Swagata Bhaumik

List of Publications (Papers Published in International Journals)

- Nonlinear and nonparallel receptivity of zero-pressure gradient boundary layer, T. K. Sengupta, S. Bhaumik, V. Singh, and S. Shukl, International Journal of Emerging Multidisciplinary Fluid Sciences, Vol. 1(1), 19–35, 2009.
- 2) Further improvement and analysis of CCD scheme: Dissipation discretization and de-aliasing properties, T. K. Sengupta, V. V. S. N. Vijay and S. Bhaumik, Journal of Computational Physics, Vol. 228(17), 6150–6168, 2009.
- 3) A new compact difference scheme for second derivative in non-uniform grid expressed in selfadjoint form, T. K. Sengupta, S. Bhaumik and S. Usman, Journal of Computational Physics, Vol. 230(5), 1822–1848, 2011.
- Linear spatial stability analysis of mixed convection boundary layer over a heated plate, T. K. Sengupta, S. Unnikrishnnan, S. Bhaumik, P. Singh and S. Usman, Prog. Applied Maths., Vol. 1(1), 1– 23 (2011).
- 5) Onset of Turbulence from the Receptivity Stage of Fluid Flows, T. K. Sengupta and S. Bhaumik, Physical Review Letters, 154501, 1–5 (2011).
- 6) Solution of Linearized Rotating Shallow Water Equations by Compact Schemes with Different Grid-Staggering Strategies, Manoj K. Rajpoot, Swagata Bhaumik and T. K. Sengupta, Journal of Computational Physics, vol. 231(5), 2300- 2327 (2012).
- 7) Direct Numerical Simulation of Two-Dimensional Wall-Bounded Turbulent Flows From Receptivity Stage, Tapan K. Sengupta, Swagata Bhaumik and Yogesh Bhumkar, Physical Review E, vol. 85(2), 026308, (2012).
- 8) Wave Properties of Fourth-Order Fully Implicit Runge-Kutta Time Integration Schemes, S. Bhaumik, S. Sengupta and A. Sengupta, Computers and Fluids, 81, 110–121, (2013).
- 9) Direct Numerical Simulation of Transitional Mixed Convection Flows: Viscous and Inviscid Instability Mechanisms, T. K. Sengupta, S. Bhaumik and R. Bose, Phys. Fluids, 25, 094102, (2013).
- 10) Diffusion in inhomogeneous flows: Unique equilibrium state in an internal flow, T. K. Sengupta, H. Singh, S. Bhaumik and R. Roy Chowdhury, Comp. Fluids, 88, 440–451, (2013), DOI: 10.1016/j.compfluid.2013.10.005.
- 11) Precursor of transition to turbulence: spatiotemporal wave front, Swagata Bhaumik and Tapan K Sengupta, Phys. Rev. E, 89, 043018, (2014).
- 12) A new velocity-vorticity formulation for direct numerical simulation of 3D transitional and turbulent flows, Swagata Bhaumik, Tapan K. Sengupta, Journal of Computational Physics, 284, 230–260, (2015).
- 13) Receptivity to harmonic excitation following non-impulsive start for boundary layer flows,

Swagata Bhaumik, Tapan K. Sengupta and Zulqarnain Akbar Shabab, AIAA J., 55(10), 3233-3238, (2017).

- 14) Impulse response and spatio-temporal wave-packets: The common feature of rogue waves, tsunami and transition to turbulence, Swagata Bhaumik and Tapan K. Sengupta, Phys. Fluids, 29, 124103, (2017).
- 15) Multiple hopf bifurcations and flow dynamics inside a 2D singular lid driven cavity Lucas Lestandi, Swagata Bhaumik, G.R.K.C. Avatar, Mejdi Azaiez, Tapan K. Sengupta, Computers and Fluids, vol. 166, 86-103 (2018).
- 16) POD applied to numerical study of unsteady flow inside lid-driven cavity, Lucas Lestandi, Swagata Bhaumik, Tapan K Sengupta, G.R. Krishna Chand Avatar, Mejdi Azaiez, J. Math. Study, 51(2), 150-176 (2018).
- 17) An Enstrophy-Based Linear and Nonlinear Receptivity Theory" Aditi Sengupta, V Suman, Tapan Sengupta, and Swagata Bhaumik, Phys. of Fluids, 30, 054106 (2018).
- Verification and Application of a Mean Flow Perturbation Method for Jet Noise, Swagata Bhaumik, S. Unnikrishnan, Datta Gaitonde, Aniruddha Sinha, Hao Shen, Aerospace Science and Technology, 80, 520-540 (2018).
- 19) Three-dimensional transition of zero-pressure-gradient boundary layer by impulsively and nonimpulsively started harmonic wall excitation, Pushpender Sharma, Tapan K. Sengupta, and Swagata Bhaumik, Phys. Rev. E 98, 053106 (2018).
- 20) The three-dimensional impulse response of a boundary layer to different types of wall excitation, Prasannabalaji Sundaram, Tapan K. Sengupta, and Swagata Bhaumik, Phys. Fluids 30, 124103 (2018).
- 21) Grid sensitivity and role of error in computing lid driven cavity problem, V. K. Suman, Siva Viknesh S., Mohit K. Tekriwal, Tapan K. Sengupta and Swagata Bhaumik, Phys. Rev. E, vol. 99, 013305 (2019).
- 22) A High Accuracy Preserving Parallel Algorithm for Compact Schemes for DNS, T. K. Sengupta, Prasannabalaji Sundaram, V. K. Suman and Swagata Bhaumik, *ACM Transactions on Parallel Computing*, Vol-7, Article No-21, 2020.
- 23) Dispersion Analysis Of Numerical Schemes Using 2D Compressible Linearized Navier-Stokes Equation for Direct Numerical Simulation, Sawant Omkar Deepak, Chandan Kumar Bhardwaj, and Swagata Bhaumik, *Computers and Fluids* 265 (2023) 106010"
- 24) Effects of bulk viscosity, heat capacity ratio, and Prandtl number on the dispersion relationship of compressible flows, Swagata Bhaumik, and Sawant Omkar Deepak, *Physics of Fluids* 35, 116116 (2023).
- 25) Linear stability analysis of compressible boundary layer over an insulated wall using compound matrix method: Existence of multiple unstable modes for Mach number beyond 3, Neha Chaturvedi, Swagata Bhaumik, Rituparn Somvanshi, *Physics of Fluids* 36, 084114 (2024) https://doi.org/10.1063/5.0219394.

Books Authored

DNS of Wall-Bounded Turbulent Flows - A First Principle Approach, Tapan K. Sengupta and Swagata Bhaumik, published by Springer Nature, Singapore (152 Beach Road, #21-01/04 Gateway East, Singapore-189721). This is a research monograph intended for graduate students, scientists

and researchers working in the areas of fluid flow transition and turbulence.

Papers Presented in National Conferences

- 1)Onset of turbulence via deterministic route T. K. Sengupta and S. Bhaumik. CTFD Div., NAL Bangalore, 3rd October, 2011. (Same talk was also presented at IIT Bombay on 7th October, 2011).
- 2)Instabilities in mixed convection flows and their computations: Revisiting Rayleigh and FjΦrtoft's theorems, Tapan K. Sengupta, Swagata Bhaumik and Rikhi Bose, 2ndNational Conference on Advances in Heat Transfer and Fluid Dynamics at Aligarh Muslim University, Aligarh on March 23-24, 2013.

Papers Presented in International Conferences

1) Receptivity analysis of mixed convection flow past a horizontal plate: Direct simulation, S. Usman,

V. Suman, S. Bhaumik and T. K. Sengupta, 7th Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, 19-21 July 2010, Antalya, Turkey.

- 2)Comparative studies of mixed convection flow instabilities past vertical and horizontal plate, T. K. Sengupta, S. Usman, V. Suman and S. Bhaumik, 7th Int. Conf. on Heat Transfer, Fluid Mechanics and Thermodynamics, 19-21 July 2010, Antalya, Turkey.
- 3)DNS, LES and High accuracy computing, T. K. Sengupta, S. Bhaumik and Y. G. Bhumkar, 1st Int. Conf. On Metacomputing (IcoMec10), December 16-17, 2010, Goa, India.
- 4)Nonlinear receptivity and instability studies by POD, T. K. Sengupta, S. Bhaumik and Y. G. Bhumkar, AIAA-2011-3293, 6th AIAA Theoretical Fluid Mechanics Conf., Honolulu, Hawaii, USA, 27-30 June 2011.
- 5)On the divergence-free condition of velocity in two-dimensional velocity-vorticity formulation of incompressible Navier-Stokes equation, Swagata Bhaumik and T. K. Sengupta, AIAA-2011-3238,

20th AIAA CFD Conf., 27-30 June, 2011, Honolulu, Hawaii, USA. (2011).

- 6)Direct numerical simulation in CFD: Now or never, Tapan K. Sengupta, Swagata Bhaumik and Yogesh Bhumkar, Int. Conf. On Metacomputing (IcoMec11), at National Institute of Oceanography, Dona Paula, Goa on December 2011.
- 7) Time integration for DNS of transitional and turbulent flows: Critical evaluation of IMEX method, Tapan K. Sengupta, Swagata Bhaumik, M. Sriramkrishnan and V. K. Sathyanarayanan, International Conference on Progress in Fluid Dynam- ics and Simulation, October 25-27, 2014, Mathematics Research Center, National Taiwan University, Taiwan.
- 8) A Navier-Stokes-Based Approach for Mean Flow Perturbation Analysis, Swagata Bhaumik, Datta Gaitonde, Mbu Waindim, 67th Annual Meeting of the APS Divison of Fluid Dynamics, November 23 25, San Francisco, USA (Proceedings published in J. Bulletin of the American Physical Society, Vol 59, 2014, Publisher- American Physical Society).
- 9) Role of Spatio-Temporal Wave-front in causing Flow Transition, Swagata Bhaumik and Tapan K.

Sengupta, 67th Annual Meeting of the APS Divison of Fluid Dynamics, November 23 - 25, San Francisco, USA (Proceedings published in J. Bulletin of the American Physical Society, Vol 59, 2014, Publisher-American Phys- ical Society).

- 10) Different Routes of Transition by Spatio-Temporal Wave-Front, Swagata Bhaumik, Tapan K. Sengupta and V. Mudkavi, IUTAM Symposium on Advances in Computation, Modeling and Control of Transitional and Turbulent Flows, 15-18 December, 2014, Goa, India.
- 11) DNS of Incompressible Square Duct Flow and its Receptivity, M. Sriramkrishnan, Tapan K. Sengupta and Swagata Bhaumik, IUTAM Symposium on Advances in Computation, Modeling and Control of Transitional and Turbulent Flows, 15-18 December, 2014, Goa, India.
- 12) Frequency dependent capacitance SDBD plasma model for flow control, S. Ghosh, P. M. Bagade, T. K. Sengupta, S. Bhaumik, S. Sengupta and H. D. Vo, IUTAM Symposium on Advances in Computation, Modeling and Control of Transitional and Turbulent Flows, 15-18 December, 2014, Goa, India.
- 13) Effects of Free-stream turbulence in a square duct flow, P. M. Bagade, S. Bhau- mik, M. Sriramkrishnan and T. K. Sengupta, IUTAM Symposium on Advances in Computation, Modeling and Control of Transitional and Turbulent Flows, 15-18 December, 2014, Goa, India.
- 14) From Tsunami to Turbulence: Link Revealed by Theory and High Performance Computing, T. K. Sengupta and S. Bhaumik, 6th ICTACEM, December 29-31, 2014, IIT Kharagpur, India.
- 15) Development of a Navier-Stokes-Based Numerical Method for Basic State Pertur- bation Analysis, Swagata Bhaumik, Datta V. Gaitonde and and Mbu Waindim, 53rd AIAA Aerospace Sciences Meeting, AIAA SciTech 2015, January 4 - 9, 2015, Orlando, Florida, USA. DOI: doi:10.2514/6.2015-1533.
- 16) Investigation of a Twinjet Configuration with and without Flow Control, Kalyan Goparaju, Datta V. Gaitonde and Swagata Bhaumik, 54th AIAA Aerospace Sciences Meeting, AIAA Aviation 2015, June 22 26, 2015, Dallas, Texas, USA.
- 17) Mean Flow Perturbation Analysis of Under-expanded Jet, Swagata Bhaumik, Datta Gaitonde and Hao Shen, 68th Annual Meeting of the APS Division of Fluid Dynamics, 60(21), Boston, Massachusetts, 2015.
- 18) Analysis of the Near-field of a Twinjet Configuration, Kalyan Goparaju, Datta Gaitonde, Swagata Bhaumik, 54th AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum and Exposition 2016.
- 19) Further Development of the Navier-Stokes Equations-Based Mean Flow Perturbation Technique, Mbu Waindim, Swagata Bhaumik, Datta Gaitonde, 54th AIAA Aerospace Sciences Meeting, AIAA Science and Technology Forum and Exposition 2016.
- 20) Application of Navier-Stokes based Mean-Flow Perturbation Method to Supersonic Jet Noise, S. Bhaumik, D. V. Gaitonde K. Goparaju, S. Unnikrishnan and M. Waindim, In 46th AIAA Fluid Dynamics Conference (p. 4092), 2016.
- 21) Physics of Twinjet Plume Interactions, K. Goparaju, D. V. Gaitonde, S. Bhaumik and D. J. Garmann, In 54th AIAA Aerospace Sciences Meeting, Chicago (p. 1109), 2016.
- 22) Investigation of the Plume Dynamics and the Near-field of a Supersonic Twinjet, Kalyan Goparaju, Datta V. Gaitonde, Swagata Bhaumik and Daniel J. Garmann, In 46th AIAA Fluid Dynamics Conference, (p. 4256), 2016.

- 23) Direct Numerical Simulation from First Principle of Transition for Zero-Pressure Gradient Boundary Layer: Spatio-Temporal Wave-Front, Swagata Bhaumik, Talk presented at First Indo-French Research Workshop held at IIT Indore, Simrol, India, from 29th-31st August, 2018.
- 24) Verification and Application of a Mean Flow Perturbation Method for Jet Noise, Swagata Bhaumik, D. Gaitonde, Unnikrishnan Nair, AA2/07, Paper Presented in WESPAC (Western Pacific Commission for Acoustics) meeting titled "Acoustical Science and Technology for Quality of Life" held at CSIR-National Physical Laboratory (CSIR-NPL), New Delhi-110012, from 11-15 November, 2018.
- 25) "Vortex induced vibration of a circular cylinder under compressible flow regime", by Swant Omkar Deepak and Swagata Bhaumik, paper presented in 9th International and 49th National Conference on Fluid Mechanics and Fluid Power (FMFP) December 14-16, 2022, IIT Roorkee, Roorkee-247667, Uttarakhand, India
- 26) Deepak, S.O., Bhardwaj, C.K., Sharma, S. and Bhaumik, S., Effect of reduced mass on twodimensional compressible flow past circular cylinder, 9th International and 49th National Conference on Fluid Mechanics and Fluid Power (FMFP-2022)
- 27) Compound Matrix Method for Calculating Stability Of 2D and 3D Compressible Boundary Layers, Neha Chaturvedi, Rituparn Somvanshi, Swagata Bhaumik, 13th Asian Computational Fluid Dynamics Conference, Oct-16-19, 2022, South Korea
- 28) Compound matrix method for linear stability analysis of flow over a flat plate, Rituparn Somvanshi, Neha Chaturvedi, and Swagata Bhaumik. 49th national and 8th International Fluid Mechanics and Fluid Power Conference, Dec 12-15 2022, IIT Roorkee, India
- 29) Direct numerical simulation of compressible adiabatic boundary layer for supersonic flows with leading edge excitation, Rituparn Somvanshi, Neha Chaturvedi, and Swagata Bhaumik. 14th Asian Computational Fluid Dynamics Conference, Nov 1-3, 2023, HAL Bengaluru, India
- 30) Stability and receptivity analysis of compressible boundary layer over the isothermal flat plate, Neha Chaturvedi, Rituparn Somvanshi, Swagata Bhaumik, 50th national and 10th International Fluid Mechanics and Fluid Power Conference, Dec 20-22, 2023, IIT Jodhpur, India.

International Poster Presentation

Recent trends in HPC at HPCL, IIT Kanpur, M. K. Rajpoot, V. K. Suman, Y. G. Bhumkar, S. Bhaumik, N. Hussian and V. V. S. N. Vijay, In: Proceedings of the Asian Technology Information Program (ATIP) Supercomputing 2009 (SC009), November 20, 2009.

Invited Talk

- 1. "Direct Numerical Simulation of Transitional and Turbulent Flows: Dynamics of Spatio-Temporal Wave-Front", Swagata Bhaumik, First Indo-French Research Workshop, 29-31 August, 2018 at IIT Indore, Simrol, India.
- 2. Delivered an online invited lecture under "Fluid Mechanics Lecture Series" on Oct 21 2020. The "Fluid Mechanics Lecture Series" is organized by the "The Mechanics Discussions" forum, an international forum of scientists and researchers working on various aspects of Continuum Mechanics. Title of the talk: "Dynamics of the spatio-temporal wave-front as unique precursor of flow transition".