foyer on the 3rd floor, poster boards will be in place for mounting upon arrival.
3. Posters should be removed at the latest by 11:30 on Friday June 28th.
4. The board space is 4ft x 8ft (width x height, note height is from the ground). Posters should fit entirely within the board boundaries.
5. Tacks/Velcro strips for mounting of the posters will be provided.
6. Each board will be labeled with "P#" corresponding to the number of your poster as per the program.

plenary sessions

KASAGI LECTURE: RICARDO VINUESA
KTH ROYAL INSTITUTE OF TECHNOLOGY, SWEDEN

DISCOVERING NOVEL CONTROL STRATEGIES FOR TURBULENT FLOWS THROUGH DEEP REINFORCEMENT LEARNING

Tuesday 25th June, 08h20 – Théâtre Symposia



INVITED LECTURE: KARTHIK DURAISAMY
UNIVERSITY OF MICHIGAN, USA

GENERALIZABLE PHYSICS-CONSTRAINED MACHINE LEARNING FOR PREDICTIVE MODELING OF TURBULENT FLOWS

Tuesday 25th June, 13h50 – Théâtre Symposia

INVITED LECTURE: BETTINA FROHNAPFEL
KARLSRUHE INSTITUTE OF TECHNOLOGY, GERMANY

TURBULENT FLOWS OVER ROUGH SURFACES

Wednesday 26th June, 08h20 – Théâtre Symposia



INVITED LECTURE: STÉPHANE MOREAU
UNIVERSITÉ DE SHERBROOKE, CANADA

TURBOMACHINERY NOISE: TURBULENCE A KEY INGREDIENT

Wednesday 26th June, 13h50 – Théâtre Symposia

INVITED LECTURE: JOERG SCHUMACHER
TECHNISCHE UNIVERSITÄT ILMENAU, GERMANY

TURBULENT MESOSCALE CONVECTION IN THE BOUSSINESQ LIMIT AND BEYOND

Thursday 27th June, 08h20 – Théâtre Symposia



INVITED LECTURE: CHUNXIAO XU
TSINGHUA UNIVERSITY, CHINA

EQUIVALENT BOUNDARY LAYER MODEL AND ITS APPLICATION IN INFLOW TURBULENCE GENERATION

Thursday 27th June, 13h50 – Théâtre Symposia

getting around



GETTING AROUND BY PUBLIC TRANSPORT

Public transport is a great and sustainable way to see the city. Our public transportation service has received many awards for its initiatives in sustainable development. Hop on the **métro** or on a **bus** and in minutes, you're at a museum, a restaurant or in Old Montréal. To top it all, it's affordable and reliable.



GETTING AROUND BY TAXI

If you prefer getting around by taxi, it's easy to flag one down on the street. You'll also find them at one of the city's many taxi stands or in front of most major hotels.

All taxis accept electronic payment and most taxi company have apps for easy reservation.



GETTING AROUND BY BICYCLE

BIXI, recipient of the Edison Award for Energy & Sustainability, allows everyone to easily explore Montréal's 600 (375 miles) kilometres of bike paths.

A \$1.35 "Unlocking fee" is all it takes to borrow a bike at one of the 460 stations across the city, for a trip on the fly. A regular BIXI charges 20 c/minute for each trip, whilst an electric one charges 35 c/minute.



Available 24 hours a day, 7 days a week from April to November.

MONTRÉAL'S PUBLIC TRANSPORTATION SERVICES



METRO

- / 4 métro lines
- / 68 stations
- / Can be accessed via the city's underground pedestrian network

Operating hours:

Monday to Friday and Sunday from 5:30 a.m. to 1 a.m., and Saturday from 5:30 a.m. to 1:30 a.m.



BUS

- / 220 bus lines of which 23 are dedicated to all-night service
- / All vehicles are wheelchair accessible, with the exception of minibuses operated on Navette Or shuttles and the 212 - Sainte-Anne line

FARES

- / One trip \$3.75 CAD
- / 1-day pass \$11 CAD
- / 3-day pass \$21.25 CAD
- / Weekly pass \$30 CAD

VISIT OFFICIAL WEBPAGE

local specialties

must try



The **Montréal bagel** is boiled in water, sweetened with honey and cooked in a wood-fired oven, giving it a crisp, golden top. Many debates are had over which bakery produces the best, but our top three are **R.E.A.L. Bagels**, **St. Viateur Bagel**, and **Fairmont Bagel**



Montréal's smoked meat was invented by Aaron Sanft, who was born in Romania. The smoked meat sandwich is piled high with thin slices of succulent meat smoked with a blend of secret spices. All the Deli and Diner restaurant's will have this on the menu, with the classics being **Schwartz's Deli**, **Lester's Deli** and **Reuben's Deli**.



Poutine is a decadent mix of fries, gravy and cheese curds (that squeak when you eat them!). Can even add smoked meat as a topping - you can't visit Canada without trying this! It will be on pretty much every food menu in bars, but the best can be found at **La Banquise**, **Poutineville**, as well as some classic diners, including **Greenspot**

iconic eateries

Montréal cuisine is a delicious combination of influences that started with Indigenous, British and French origins, but now knows no rules nor boundaries. Chefs across the city transform fresh, locally grown products into creative culinary concepts. An ever-changing whirlwind of flavours has elevated classic Québécois dishes from everyday cooking to surprisingly inventive delights. You won't be disappointed by the aptly named nouvelle cuisine québécoise.

- The **Jean-Talon Market** is open 361 days a year and offers products coming from a 60-kilometre radius of the city.
- The **Wilensky's Light Lunch** restaurant has not changed much since 1932. Travel back in time and order a special—"a beef bologna and salami sandwich."
- The **Gibeau Orange Julep** is a fast food restaurant built in the shape of a giant orange, a nod to the delicious juice it serves.
- The pretty little store **Le Petit Dep** is the ultimate candy shop of grown-ups and kids alike, with special treats, gourmet products, pastries and all the special touches to sweeten your stay.
- Hot dogs have been a must since 1912 at **Montréal Pool Room**, one of the city's institutions.
- La **Binerie Mont-Royal** serves iconic French-Canadian cuisine.



Going from your hotel to the convention facilities
will take you a few minutes

Going from your hotel to the convention facilities
will take you a few minutes

Whether you decide to walk, hail a cab, hop the Metro or rent a BIXI bike (public bike system), everything is safe, affordable and within easy reach.



Food Courts

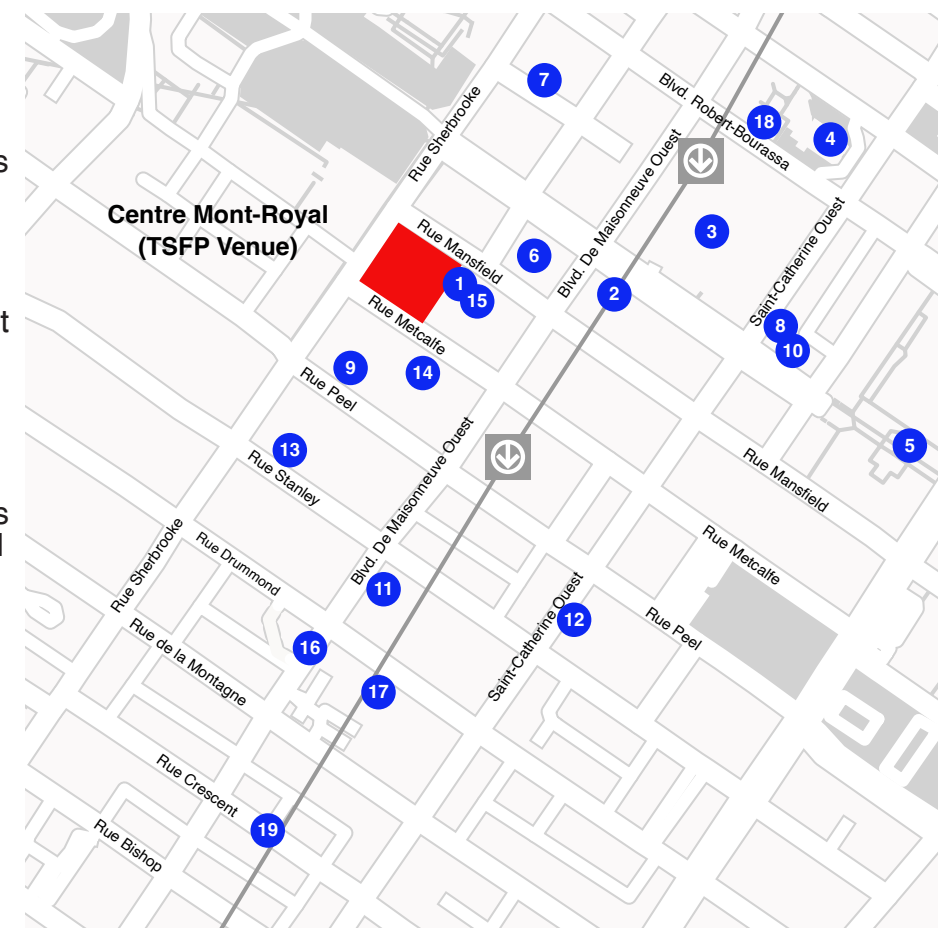
There are food courts in the basement (underground level) levels of many Montréal office buildings, generally serving fast food [\$-label]. Two high-end food courts, serving better quality meals, exist within walking distance of the Centre Mont-Royal [\$\$].

- | | |
|---|--------|
| (1) Centre Mont-Royal (2200 Mansfield St; Very small) | \$ |
| (2) Place Montréal Trust (1500 McGill College Ave) | \$ |
| (3) Eaton Centre (705 Sainte-Catherine St W) | \$ |
| (4) Place de la Cathédrale (625 Saint-Catherine St W) | \$ |
| (3) Time Out Market Montréal (2 nd floor Eaton Centre) | \$\$ |
| (5) Le Cathcart Restaurants (Place Ville-Marie, Mansfield & Cathcart, Ground level) | \$\$\$ |

Restaurants

- | Rank | Restaurant | Price |
|------|--|-------|
| (6) | Pigeon Café & Bar (2000 McGill College Ave – in iA Clarington) | \$ |
| (7) | Café Notman (690 Sherbrooke St W – in the McCord Stewart Museum) | \$ |
| (8) | Les 3 Brasseurs (732 Saint-Catherine St W) | \$\$ |
| (9) | Universel Déjeuners et Grillades (2055 Peel St) | \$\$ |
| (10) | Enoteca Monza Pizzeria Moderna (1251 McGill College Ave) | \$\$ |
| (11) | Copper Branch Stanley (1180 de Maisonneuve Blvd W; Vegan) | \$\$ |
| (12) | Reuben's Deli & Steakhouse (1116 Saint-Catherine St W) | \$\$ |
| (13) | Le Taj (2077 Stanley St; Vegetarian + Vegan options) | \$\$ |
| (14) | Restaurant Sho-dan (2020 Metcalfe St) | \$\$ |
| (15) | Le Boulevardier Restaurant (2050 Mansfield St – in Hôtel Le Germain) | \$\$ |
| (16) | Le Pois Penché (1230 de Maisonneuve Blvd W) | \$\$ |
| (17) | Bar George (Le Mount Stephen, 1440 Drummond St) | \$\$ |
| (18) | Osteria mkt (1333 Blvd. Robert-Bourassa) | \$\$ |

Known as one of the world's friendliest and liveliest cities, Montréal is recognized for its cosmopolitan side and its openness. In the middle of it all, is the famous **Crescent Street (19)**, the heart of downtown Montréal for tourists and locals alike. A wonderful sense of hospitality characterizes this tiny strip as well as a typical architecture that tends to create a warm and authentic atmosphere. With its bars, clubs, restaurants and discotheques, **Crescent Street (19)** is witness to round-the-clock action.



day trips

OTTAWA

Ottawa, the nation's capital, is only two hours from Montréal and home to the Canadian Parliament and federal institutions. The city will astound you with its imposing government buildings towering above the Ottawa River—especially the magnificent Library of Parliament and its superb Gothic Revival architecture. Each spring, the city welcomes visitors from around the world for the Canadian Tulip Festival, the largest in the world, with the breathtaking beauty of millions tulips bloom throughout the Capital Region. Ottawa is bursting with grand museums and beautifully designed parks along or close to the historic Rideau Canal which runs through the city centre.

LAURENTIANS

For fine dining and simple relaxation in fabulous natural surroundings, the Laurentians are about an hour's drive from Montréal. Featuring world-class resorts and parks—including the famous Mont-Tremblant four-season resort—here you'll find plenty of water sports, challenging golf courts, mountain biking, rock climbing, snowmobiling, dog sledding, and fantastic downhill and crosscountry skiing.

MONTÉRÉGIE

A short hop south of the river, the Montérégie region is a treasure trove of inviting attractions. Explore the Richelieu Valley, visit Chambly's famous microbrewery, or enjoy a picnic among the apple orchards on tranquil Mont Saint-Hilaire. Close by, Parc Safari is a great way to spend an afternoon.

EASTERN TOWNSHIPS

Head south from Montréal and you'll find yourself in the picturesque Townships region, well known for its bed-and-breakfast inns and gourmet cuisine. Tour vineyards and sample homemade wines, jams and syrups; then visit the Orford Arts Center for a summer concert under the stars.

QUÉBEC CITY

Just a two-and-a-half-hour drive from Montréal, Québec City lives up to its UNESCO World Heritage Site designation. Located on a spectacular bluff overlooking the St. Lawrence River, the streets and buildings of Cap Diamant, Québec City's historic quarter, and Place Royale recount the history of New France. Inside the city's old walls, the aroma of fresh bread, croissants and coffee waft through the narrow streets—an irresistible atmosphere of Old Europe is so pervasive that you'll find it hard to believe that you're still in North America.



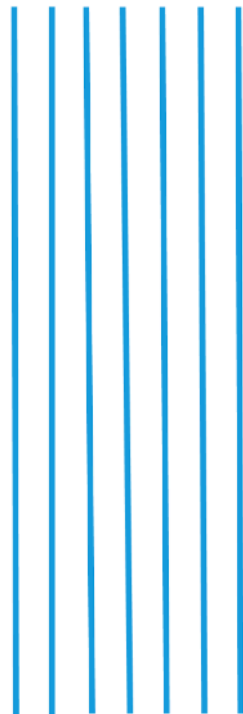
13th International Symposium on Turbulence and Shear Flow Phenomena

25th - 28th June 2024

SCIENTIFIC PROGRAM



International
Symposium
on Turbulence
and Shear Flow
Phenomena



Monday 24 th June 2024			
15h00 - 20h00	Registration (Foyer)		
Tuesday 25 th June 2024			
07h00 - 18h00	Registration (Foyer)		
08h00 - 08h20	Opening Ceremony (Théâtre Symposia)		
08h20 - 09h10	Session 1: Kasagi Award Lecture - <i>Ricardo Vinuesa</i> (Théâtre Symposia)	Salon International II	Salon Cartier I
09h20 - 10h40	Session 2A: Fundamentals of Turbulence	Session 2B: Active Flow Control I	Session 2C: Compressible Flows I
10h40 - 11h00	Coffee break (Foyer)		
11h00 - 12h00	Session 3A: Vortex Flows and Wingtip Vortices	Session 3B: Active Flow Control II	Session 3C: Compressible Flows II
12h00 - 13h50	Lunch break		
13h50 - 14h40	Session 4: Invited Lecture 1- <i>Karthik Duraisamy</i> (Théâtre Symposia)		
14h50 - 16h10	Session 5A: Resolvent Analysis	Session 5B: Active Flow Control III	Session 5C: Turbulence Modeling
16h10 - 16h30	Coffee break (Foyer)		
16h30 - 17h30	Session 6A: Combustion	Session 6B: Experimental Techniques	Session 6C: Interfacial Flows
18h00 - 20h00	Welcome Reception and Poster Presentations (Foyer)		
Wednesday 26 th June 2024			
08h20 - 09h10	Session 7: Invited Lecture 2 - <i>Bettina Frohnäpfel</i> (Théâtre Symposia)		
09h20 - 10h40	Session 8A: Jets I	Session 8B: Active Flow Control IV	Session 8C: Adverse Pressure Gradient Turb. Boundary Layers
10h40 - 11h00	Coffee break (Foyer)		
11h00 - 12h00	Session 9A: Jets II	Session 9B: Active Flow Control V	Session 9C: Instability I
12h00 - 13h50	Lunch break		
13h50 - 14h40	Session 10: Invited Lecture 3 - <i>Stéphane Moreau</i> (Théâtre Symposia)		
14h50 - 16h10	Session 11A: Heat Transfer	Session 11B: Applications	Session 11C: Compressors and Turbines
16h10 - 16h30	Coffee break (Foyer)		
16h30 - 17h30	Session 12A: Stratification and Buoyancy	Session 12B: Flow Over Porous Walls	Session 12C: Instability II
18h00 - 21h30	Symposium Banquet (Marché Bonsecours)		
Thursday 27 th June 2024			
08h20 - 09h10	Session 13: Invited Lecture 4 - <i>Joerg Schumacher</i> (Théâtre Symposia)		
09h20 - 10h40	Session 14A: Multiphase Flows I	Session 14B: Shear Layers	Session 14C: Flow Over Rough Walls I
10h40 - 11h00	Coffee break (Foyer)		
11h00 - 12h00	Session 15A: Multiphase Flows II	Session 15B: Wakes I	Session 15C: Flow Over Rough Walls II
12h00 - 13h50	Lunch break		
13h50 - 14h40	Session 16: Invited Lecture 5 - <i>Chunxiao Xu</i> (Théâtre Symposia)		
14h50 - 16h10	Session 17A: Multiphase Flows III	Session 17B: Wakes II	Session 17C: Flow Over Rough Walls III
16h10 - 16h30	Coffee break (Foyer)		
16h30 - 17h30	Session 18A: Environmental Flows	Session 18B: Wakes III	Session 18C: Flow Over Rough Walls IV
Friday 28 th June 2024			
08h20 - 09h40	Session 19A: Aerodynamics	Session 19B: Free Shear Flows	Session 19C: Rough Walls and Riblets
09h40 - 10h00	Coffee break (Foyer)		
10h00 - 11h00	Session 20A: Stability and Transition	Session 20B: Acoustics	Session 20C: Compressible Flows III
11h10 - 11h30	Closing Ceremony (Théâtre Symposia)		Session 20D: Wall-Bounded Turbulent Flows IV

08h00	OPENING CEREMONY Location: Théâtre Symposia Chair: Laurent Mydlarski , McGill University, Canada Chair: Stavros Tavoularis , University of Ottawa, Canada	Théâtre Symposium			
Session 1					
08h20	Kasagi Award Lecture Chair: Stavros Tavoularis , University of Ottawa, Canada				
	Discovering Novel Control Strategies for Turbulent Flows Through Deep Reinforcement Learning Ricardo Vinuesa				
Session 2	Salon International I Fundamentals of Turbulence Chair: Martin Oberlack , TU Darmstadt, Germany	Salon International II Active Flow Control I Chair: Philippe Lavoie , University of Toronto, Canada	Salon Cartier I Compressible Flows I Chair: Daniel Bodony , University of Illinois at Urbana-Champaign, USA	Salon Cartier II Transient Flows Chair: Jovan Nedić , McGill University, Canada	
1	Large-Scale Forcing Modulation of High Reynolds Number Turbulence in a Von Kármán Swirling Flow Farid Aligolzadeh, Pawel Baj, James R. Dawson	Optimization of Tollmien-Schlichting Waves Control: Comparison Between Deep Reinforcement Learning and Particle Swarm Optimization Approach Babak Mohammadikalakoo, Marios Kotsonis, Nguyen Anh Khoa Doan	Wall-Modeled LES of Unsteady Aerodynamics Over a Transonic Pitching Airfoil at High Reynolds Number Hiromichi Sashida, Shigetaka Kawai, Soshi Kawai	Effect of Deceleration on Laminar Separation Bubbles on SD7003 Airfoils Wolfgang Dierl, Rainer Hain, Serhiy Yarusyevych, Christian J. Kähler	
2	Helical Turbulence - The Transition Between 2D and 3D Turbulence Schahin Akbari, Martin Oberlack	Active Flow Control of Three-Dimensional Cylinders Using Deep Reinforcement Learning Pol Suárez, Francisco Alcántara-Avila, Jean Rabault, Arnau Miró, Bernat Font, Oriol Lehmkuhl, Ricardo Vinuesa	Wall-Modeled Large-Eddy Simulations of Wall Heating and Cooling Effects in Shock-Turbulent Boundary Layer Interactions Vanessa Rubien, Ivan Bermejo-Moreno	Formation Process of Laminar Separation Bubbles Over an SD7003 Airfoil at Various Accelerations Wolfgang Dierl, Rainer Hain, Serhiy Yarusyevych, Christian J. Kähler	
3	On the Return to Isotropy From Anisotropic Homogeneous Turbulent Shear Flow Frank Jacobitz, Kai Schneider	Influence of the State Observation on Deep-Reinforcement-Learning Drag-Reduction Policies in Wall-Bounded Flows Ricardo Vinuesa, Jean Rabault, Hossein Azizpour, Luca Guastoni	Towards High-Reynolds Number Shock-Turbulence Interaction via One-Dimensional Turbulence Pranav Nath, Jean-Pierre Hickey	Transient Dynamics of Separation and Reattachment on an Airfoil and Wing at Low Reynolds Numbers Connor Toppings, Serhiy Yarusyevych	
4	Dissipation Scaling in Production Region of Fractal Grid Turbulence Amir Sagharichi, Mark Francis Tachie	Development of Feedback Control Law for Wall Turbulence by Combining Optimal Control Theory and Bayesian Optimization Yusuke Yugeta, Yosuke Hasegawa	Experimental Investigation of the Transition Between Regular and Mach Reflections of a Shock Wave Impinging on a Turbulent Boundary Layer Sven Scharnowski, Rito Baidya, Christian J. Kähler	Shear Layer Instabilities in an Impulsively Started Airfoil Anushka Goyal, Jovan Nedić	
10h40 11h00				Coffee Break Foyer	

Session 3	Salon International I		Salon International II	Salon Cartier I	Salon Cartier II
	Vortex Flows and Wingtip Vortices		Active Flow Control II	Compressible Flows II	Separated Flows I
	Chair: David Rival , Technische Universität Braunschweig, Germany		Chair: Hiroya Mamori , The University of Electro-Communications, Japan	Chair: Mark Glauser , Syracuse University, United States of America	Chair: Julien Weiss , TU Berlin, Germany
	The Effect of Freestream Meandering		Direct Numerical Simulation of Turbulent Channel Flow With Opposition Control Based on Nonlinear Forecasting	Experimental and Numerical Investigation of Supersonic Multi-Stream Rectangular Jet Flow Using Steady Blowing Control	Low-Frequency Modal and Non-Modal Stability of a Turbulent Separation Bubble
	Marie Couliou, Girish Jankee, Srikar Yadala Venkata, Ingrid Neunaber, R. Jason Hearst		Togo Terui, Hiroya Mamori, Takeshi Miyazaki, Yusuke Nabae, Hiroshi Gotoda	Matthew Qualters, Melissa Yeung, Seth Kelly, Thakare Pranav, Yiyang Sun, Fernando Zigunov, Datta Gaitonde, Mark Glauser	Carolina Cura, Ardeshir Hanifi, André Cavalleri, Julien Weiss
1	11h00	The Impact of Finite Span and Wing-Tip Vortices on a Turbulent NACA0012 Wing		Optimizing Wall Blowing for Global Skin-Friction Drag Reduction Using a Bayesian Optimization Framework	Low-Frequency Spanwise Dynamics of a Turbulent Separation Bubble
2	11h20	Siavash Toosi, Adam Peplinski, Philipp Schlatter, Ricardo Vinuesa		Xiaonan Chen, Mike Diessner, Kevin Wilson, Richard D. Whalley	Ben Steinfurth, Carolina Cura, Lukas Fuchs, Kilian Oberleithner, Julien Weiss
3	11h40	Study of Crescent Wings in Backward and Forward Configurations		Artificial Intelligence Control of an Ahmed Vehicle Model Using Distributed Jets	Wall Pressure Signature of Separated Flows: A Comparison Between Flat Plate and Airfoil
		Mark Godfrey Mungal, Andrew Karl Mahler		Bingtu Zhang, Dewei Fan, Yu Zhou	Arnaud Le Floch, Alexandre Suryadi, Michaela Herr, Sen Wang, Sina Ghaemi, Jérôme Vétel, Giuseppe Di Labbio, Louis Dufresne
		12h00 13h50		Lunch	

Session 4	Théâtre Symposium				
13h50	Invited Lecture 1				
	Chair: Bharathram Ganapathisubramani , University of Southampton, United Kingdom				
Session 5	Generalizable Physics-Constrained Machine Learning for Predictive Modeling of Turbulent Flows				
	Karthik Duraisamy				
	Salon International I	Salon International II	Salon Cartier I	Salon Cartier II	
	Resolvent Analysis	Active Flow Control III	Turbulence Modeling	Separated Flows II	
	Chair: Beverley McKeon , Stanford University, United States of America	Chair: Michael Amitay , Rensselaer Polytechnic Institute, United States of America	Chair: Suad Jakirlic , Technical University of Darmstadt, Germany	Chair: Jérôme Vétel , Polytechnique Montréal, Canada	
1	14h50	An Efficient Algorithm for Resolvent and Harmonic Resolvent Analyses	Jet Control Using Distributed Minijets: Reynolds Number Effect and Scaling	Turbulent Scaling Laws and Symmetry-Based Second Moment Turbulence Modeling	LSB Flow Conditioning Using Spanwise Modulated Disturbances: HWA and Tomo-PIV Measurements
		Ali Farghadan, Aaron Towne	Dewei Fan, Jianjun Du, Zhi Wu, Yu Zhou	Felician Constantin Putz, Martin Oberlack	John W Kurelek, Theodoros Michellis, Marios Kotsonis, Serhiy Yarushevych
2	15h10	Resolvent Analysis of Separated Flows Over NACA0012 Wings: Reynolds Number Effects	Synthetic Jet Actuation for Boundary Layer Re-Energization and Physio-Cyber Simulations	Autonomous Large Eddy Simulations of Turbulence Using Eddy Viscosity Derived From the Sub Grid Scale Similarity Stress Tensor	On the Structure and Behaviour of the Wake Behind a Three-Dimensional Hill
		Laura Victoria Rolandi, Luke Smith, Kunihiro Taira	John Wylie, Akshit Jarwala, Saikishan Suryanarayanan, David Goldstein, Michael Amitay	Julian Andrzej Domaradzki	Daniel MacGregor, Philippe Lavoie
3	15h30	Resolvent Analysis of Transitional and Turbulent Flows Around Airfoils for Trailing-Edge Noise Model	Experimental Studies of Spanwise Correlation in an Actuated Turbulent Boundary Layer	Enhanced RANS Modeling Using Field Inversion	Experimental and Numerical Investigation of Oncoming Flow Conditions on the Dynamics of Flow Over a Forward-Facing Step
		Simon Demange, Zhenyang Yuan, Ardeshir Hanifi, André V. G. Cavalleri, Kilian Oberleithner	Mitchell Lozier, Flint O. Thomas, Stanislav Gordeyev	Karim Ahmed, Dylan Sitarski, Anupam Sharma, Paul Durbin	Emil Larose, Franck Kerhervé, Yann Fraigneau, Bérengère Podvin, Chris Morton, Robert Martinuzzi
4	15h50	Sparsity-Promoting Methods for Isolating Dominant Linear Amplification Mechanisms in Turbulent Flows	Optimizing Active Flow Control Strategies for Random and Controlled Wind Speeds via Bayesian Optimization	Conventional and Sensitized-RANS Modeling of Concentric Annular Couette Flow	Turbulent Separation Detection Based on a Lagrangian Approach
		Scott Thomas McGregor Dawson, Jaime Prado Zayas, Barbara Lopez-Doriga	Mike Diessner, Xiaonan Chen, Kevin Wilson, Richard D. Whalley	Xiaoyu Wang, Jeanette Hussong, Suad Jakirlic	Motahareh Sadr, Jérôme Vétel
		16h10 16h30	Coffee Break Foyer		

Welcome Reception and Poster Presentations

Foyer

POSTER SESSION Foyer	
P1	Scaling of the Reynolds Stress in Wall-Bounded Flows TW Lee, J.E. Park
P2	Evaluation of Mixing Performance of Three-Dimensional Jets Using Material Line Stretching Mamoru Takahashi, Ryota Matsui, Koichi Tsujimoto, Toshitake Ando
P3	Hot Wire Anemometry Temperature Correction in a Free Shear Layer Francesco Scarano, Emmanuel Jondeau, Edouard Salze
P4	Analysis and Modeling of the Tip Leakage Vortex of an Axial Fan US17 Natacha Galand, Ahmadou Bamba Drame, Marlène Sanjose
P5	The Balance of Power in Controlled Channel Flow: Limits and Possibilities Leo Mangalath, Daniel Floryan
P6	Primary Atomization and Turbulent/Non-Turbulent Interface in Liquid Round Jet Flow Seongdeuk Moon, Jinyul Hwang
P7	Turbulent Entrainment in the Transition of the Separated and Reattaching Flow Over a Wall-Mounted Fence Sicheng Li, Jinjun Wang
P8	Non-Local Eddy Diffusivity Model for Turbulent Scalar Flux Fujihito Hamba
P9	3D3C Rainbow Particle Tracking Velocimetry: Multi-Cycle Rainbow Pattern Using Color Space and In-Picture Tracking to Improve Velocity Vector Acquisition Mao Takeyama, Kota Fujiwara, Yasuo Hattori
P10	Conditional Analysis of Vortices Between Sirocco Fan Blades by POD of Suction Surface Pressure Kosuke Seto, Koji Iwano, Yasuhiko Sakai, Yasumasa Ito, Sho Kosaka, Kenji Yoshida
P11	Causal Analysis of Inner and Outer Motions in Near-Wall Turbulent Flow Jingxuan Zhang, Zhengping Zhu, Ricardo Vinuesa, Ruifeng Hu
P12	Experimental Characterization of a Sweeping Jet Actuator to Control Separated Flows Mathieu Tocquer, Cédric Raibaud, Azeddine Kourta
P13	Reduced-Order Model of Large-Scale Structures in Turbulence in a Periodic Cube Satoshi Matsumoto, Masanobu Inubushi, Susumu Goto
P14	Transition to Turbulence on a Concave Surface: Exploring the Effects of Temperature on Görtler Instability Maher Sawaf, Stephane Moreau, Sébastien Poncet, Abdellah Hadjadj, Mostafa Safdari Shadloo
P15	Effect of Freestream Turbulence on Flow Separation Around Ahmed Body Amir Sagharichi, Mark Francis Tachie
P16	Experimental and Numerical Study of Turbulent Jet Shear Layer Interacting With a Free Surface Nimesh Virani, Vesselina Roussinova, Ram Balachandrar
P17	On the Measurement of Structure Functions of High Schmidt Number Scalar in Turbulence Koji Iwano
P18	Deep Reinforcement Learning Model for Reducing Drag in Turbulent Channel Flow Based on Vortex Developing and Decaying Process Taisei Sato, Tomohiro Nimura, Akira Murata, Kaoru Iwamoto
P19	Flow State Transition of Mixed Convection in Vertical Channel With Horizontal Pressure Gradient Yuki Matsukawa, Ryo Araki, Takahiro Tsukahara
P20	Numerical Modeling of Atmospheric Boundary Layer Conditions for a Scaled-Down, Low-Speed Wind Tunnel Sheilla N Torres-Nieves, Francesco Forina
P21	Realizability in Tensor Basis Neural Networks for Two-Dimensional Turbulent Flows Anthony Man, Yasser Mahmoudi
P22	Experimental Study of Instantaneous Velocity-Pressure Correlations by PIV Measurement in a Turbulent Pipe Flow With Drag Reduction by Added Surfactant Takuya Yoshida, Shinnosuke Obi
P23	Comparison of a Turbulent Boundary Layer Encountering a Ramp Versus a Bump Akhileshwar Borra, Theresa Saxton-Fox
P24	Direct Numerical Simulation of Turbulent Flow Through a Concentric Annular Square Duct Taylor C. Opperman, Mark S. Tachie, Bing-Chen Wang
P25	Numerical Simulation of Boundary Layer Flow on a Flat Plate With Turbulence Stimulator Youhei Takagi
P26	Numerical Investigation of Distributed Roughness Effects for Transient Flow Takuto Ogawa, Aiko Yakeno
P27	On Vortex Ring Formation in Radially-Confined Spaces Under Co-Flow and Pressure Gradients Nora C. Wild, Kartik V. Bulusu, Michael W. Plesniak

Théâtre Symposium					
Session 7	Invited Lecture 2 Chair: Martin Oberlack , TU Darmstadt, Germany Turbulent Flows over Rough Surfaces Bettina Frohnapefel				
Session 8	08h20				
		Salon International I Jets I Chair: Bianca Viggiano , Polytechnique Montréal, Canada	Salon International II Active Flow Control IV Chair: Marios Kolsonis , Delft University of Technology, The Netherlands	Salon Cartier I Adverse Pressure Gradient Turbulent Boundary Layers Chair: Yvan Maciel , Université Laval, Canada	Salon Cartier II Data-driven Modeling I Chair: Aaron Towne , University of Michigan, United States of America
	1 09h20	Turbulent Impinging Jets on Smooth and Rough Plates Francesco Secchi, Davide Gatti, Bettina Frohnapefel	On the Effect of Buffer Layer Spanwise Blowing in Turbulent Boundary Layers Using Pulsed-DC Plasma Actuation Andrew Myers, Flint Thomas, Thomas Corke	Evolution of a High Reynolds Number Adverse-Pressure Gradient Turbulent Boundary Layer from a Canonical Upstream Condition Mitchell Lozier, Ahmad Zarei, Ivan Marusic, Rahul Deshpande	Extreme Aerodynamics of Vortex Impingement: Machine-Learning-Based Compression and Situational Awareness Kai Fukami, Kunihiro Taira
	2 09h40	Comparative Analysis of the Mixing Characteristics of Slot and Duct Twin-Jet Impingement: A Sensitized RANS Study Steffen Gröninger, Maximilian Bopp, Suad Jakirlic	Scaling of Drag Reduction in a Turbulent Boundary Layer Based on Plasma-Generated Streamwise Vortices Xiaohui Wei, Yu Zhou	Spatial Features of Reynolds-Stress Carrying Structures in Turbulent Boundary Layers With Pressure Gradient Taygun Recep Gungor, Ali Yesildag, Ayse Gul Gungor, Yvan Maciel	Machine-Learned Sub-Grid Scale Backscatter in Coarse-grid LES Soju Maejima, Soshi Kawai
	3 10h00	Asymmetric Jet Impingement on a Rotating Surface Corey Klinkhamer, Jerry Adjetey, Ram Balachandar	Wall-Normal-Microjet-Based Drag Reduction of High Reynolds Number Turbulent Boundary Layers Xin Zhang, Xiao Hui Wei, Han Feng Wang, Yu Zhou	Effect of Flow History in Turbulent Boundary Layers with Adverse Pressure Gradient Taygun Recep Gungor, Ayse Gul Gungor, Yvan Maciel	A GNN-Based Comprehensive SGS Stress Model for Turbulence and Turbulent Combustion Haruya Shimamoto, Ye Wang, Sayaka Suzuki, Mamoru Tanahashi
	4 10h20	The Velocity Field Parallel to the Wall in a Turbulent Three-Dimensional Wall Jet Bonnie Sim, Joseph W. Hall	Large-Scale Energy Attenuation in Turbulent Boundary Layer Flow Using an Inner-Scaled Helmholtz Resonator Abdelrahman Hisham Ahmed Sabri Hassanein, Davide Modesti, Fulvio Scarano, Woutijn J. Baars	Turbulent Actuation of Inlet Flow for a Mild Adverse-Pressure-Gradient Boundary Layer Ehsan Asgari, Mohammad Saeedi	Resolvent-Based Estimation and Control of Wakes and Jets Aaron Towne, Junoh Jung, Rutvij Bhagwat, Yuhao Zhou, James Paulson
	10h40 11h00	Coffee Break Foyer			

Session 9		Salon International I Jets II Chair: Giuseppe Di Labbio , École de Technologie Supérieure, Canada	Salon International II Active Flow Control V Chair: Yulia Peet , Arizona State University, United States of America	Salon Cartier I Instability I Chair: David Sumner , University of Saskatchewan, Canada	Salon Cartier II Wall-Bounded Turbulent Flows I Chair: Joseph Klewicki , University of Melbourne, Australia
	1 11h00	Scalar Mixing in Axisymmetric Jets with External Turbulence Khashayar F. Kohan, Susan J. Gaskin	Reducing Drag in Turbulent Pipe Flow by Azimuthal Wall Oscillation Lena F Sabidussi, Liuyang Ding, Marcus Hultmark, Alexander J Smits	On the Transition in Spanwise Instability Relaminarization in the Wake of Oscillating Foils Suyash Verma, Arman Hemmati	An Experimental Investigation of Tangential and Radial Velocity Statistics of a Rotating Disk Boundary Layer Mohammadreza Mollaei, Jimmy Philip, Joseph C. Klewicki
	2 11h20	The Entrainment of Mass, Momentum, and Kinetic Energy From a Turbulent Background Oliver R.H. Buxton, Jiangang Chen	Transverse Wall Oscillation Impact on Vortex Populations in Turbulent Pipe Flow With Drag Reduction Daniel Cox, Yulia Peet, Ronald Adrian	On the Formation of the Primary and Secondary Vortex Street Instabilities Elif Bekoglu, Nikos Bempedelis, Konstantinos Steiros	Topology of Fine Scale Motions in a Polymer Drag-Reduced Boundary Layer Lucas Warwaruk, Sina Ghaemi
	3 11h40	Turbulent Twin Jets in the Presence of a Turbulent Ambient Farzin Homayounfar, Khashayar F. Kohan, Babak Khorsandi, Susan Gaskin	Boundary Layer Response to Travelling Surface Waves at High Reynolds Number Isabella Fumarola, Matthew Santer, Jonathan Morrison	Stability Analysis of Oblique Couette-Poiseuille Flows Muhammad Abdullah, George Ilhwan Park	Smart Targeting Particles for Efficient Polymer Drag Reduction Ryan Edward Kelly, David Goldstein, Saikishan Suryanarayanan, Robert Handler, Rabia Sonmez
	12h00 13h50	Lunch			

Théâtre Symposium					
Session 10	United Lecture 3 Chair: Beverly McKeon , Stanford University, United States of America Turbomachinery Noise: Turbulence a Key Ingredient Stéphane Moreau				
Session 11	13h50				
		Salon International I Heat Transfer Chair: Stavros Tavoularis , University of Ottawa, Canada	Salon International II Applications Chair: Raúl Bayoán Cal , Portland State University, United States of America	Salon Cartier I Compressors and Turbines Chair: Karen Mulleners , EPFL, Switzerland	Salon Cartier II Wall-Bounded Turbulent Flows II Chair: Alexander John Smits , Princeton University, United States of America
	1 14h50	Super-Ultimate Heat Transfer in Turbulent Thermal Convection Between Horizontal Porous Walls Fanyu Meng, Shingo Motoki, Genta Kawahara	Identification of Coherent Structures in the Wake of a Rotating Tire Using High-Speed PIV Measurements and the Spectral POD Method Ivan Joksimovic, Philipp Brockmann, Jeanette Hussong, Suad Jakirlic	Analysis and Identification of the Appearance of Unsteadiness Effects in an Axial Compressor Cascade Ahmadou Bamba Drame, Marlène Sajose	Spectral Analysis of the Recovery of the Energy-Containing Scales of Motion in Turbulent Boundary Layers Antonio Matas, Ezhilsabareesh Kannadasan, Callum Atkinson, Julio Soria
	2 15h10	DNS Study of Turbulent Heat Transfer in a Circular Pipe Subjected to Axial System Rotation Zhao-Ping Zhang, Bing-Chen Wang	The Airflow in the Human Nose: Simulations and Experiments of Clinical Interest Marco Atzori, Guido Guglielmo Tesa, Gabriele Dini Ciacci, Maurizio Quadrio	Direct Numerical Simulation of Unsteady Boundary-Layer Separation in a Compressor Cascade Taiyang Wang, Yaomin Zhao	Prediction of Boundary Layer Thickness and Friction Velocity by Symmetry Arguments Chenning Tong
	3 15h30	Cellular Vortex Formation Between a Heated Horizontal Cylinder and an Adiabatic Upper Wall Marc-Etienne Lamarche-Gagnon, Stavros Tavoularis	Flow and Heat Transfer Dynamics in Fuel Cell Cooling Systems: A Scale-Resolving Computational Study Louis Krüger, Suad Jakirlic	Numerical Analysis on Thrust Characteristics of a Cyclorotor: Effect of Number of Blades Manabu Saito, Jun Nagao, Ryoichi Kurose	The Universality of the Law of the Wall: A Long-Lasting Controversial Debate Stefan Heinz
	4 15h50	Direct and Large-Eddy Simulations of Turbulent Heat Transfer in Taylor-Couette Flows With a Stationary Grooved Outer Cylinder Yoshimi Amano, Kohei Takeda, Yusuke Kuwata, Masayuki Kaneda, Kazuhiko Suga	Particle Transport-Driven Flow Modulation in Solar Photovoltaic Modules Sarah Smith, Henda Djeridi, Marc Calaf, Raúl Bayoán Cal, Martin Obligado	Interaction of Freestream Turbulence With Vortex Structures in Vertical Axis Turbines Jovan Nedić, Daniel Fernex, Karen Mulleners	Characteristics of Active and Inactive Motions in High-Reynolds-Number Turbulent Boundary Layers Rahul Deshpande, Ricardo Vinuesa, Ivan Marusic
	16h10 16h30	Coffee Break Foyer			

Théâtre Symposium					
Session 12		Salon International I Stratification and Buoyancy Chair: Sutanu Sarkar , UCSD, United States of America	Salon International II Flow Over Porous Walls Chair: Bettina Frohnäpfel , Karlsruhe Institute of Technology (KIT), Germany	Salon Cartier I Instability II Chair: Arman Hemmati , University of Alberta, Canada	Salon Cartier II Data-Driven Modeling II Location: Salon Cartier II Chair: Scott T. M. Dawson , Illinois Institute of Technology, United States of America
	1 16h30	The Interaction Between Cylinders and Non-Boussinesq Gravity Currents Peter Brearley, Paul Bartholomew, Sylvain Laizet	Coupling of Wall-Pressure Fluctuations in a Transpiratively- Cooled Turbulent Boundary Layer Sophie Hillcoat, Jean-Pierre Hickey	Suboptimal Transient Growth: Statistical and Data-Driven Viewpoints Peter Frame, Zhicheng Kai, Aaron Towne	Modal Decomposition of High-Speed Cavity Flows Using Non-Time- Resolved PIV and Quantitative Schlieren Yang Zhang, Louis Cattafesta, Lawrence Ukeiley, Kunihiko Taira
	2 16h50	Symmetry-Based Parametrization of the Stable Atmospheric Boundary Layer Marta Wacławczyk, Jun-Ichi Yano, Grzegorz Florczyk, Jackson Nzotungishaka	Amplitude Modulation of Turbulent Boundary Layer Over Anisotropic Permeable Wall Xiaonan Chen, Qingqing Ye, Zhixiang Feng	New Linear 3D Oblique Modes - A Novel Path to Turbulence Martin Oberlack, Alparslan Yalcin, Jonathan Laux, Simon Görtz, Lara de Broeck, Yongqi Wang, Kilian Wilhelm	Sparse Sensor Placement for Turbulent Flow Field Reconstruction Based on Mean-Flow-Linearized Dynamics Benjamin Herrmann, Erick Kracht, Steven L. Brunton, Beverley J. McKeon
	3 17h10	Stratified Wakes of a Prolate Spheroid at Moderate Angle of Attack Sheel Nidhan, Sanidhya Jain, Jose Ortiz Tarin, Sutanu Sarkar	Numerical Investigation of Turbulent Open Channel Flow Over a Permeable Bed: Pore- Resolved Simulations and Upscaled Modeling Shashank Karra, Sourabh Apte	Association of Ground Effect and LEV Instability Around Parallel Oscillating Foils Ahmet Gungor, Suyash Verma, Muhamad Saif Ullah Khalid, Arman Hemmati	Nonlinear Frequency-Domain Reduced-Order Modelling of Turbulent Flows Xiaodong Li, Davide Lasagna
	18h00 21h30	Symposium Banquet Marché Bonsecours			

Théâtre Symposium				
Session 13	Invited Lecture 4 Chair: Kazuhiro Suga , Osaka Metropolitan University, Japan Turbulent mesoscale convection in the Boussinesq limit and beyond Joerg Schumacher			
08h20				
Session 14	Salon International I Multiphase Flows I Chair: Ian Jacobi , Technion, Israel	Salon International II Shear Layers Chair: Serhiy Yarusyevych , University of Waterloo, Canada	Salon Cartier I Flow Over Rough Walls I Chair: Bharathram Ganapathisubramani , University of Southampton, United Kingdom	Salon Cartier II Numerical Methods Chair: Sylvain Laizet , Imperial College London, United Kingdom
	1 09h20	Direct Numerical Study of Turbulent Pipe Flow Laden with Thermal Particles Using a Hybrid Lattice Boltzmann Method Farshad Gharibi, Amir Eshghinejadfard, Dominique Thievenin	Aspect Ratio Effects on Flow Past a Bed-Mounted Emergent Cylinder Abhinav Thakurta, John Boamah, Vesselina Roussinova, Ram Balachandar	Higher DNS-Resolution Requirements for Expanded Overlap Region and Confirmation of a Convergence Criterion Sergio Hoyas, Ricardo Vinuesa, Peter J. Schmid, Hassan Nagib
	2 09h40	Attenuation Mechanism of Wall Turbulence by Heavy Finite-Size Particles Yutaro Motoori, Susumu Goto	Three-Dimensional Effects in Turbulent Shear Layers Vedant Kumar, Dipendra Gupta, Gregory Paul Bewley, Johan Larsson	Continuous Eddy Simulation (CES): Conceptual Approach and Applications Stefan Heinz, Adeyemi Fagbade
	3 10h00	Multiresolution Analysis of Convergence and Divergence of Inertial Particle Velocity in Turbulence Thibault Maurel-Oujia, Keigo Matsuda, Kai Schneider	On the Experimental Study of 3D Turbulent Shear Layers Dipendra Gupta, Vedant Kumar, Johan Larsson, Gregory P Bewley	Dissipation Element Analysis for Physics Based Tailored Numerical Grid in Statistical Turbulence Fettah Aldudak, Holger Foysi
	4 10h20	Dispersion of Heated Particles in a Subsonic Jet Ahmed Saieed, Jean-Pierre Hickey	The Effects of Free-Stream Turbulence on Flow-Induced Loads Francisco José Gomes de Oliveira, Zahra Sharif Khodaei, Oliver Buxton	Advancing Wall-Modelled Large-Eddy Simulations: A Lagrangian Relaxation Approach for Rough Surfaces Teresa Salomone, Charles Meneveau, Giuliano De Stefano, Ugo Piomelli
	10h40 11h00	Coffee Break Foyer		

Session 15	Salon International I Multiphase Flows II Chair: Sébastien Poncet , Université de Sherbrooke, Canada	Salon International II Wakes I Chair: Ebenezer Ekow Essel , Concordia University, Canada	Salon Cartier I Flow Over Rough Walls II Chair: Christian J. Kähler , University of the Bundeswehr, Germany	Salon Cartier II Scalar Mixing Chair: Christina Vanderwel , University of Southampton, United Kingdom
	1 11h00	Numerical Study on Turbulent Bubbly Flow in Vertical Channel Fang-yu Chen, Wei-xi Huang, Chun-xiao Xu	Turbulent Boundary Layer Scale Interactions in the Presence of a Freestream Cylinder Wake Guangyao Cui, Alexey Zhelebovskiy, Ian Jacobi	Application of Turbulent Diffusivity Models to Point-Source Dispersion in Outdoor and Indoor Flows Desmond Lim, Christina Vanderwel
	2 11h20	Modification of Flow Structure and Energy Cascading Process by Small Bubbles in Turbulent Jets Hyunduk Seo, Kyung Chun Kim	Roughness Impacts on Boundary Layer Superstructures Humza Butt, Shishir Damani, Bhavika Sharma, Eric Totten, Todd K. Lowe, William J. Devenport	Quantifying Mixing in Flows Transporting Multiple Scalars Alais Hewes, Laurent Mydlarski
	3 11h40	Turbulent Two-Phase Flows in a Transcritical CO2 Ranque-Hilsch Vortex Tube Raphael Oberli, Antoine Metsue, Yu Fang, Sébastien Poncet	On the Impact of Calcareous Biofouling on Turbulent Boundary Layers Ioannis Kaminaris, Elias Balaras, Vidya Vishwanathan, Michael Schultz	Turbulent Mixing of Heat and Momentum of a Turbulent Boundary Layer Perturbed by an Effusion Film Daniel Burnett, Jonathan Morrison
	12h00 13h50	Lunch		

Théâtre Symposium					
Session 16	United Lecture 5 Chair: Hyung Jin Sung , KAIST, Republic of South Korea Equivalent Boundary Layer Model and its Application in Inflow Turbulence Generation Chunxiao Xu				
Session 17		Salon International I Multiphase Flows III Chair: Kai Schneider , Aix-Marseille Université, France	Salon International II Wakes II Chair: Taehoon Kim , Seoul National University of Science and Technology, Republic of South Korea	Salon Cartier I Flow Over Rough Walls III Chair: Hassan M. Nagib , Illinois Tech, United States of America	Salon Cartier II Urban Flows I Chair: Marius Paraschivoiu , Universite Concordia, Canada
	1	14h50 Experimental Investigation of Particle-Wake Interactions Based on Freely Falling Finite Particles Yi Hui Tee, James R Dawson, R. Jason Hearst	The Effect of Permeability on Wake Characteristics Behind Structured Porous Cylinders Chansoo Seol, Taewoo Kim, Taehoon Kim	Direct Numerical Simulation of Turbulent Flow Through a Square Duct With Longitudinal Ribs Mark Sedem Tachie, Wei-Jian Xiong, Bing-Chen Wang	Scaling the Sectional-Drag Profile of Urban-Canopy Layers Manuel Aguiar Ferreira, Bharathram Ganapathisubramani
	2	15h10 Sensitized RANS-Based Euler-Lagrange Modeling of a Turbulent Particle-Laden Flow Xiaoyu Wang, Jeanette Hussong, Suad Jakirlic	Undulated Cylinder Array Distribution Effect on Flow Structure Dynamics Ondřej Ferčák, Zein Sadek, Trevor K. Dunt, Christin T. Murphy, Jennifer A. Franck, Raúl Bayoán Cal	The Influence of Windward and Effective Slope on Turbulent Channel Flow Over Ratchet Roughness Oleksandr Zhdanov, Thomas O. Jelly, Angela Busse	Turbulent Reduction in the Wake of Tall Building Clusters Abhishek Mishra, Marco Placidi, Matteo Carpentieri, Alan Robins
	3	15h30 Stokes-Number Dependence of Inertial Particle Clustering in Turbulence Inertial Subrange Keigo Matsuda, Katsunori Yoshimatsu, Kai Schneider	Turbulence Transition in the Wake of Wall-Mounted Prisms Shubham Goswami, Arman Hemmati	Boundary Layer Development Under Streamwise Pressure Gradients at High Reynolds Numbers over Rough Walls Thomas Preskett, Bharathram Ganapathisubramani	Slenderness Effects on the Flow Over an Array of Tall Buildings With Random Heights Donnchadh MacGarry, Zheng-Tong Xie, Christina Vanderwel
	4	15h50	Experimental Study on the Merging of Two Axisymmetric Wakes Generated by Porous Discs Ingrid Neunaber, R. Jason Hearst	Extending the $v^{\wedge}2$-f Model to Rough Walls Ata Sojoudi, Donald J. Bergstrom	Printed Urban Environment Using a Water Tunnel Tomos Jared Rich, Christina Vanderwel
		16h10 16h30	Coffee Break Foyer		

Session 18		Salon International I	Salon International II	Salon Cartier I	Salon Cartier II
		Environmental Flows Chair: Sean Bailey , University of Kentucky, United States of America	Wakes III Chair: Robert Martinuzzi , University of Calgary, Canada	Flow Over Rough Walls IV Chair: Bing-Chen Wang , University of Manitoba, Canada	Urban Flows II Chair: Horia Hangan , Ontario Tech University, Canada
1	16h30	Towards an Improved Understanding and Modelling of Sensible Turbulent Heat Fluxes over Melting Glaciers Sheldon Russell Harrison, Laurent Bernard Mydlarski	Spectral POD Analysis of Dual Vortex Shedding Modes Around Intermediate Rectangular Cylinders Sedem Kumahor, Xingjun Fang, Robert J. Martinuzzi, Mark F. Tachie	Characterization of Anisotropic Irregular Roughness Through Direct Numerical Simulations Jiasheng Yang, Alexander Stroh, Shervin Bagheri, Bettina Frohnapef, Pouroya Forooghi	Predicting Turbulence Structure in Street-Canyon Flows Using Machine Learning Tomek Jaroslowski, Aakash Patil, Beverley McKeon
2	16h50	Optimising Wind Turbine Placement in Hilly Terrains: Insights From Bayesian Optimisation Based on Large Eddy Simulations Christian Jané-Ippel, Nikolaos Bempedelis, Rafael Palacios, Sylvain Laizet	Spectral POD Analysis of the Ahmed Body Wake at High Reynolds Numbers Robert J.G. Forgie, Kareem Ali, Sen Wang, Sina Ghaemi	Near-Wall Characteristics of Non-Equilibrium Turbulent Boundary Layers on Rough Walls Junlin Yuan, Matthew Gatzek, Saurabh Pargal	Indoor-Outdoor Pollutant Exchange in a Flow Through a Hollow Cube Immersed in a Turbulent Boundary Layer Subhajit Biswas, Christina Vanderwel
3	17h10	Using Small Uncrewed Aircraft Systems to Examine the Scale Dependence of Surface Layer Turbulence Statistics Over Complex Terrain Sean Bailey, Christina Vezzi, Ryan Nolin	Characterizing Wake Patterns in Scattered Two-Foil Schools Priscila Portocarrero, Arman Hemmati	Spectral Analysis of Energy Transport Processes in Turbulent Flow Over Circular-Arc Ribs Wei-Jian Xiong, Jinglei Xu, Bing-Chen Wang	Tornado-Induced Wind Loads on a Community of Low-Rise Buildings Ruijia Yang, Djordje Romanic, Horia Hangan
	18h00 21h30	Symposium Banquet Marché Bonsecours			

Session 19	Salon International I		Salon International II	Salon Cartier I	Salon Cartier II
	Aerodynamics		Free Shear Flows	Rough Walls and Riblets	Wall-Bounded Turbulent Flows III
	Chair: Shinnosuke Obi , Keio University, Japan		Chair: Mark Francis Tachie , University of Manitoba, Canada	Chair: Kaoru Iwamoto , Tokyo University of Agriculture and Technology, Japan	Chair: Hyung Jin Sung , KAIST, Republic of South Korea
	Boundary Layer Separation Control on Airfoils and Wings With Finite Trips at Low Reynolds Numbers Nianhua Liu, Serhiy Yarusevych		Anisotropic Damping of Steady and Pulsatile Shear Layers in Turbulent Shear-Thinning Flows Maira Barnes, Giuseppe A. Rosi, David Rival	Towards a New Roughness Parametrization Through the Effective Distribution Function Federica Bruno, Mauro De Marchis, Stefano Leonardi	High-Order Moment Scaling of Near-Wall Turbulence for Arbitrary Velocities: An Extended Symmetry Approach Martin Oberlack, Sergio Hoyas, Simon Görtz
	08h20	Computational and Experimental Study of Spanwise Synthetic Jet Flow Control Haonan Howard Ho, Adnan Machado, Pierre Edward Sullivan		The Effect of Fractal Orifices on the Entrainment of Synthetic Jets Congyi Xu, Jinjun Wang	Restricted Nonlinear Zero Pressure-Gradient Turbulent Boundary Layers Benjamin Austin Minnick, Dennice Gayme
	08h40	Wake Flow Dynamics of an A320 Morphing Wing Prototype Through Time-Resolved PIV and Hi-Fi Simulations Mateus Carvalho, Jacques Abou-Khalil, Clément Rouaix, Aberahmane Marouf, Horia Hangan, Jean-François Rouchon, Marianna Braza		PTV of Turbulent Flow Separation Induced by a Forward-Facing Step: A Lagrangian Perspective Xingjun Fang, Seyed Sobhan Aleyasin, Sedem Kumahor, Ebenezer Ekow Essel, Mark Francis Tachie	Self-Similarity for Turbulence Statistics of Logarithmic Region in High Reynolds Number Pipe Flow Noriyuki Furuichi, Marie Ono, Yoshiyuki Tsuji
09h00					
09h20			Vortex Breakdown Behind Polygonal Disks Dylan Caverly, Jovan Nedić	Reduced Order Model Based Investigations Into the Drag Reduction Breakdown in Flow Over Blade Riblets Bianca Viggiano, Benjamin Minnick, Xiaowei Zhu, Dennice Gayme	Nature of Sub-Convective Pressure Fluctuations in a Turbulent Boundary Layer Shishir Damani, Humza Butt, Eric Totten, Bhavika Sharma, William J. Devenport, Todd K. Lowe
09h40 10h00			Coffee Break Foyer		

Session 20	Salon International I		Salon International II	Salon Cartier I	Salon Cartier II
	Stability and Transition		Acoustics	Compressible Flows III	Wall-Bounded Turbulent Flows IV
	Chair: Catherine Mavriplis , University of Ottawa, Canada		Chair: Stephane Moreau , Université de Sherbrooke, Canada	Chair: Sven Scharnowski , University of the Bundeswehr Munich, Germany	Chair: Sina Ghaemi , University of Alberta, Canada
	Transition to Turbulence of an Incompressible Flow Over a High-Lift Airfoil Ming Teng, Catherine Mavriplis		Experimental Investigation of Acoustic Scattering by a Turbulent Shear Layer Francesco Scarano, Vincent Clair, Antonio Augusto Pereira, Edouard Salze, Joannes Chambon	Spanwise Wall Oscillation Control of Compressible Channel Flow Marius Ruby, Holger Foysi	On the Dynamics of Instantaneous Wall-Normal Integrals Perry Johnson, Tanner Ragan
	10h00	Coherent Wave Generation in Swept-Wing Boundary Layer Transition at a Real Flight Condition Yuji Mori, Aiko Yakeno, Shigeru Obayashi		Laminar-to-Turbulent Transition of M=0.8 Boundary Layer Over a Heated/Cooled Flat Plate Yuta Iwatani, Hiroyuki Asada, Soshi Kawai	Self-Similar Properties of the Reynolds Shear Stress Probability Distribution in Wall-Bounded Flows Spencer James Zimmerman, Jimmy Philip, Yoshinobu Yamamoto, Yoshiyuki Tsuji, Joseph Klewicki
	10h20	Analytical Solutions and Optimal Perturbations in Accelerating and Decelerating Laminar Channel Flows Alec J Linot, Peter J Schmid, Kunihiro Taira		Estimating Mean Profiles and Fluxes in High-Speed Turbulent Boundary Layers Using Inner/Outer-Layer Transformations Asif Manzoor Hasan, Johan Larsson, Sergio Pirozzoli, Rene Pecnik	Wall-Attached Momentum Transfer Structures in Slip Channel Flows Junwoo Jae, Hyung Jin Sung, Jinyul Hwang
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11h10 11h30	CLOSING CEREMONY Location: Théâtre Symposia Chair: Laurent Mydlarski , McGill University, Canada Chair: Stavros Tavoularis , University of Ottawa, Canada				

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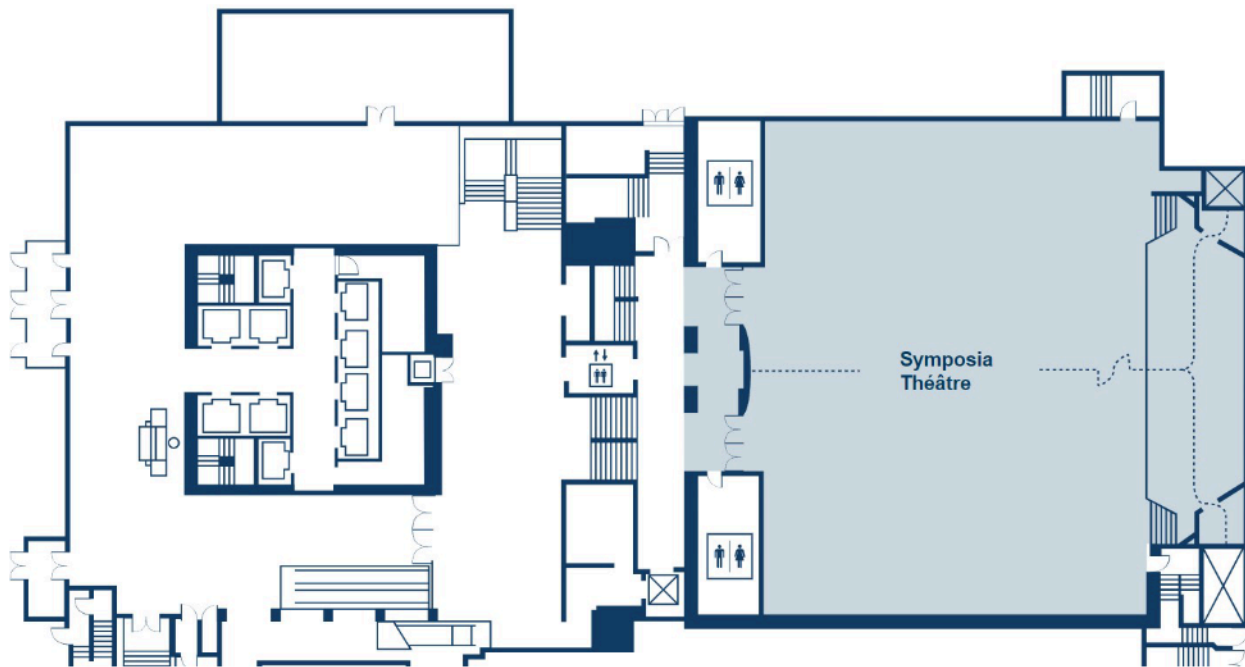
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