

iTi Workshop on Structure and control of wall-bounded turbulent flows

July 27, 2025 | Bertinoro, Italy

Time	Sunday (27 th of July)
08.30	Registration and Introductory remarks
	Session 1 – Chair: Marios Kotsonis
9:00	Keynote: <i>Smooth surface modifications for passive laminar flow control: recent results and future steps.</i> <u>M. Kotsonis</u> page 3
10:00	<i>Direct numerical simulation of streamwise traveling wave induced turbulent pipe flow relaminarization.</i> <u>C. Bauer</u> , C. Wagner page 4
10:20	<i>Towards optimal plasma actuator arrays for friction drag reduction.</i> <u>E. Fracchia</u> , L. Antal, G. Cafiero, D. Gatti and J. Serpieri page 6
10:40	<i>Space-time wall-pressure–velocity correlations spanning across a turbulent boundary layer and large streamwise offsets.</i> <u>R. Deshpande</u> , A. Hassanein, W. J. Baars page 8
11:00	<i>On the optimal parameters of spanwise forcing for turbulent drag reduction.</i> <u>F. Gattere</u> , A. Chiarini, M. Castelletti, M. Quadrio page 10
	Coffee break (11:20 -11:50)

	Sunday (27 th of July)
	Session 2 – Chair: Clara Marika Velte
11:50	<i>Real-time particle image velocimetry using event-based imaging.</i> C. Willert , L. Franceschelli page 12
12:10	<i>Design and characterization of the transient response of oscillating plasma actuators for turbulent skin-friction control.</i> L. Magnani , G. Neretti, J. Serpieri, A. Popoli, A. Cristofolini, A. Talamelli, G. Bellani page 14
12:30	<i>Turbulent drag reduction using metamaterial surfaces.</i> N. Fu , J. Morrison, M. Santer page 16
12:50	<i>Wall-bounded turbulence manipulation using miniature Helmholtz resonators.</i> A. H. Hassanein , D. Modesti, W. J. Baars page 18
	Lunch (13:10 – 14:30)
	Session 3 – Chair: Peter Schmid
14:30	Keynote: <i>Data-driven flow control.</i> P. Schmid page 20
15:30	<i>From robotics to fluid dynamics: opportunities and pitfalls of Reinforcement Learning in flow control.</i> O. Semeraro , L. Mathelin page 21
15:50	<i>Gradient-enriched machine learning control of wingtip vortices via online S-PIV and synthetic jets.</i> G. Salomone , A. Scala, G. Paolillo, T. Astarita, G. Cardone, C.S. Greco Page 22
16:10	<i>Towards a bio-inspired flow estimation in wall-bounded turbulence.</i> A. Ianiro page 24
16.30	<i>Deep reinforcement learning for turbulent control: drag reduction and heat transfer management.</i> Z. Zhou, X. Zhu page 25
	Coffee break (16:50-17:20)
	Session 4 – Chair: Woutjin Baars
17:20	<i>Intra-phase recovery in a turbulent boundary layer subjected to spatial square-wave spanwise forcing.</i> M. Knoop , R. Deshpande, B. van Oudheusden page 26
17:40	<i>Boundary layer development derived from Galilean symmetry.</i> C. M. Velte , P. Buchhave page 28
18:00	<i>Reconstructed modal velocity fields in wall turbulence.</i> M. Guala , R. Ehsani, A. Ghosh, M. Heisel, I. Jacobi page 30
18:20	<i>On the manipulation of coherent structures in turbulent flows using Fourier-based wall modifications.</i> Y. Dincoglu , S. Verma, A. Hemmati page 32
18:40	Concluding remarks and final discussion: Chair G. Bellani and G. Cafiero

iTi CONFERENCE ON TURBULENCE XI

July 28 - 30, 2025 | Bertinoro, Italy

time	Sunday (27 th of July)
19:00	Welcome buffet - Registration

Time	Monday (28 th of July)
08.30	Registration and Introductory remarks
	Session 1 – Roughness I – Chair: Elias Balaras
9:00	Keynote: <i>Urban Aerodynamics and Turbulent Dispersion.</i> <u>C. Vanderweel</u> page 37
9:30	<i>Turbulent Boundary Layers over Multiscale Urban Arrays.</i> <u>C. Southgate-Ash</u> , S. Grimmond, A. Robins, M. Placidi page 39
9:50	<i>Energetic aspects of the Reynolds analogy in rough-wall turbulent forced convection.</i> F. Secchi, D. Gatti, U. Piomelli, <u>B. Frohnapfel</u> page 41
10:10	<i>The influence of wall-normal oscillating roughness on a turbulent boundary-layer.</i> <u>A. Ramani</u> , T. P. Illukkumbura, B. Ganapathisubramani, J. P. Monty, N. Hutchins page 43
10:30	<i>Influence of oncoming boundary layer on flow over a protruding forward-facing step.</i> <u>R. J. Martinuzzi</u> , E. Larose page 45
	Coffee break (10:50 -11:20)

Time	Monday (28 th of July)
	Session 2 – Turbulence Theory I – Chair: Martin Oberlack
11:20	<i>Wavenumber-to-wavenumber energy exchange by triadic Fourier-mode interactions in wall turbulence.</i> <u>T. Kawata</u> , T. Tsukahara page 47
11:40	<i>On velocity spectra in turbulent wall-bounded flows.</i> <u>S. Pirozzoli</u> page 49
12:00	<i>The Reynolds shear stress phase distribution and its relationship to spectral energy density in wall bounded flows.</i> <u>S. Zimmerman</u> , J. Philip, J. Klewicki page 50
12:20	<i>Homogeneous shear turbulence: kinetic energy growth rate as a nonlinear eigenvalue problem.</i> <u>J. Albert</u> , T. Gebler, M. Oberlack page 52
12.40	<i>Two-point enstrophy budget and energy cascade in turbulence.</i> <u>A. Cimarelli</u> , C.B. da Silva, G. Boga page 53
	Lunch (13:00 – 14:00)
	Session 3 – Wall Turbulence I – Chair: Ramis Örlü
14:00	Keynote: <i>Turbulent drag reduction by streamwise traveling waves of wall deformation.</i> <u>K. Fukagata</u> page 55
14:30	<i>Restricted Nonlinear Investigation of Developing Boundary Layers over Accelerating Walls.</i> <u>A. Risha</u> , B. A. Minnick, D. F. Gayme page 56
14:50	<i>Towards a composite mean velocity profile for adverse pressure gradient turbulent boundary layers.</i> <u>A. Zarei</u> , M. Lozier, R. Deshpande, I. Marusic page 58
15:10	<i>Constructing wall turbulence using attached hairpin vortices.</i> Y. Ge, W. Shen, Z. Han, <u>Y. Zhao</u> , Y. Yang page 60
15.30	<i>High Spatial Resolution PIV Study of Self-Similar Adverse Pressure Gradient Turbulent Boundary Layer on the Verge of Separation.</i> <u>Z. Chen</u> , B. Sun, A. Heidarian, C. Atkinson, J. Soria page 62
15:50 – 16:50	Coffee break and Poster presentation (session 1)

time	Monday (28 th of July)
	Session 4 – Roughness II – Chair: Christina Vanderweel
16:50	<i>Characterisation of rough-wall drag in compressible turbulent boundary layers.</i> <u>D. D. Wangsawijaya</u> , R. Baidya, S. Scharnowski, B. Ganapathisubramani, C. J. Kähler <i>page 64</i>
17:10	<i>Relaxation of staggered roughness generated turbulence in a low Re number channel flow.</i> <u>S. Tardu</u> , B. Arrondeau <i>page 66</i>
17:30	<i>A rough recovery.</i> <u>M. Formichetti</u> , A. Kwong, S. Symon, B. Ganapathisubramani <i>page 68</i>
17:50	<i>Influence of windward and effective slope on the structure of turbulent channel flow over ratchet-type roughness.</i> <u>O. Zhdanov</u> , A. Busse <i>page 70</i>
18:10	<i>DNS of turbulent boundary layers over dense soft filaments.</i> N. Beratlis, A. Camminatiello, K. Squires, <u>E. Balaras</u> <i>page 72</i>
18:30	Possible Visit to CICLoPE

time	Tuesday (29 th of July)
	Session 5 – Turbulence Theory II – Chair: Martin Oberlack
8:30	Keynote: <i>Breakup of small aggregates in turbulent flows.</i> <u>A. Lanotte</u> page 74
9:00	<i>A Universal Relation Between Intermittency and Dissipation in Turbulence.</i> <u>F. Schmitt</u> , J. Peinke, M. Obligado page 75
9:20	<i>Spontaneous generation of helicity in anisotropic turbulence near the two-dimensional limit.</i> <u>S. Sukoriansky</u> , E. Barami page 77
9:40	<i>Near and far field development of the turbulent round jet derived from Galilean symmetry.</i> P. Buchhave, <u>C. M. Velte</u> page 79
10:00	<i>Amplitude Modulation in Restricted Nonlinear Turbulence.</i> <u>B. Viggiano</u> , B. Minnick, D. F. Gayme page 81
	Coffee break (10:20 -10:50)
	Session 6 – Wake Turbulence – Chair: Bettina Frohnappfel
10:50	<i>Turbulent/turbulent entrainment in a planar wake.</i> <u>O. R. H. Buxton</u> , J. Chen page 83
11:10	<i>Coherent structures in the turbulent near-wake of a flapping wing.</i> <u>Y. Goodwin</u> , G. Rigas, J. F. Morrison page 85
11:30	<i>Turbulent wake resonance via oscillation of a solid plate.</i> <u>G. Xiangyu</u> , K. Steiros page 87
11:50	<i>A CFD Flow Control Study Using Plasma Actuation on the Leading Edge of a Bluff Body.</i> <u>G. Minelli</u> , R. Magal, G. Bellani page 89
	Lunch (12:10-13:10)

	Session 7 – Turbulence theory III – Chair: Michael Wilczek
13:10	Keynote: <i>Turbulence: statistical approach versus coherent structures.</i> <u>J. Peinke</u> page 91
13:40	<i>Entrainment and small-scale features in merging turbulent regions.</i> <u>F. A. Branco,</u> C. B. da Silva page 92
14:00	<i>Multiscale circulation in wall-parallel planes of turbulent channel flows.</i> <u>P.-Y. Duan,</u> X. Chen, K. R. Sreenivasan page 94
14:20	<i>Noise-expansion cascade – a fundamental property of turbulence.</i> <u>S. Liao,</u> S. Qin Page 95
14:40	<i>Extending Kolmogorov Theory to Polymeric Turbulence.</i> <u>A. Chiarini,</u> R. K. Singh, M. E. Rosti page 96
15:00 – 16:00	Coffee break and Poster presentation (session 2)
	Session 8 – Simulation Techniques – Chair: Martin Obligado
16:00	<i>Resolvent-Based Models for Wall-Modelled Large-Eddy Simulations.</i> Z. Hantsis, M. Chan, N. Hoang, B. J. McKeon, <u>U. Piomelli</u> page 98
16:20	<i>Investigation of the physical role of backward scatter in minimal channel flow.</i> <u>K. Inagaki</u> page 100
16:40	<i>Efficient Compressible Turbulent Flow Simulations: Entropy Projection and Correction for an ILES in a Discontinuous Galerkin solver.</i> A. Crivellini, L. Alberti, <u>E. Carnevali,</u> A. Colombo page 102
17:00	<i>Merging Filtering, Modeling and Discretization to Simulate Large Eddies in Burgers' Turbulence.</i> <u>R. Verstappen</u> page 104
17:50	Conference dinner: Bagno Holiday, Milano Marittima (BUS)

time	Wednesday (30 th of July)
	Session 9 – Convection & Complex flows – Chair: Sergio Pirozzoli
8:30	<i>Very low Ekman number turbulent rotating convection.</i> <u>E. Knobloch</u> , A. van Kan, B. Miquel, K. Julien, G. Vasil page 106
8:50	<i>Heat transfer fluctuations measurements with a heated thin foil.</i> <u>A. Cuéllar</u> , E. Amico, J. Serpieri, G. Cafiero, W. J. Baars, S. Discetti, A. Ianiro page 108
9:10	<i>Validation of helicity turbulence model and its application to stellar convection.</i> <u>N. Yokoi</u> page 110
9:30	<i>Richtmyer-Meshkov induced turbulent mixing in a shock tube.</i> <u>J. Griffond</u> , O. Soulard, Y. Bury, S. Jamme page 112
9:50	<i>Learning to Backtrace Turbulent Scalar Fields.</i> <u>M. Carbone</u> , L. Piro, R. Heinonen, L. Biferale, M. Cencini page 114
	Coffee break (10:10-10:30)
	Session 10 – Wall turbulence II – Chair: Hassan Nagib
10:30	<i>On the flow statistics and dynamics of axial rotating turbulent pipe flows: A DNS study.</i> <u>L. Yang</u> , J. Yao page 116
10:50	<i>Momentum and heat transfer in turbulent channels with drag-increasing riblets.</i> S. Cipelli, N. Rapp, B. Frohnäpfel, <u>D. Gatti</u> page 117
11:10	<i>Identity variation of turbulent spots in pipe flow associated with multigenerational splits, reconnect and re-splits.</i> <u>X. Wu</u> , P. Moin, R. J. Adrian page 119
11:30	<i>Direct Numerical simulations of Taylor-Couette flows with extreme small radius inner rotating cylinders.</i> <u>P. Orlandi</u> , S. Pirozzoli page 121
	Coffee break (11:50-12:10)

	Session 11 – Wall turbulence III – Chair: Alessandro Talamelli
12:10	<i>Experimental and numerical investigations of laminarization via preconditioning in turbulent pipe flows.</i> <u>S. Nozarian</u> , M. J. Rincón, P. Forooghi, M. Reclari, M. Abkar page 123
12:30	<i>High Reynolds number trends of centerline mean velocity and normal stress in pipe flow.</i> <u>H. Nagib</u> , L. Lazzarini, G. Bellani, A. Talamelli page 125
12:50	<i>On the inertial sublayer of the mean velocity profile in turbulent wall-flows.</i> <u>J. Klewicki</u> , J. Philip page 127
13.10	<i>High-order moment scaling of near-wall turbulence for arbitrary velocities: Extending the symmetry approach.</i> <u>M. Oberlack</u> , S. Hoyas, S. Görtz page 129
13:30	Concluding remarks
	Lunch (13:40-14:40)

Posters

Generalized Scaling of Wall-Bounded Turbulent Flow Structure. T.-W. Lee, J. E. Park
page 133

Structures and cascades for each wall-normal mode in wall-less models of wall-bounded turbulent flows. M. Takaoka page 135

Angular momentum transport scaling in Very wide gap turbulent Taylor-Couette flow ($\eta = 0.1$). M.H. Hamede, S. Merbold, C. Egbers
page 137

Connecting the Kramers-Moyal coefficients of turbulent flows with the turbulence dissipation constant C_ϵ . F. Köhne, F. Schmitt, J. Peinke page 139

Correlating large-scale turbulent structures and wind turbine loads within LES Simulations. M. Bock, D. Moreno, J. Peinke page 141

Spatio-temporal linear stability of plane Couette flow. K. Wilhelm, M. Oberlack, S. Görtz, J. Conrad, L. De Broeck, Y. Wang page 143

On the impact of tip speed ratio and free-stream turbulence on blade dynamics of a wind turbine. F. J. G. de Oliveira, Z.S. Khodaei, O. R. H. Buxton page 144

Effects of pressure gradient sequences on wall shear stress in turbulent boundary layers at $Re_\tau = 1500$. M. Mattei, T. Saxton-Fox page 146

Coherent structures and pressure fluctuations in axisymmetric turbulent boundary layer. C. Xu, Y. Xu, W. Huang page 148

Experimental Investigation of Turbulent Thermal Diffusion in Inhomogeneous and Anisotropic Turbulence. E. Elmakies, O. Schildkrot, N. Kleorin, A. Levy, I. Rogachevskii
page 150

A Lie-symmetry-based approach for the self-similar profiles of velocity moments in the turbulent round jet. N. Benedikt, M. Oberlack, C. T. Nguyen page 151

Experimental investigation of wind turbine wakes exposed to freestream turbulence. M. Bourhis, T. Messmer, M. Hölling, O. R. H. Buxton page 154

A new definition for the turbulent boundary layer thickness based on streamwise velocity skewness. M. Lozier, R. Deshpande, A. Zarei, L. Lindić, W. A. Rowin, I. Marusic
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Reducing the rough wall pressure drag via imposition of spanwise wall oscillations. R. Deshpande, A. G. Kidanemariam, I. Marusic page 158

Influence of Adverse Pressure Gradients on the Outer Region of High Reynolds Number Wall Turbulence. L. Lindić, R. Deshpande, W. A. Rowin, I. Marusic page 160

The fractal atmospheric turbulent-non-turbulent interface: characterization and experimental reproduction. M. Wächter, L. Neuhaus, M. Hölling, K. Avila, J. Peinke page 162

Drag reduction of a turbulent boundary layer by imposing a square-wave type spatial spanwise forcing. M. W. Knoop, R. Deshpande, B. W. van Oudheusden page 164

Non-uniform heating effects in turbulent pipe flows. J. Neuhauser, D. Gatti, B. Frohnäpfel page 166

Balancing of MHD turbulence imbalance in strong shear flows. M. Kavtaradze, G. Mamatsashvili, G. Chagelishvili page 168

Scalings for transition of the boundary layer on a rotating slender cone in axial flow. K. Kato, K. Yamada, K. Takahara, P. H. Alfredsson, M. Matsubara page 170

Direct Numerical Simulations of turbulent channel flow roughened with 2D triangular bars: on the Effective Distribution parametrization. F. Bruno, S. Leonardi, M. De Marchis page 172

Anisotropic turbulence in transition phenomena of Taylor–Couette–Poiseuille flow. Y. Matsukawa, R. Araki, T. Tsukahara page 174

Turbulent channel flow manipulations by sinusoidal riblets – a numerical study. E. Amico, A. Busse, F. A. Portela, G. Cafiero page 176

Geometric and Statistical Characterization of the Turbulent/Non-Turbulent Interface in a Turbulent Boundary Layer Flow Identified Using Uniform Momentum Zone Concepts. B. Sun, C. Atkinson and J. Soria page 178

Structure of the momentum and temperature fields in a turbulent boundary layer perturbed by an effusion film. D. Burnett, J. F. Morrison page 180

Direct Numerical Investigation of Flow Dynamics in Karst Conduits. I. El Mellas, J. Hidalgo, M. Dentz page 182

The effect of porosity on the drag of a sphere. N. Conlin, K. Steiros, M. Hultmark page 184

Influence of wall temperature on separation-induced transition in boundary layers of real gas flows. D. Bulgarini, M. Dellacasagrande, A. Ghidoni, E. Mantecca, G. Noventa page 186

Oscillating grid turbulence: the influence of Reynolds number and forcing. M. Iovieno, H. Foyi, G. Khujadze page 187

Multi-point probability density hierarchy for homogeneous isotropic turbulence. S. Görtz, J. Conrad, N. Benedikt, M. Oberlack page 189

Convective organization and their influence on wind stress in a Large-Eddy Simulation ensemble. E. Foschi, L. Nuijens, P. Lopez-Dekker page 190

Image Processing Analysis of Large-Scale Structures in Two-Dimensional Turbulent Channel Flow. R. Takai, K. Takahara, K. Sato, S. Yimprasert, K. Kato, M. Matsubara page 192

Physical significance of artificial numerical noise of DNS for turbulence. S. Liao, S. Qin page 194

The Stability of The Frozen Top Bubble Model: Two-Dimensional Rayleigh-Bénard Convection on the Spherical Surface. X. He, P. Fischer, K. Kadhra, Y. Xiong page 195

Active heat-transfer control by pulsed jet in a turbulent pipe flow at high Reynolds numbers. L. Magnani, S. Discetti, A. Ianiro, G. L. Morini, A. Talamelli, M. Rossi, G. Bellani page 197

Scaling and Filtering of Sparse Wall-Pressure Measurements at the CICLoPE Long Pipe. L. Lazzarini, G. Dacome, W. J. Baars, G. Bellani, A. Talamelli page 199

An experimental platform to investigate the propagation of turbulent fluctuations in a lung model. A. Ravaioli, G. Santi, B. Bortolani, E. Marcelli, A. Benassi, G. Bellani page 201

Representation of turbulent structures in stable atmospheric boundary-layer regimes using large eddy simulations. L. Bührend, A. Englberger page 203

Differential lag equations to predict the effects of pressure gradient histories on turbulent boundary-layers. M. Virgilio, T. Preskett, P. Jaiswal, B. Ganapathisubramani page 205