



Discrete Geometric
Analysis for
Materials Design

International Conference

on

Discrete Geometric Analysis for Materials Design

The 21st International Conference, Graduate School of Mathematics, Nagoya University

Date: September 26 (Sun) – September 29 (Wed), 2021

Venue: Online (Zoom)

Note: all displayed-times are **JST** (UTC+0900)

26 September (Sun)

10:15 – 10:30 Motoko Kotani (Tohoku Univ., Japan)

Opening

Plenary talk (chair: Koya Shimokawa (Saitama Univ., Japan))

10:30 – 11:30 Makoto Fujita (Univ. Tokyo & IMS, Japan)

Chemical Construction of Molecular Topologies under Mathematical Restrictions

Plenary talk (chair: Motoko Kotani (Tohoku Univ., Japan))

11:30 – 12:30 Kunio Awaga (Nagoya Univ., Japan)

Topological Properties Generated by Molecule-Based Strongly Isotropic Structures: Materials Science Driven by Mathematics

(60 mins break)

Plenary talk (chair: Shinichiroh Matsuo (Nagoya Univ., Japan))

13:30 – 14:30 Shuichi Murakami (Tokyo Inst. Tech., Japan)

Higher-order topology in crystals in the shapes of polygons and polyhedra

Invite talks (chair: Takeshi Aoyagi (AIST, Japan))

14:30 – 15:00 Jun-ichi Fukuda (Kyushu Univ., Japan)

Exotic structures of frustrated cholesteric blue phases

15:00 – 15:30 Lu Han (Tongji Univ., China)

Self-assembled triply periodic hyperbolic surface structures

15:30 – 16:00 Kazuya Saito (Univ. Tsukuba, Japan)

Gyroid Phase in Low Molecular-Mass Liquid Crystals

(15 mins break)

Invite talks (chair: Motoko Kotani (Tohoku Univ., Japan))

16:15 – 16:45 Miyuki Koiso (Kyushu Univ., Japan)

Geometry of crystalline variational problem

16:45 – 17:15 Hisashi Naito (Nagoya Univ., Japan)

Carbon Structures and Geometry of Trivalent Discrete Surfaces

17:15 – 17:45 Hosho Katsura (Univ. Tokyo, Japan)

Intertwining construction of flat band

(15 mins break)

Invite talks (chair: Koji Hashimoto (Kyoto Univ., Japan))

18:00 – 18:30 Yosuke Kubota (Shinshu Univ., Japan)

The bulk-dislocation correspondence: an operator-algebraic approach

18:30 – 19:00 Minoru Eto (Yamagata Univ., Japan)

Radiolaria – Topological planktons?

19:00 – 19:30 Stefano Sanvito (Trinity College Dublin, Ireland)

Machine learning for the design of magnetic materials

19:30 – 20:00 Tsuyoshi Kato (Kyoto Univ., Japan)

Finite propagation operators and Hilbert bundles with end

27 September (Mon)

Invite talks (chair: Shinichiroh Matsuo (Nagoya Univ., Japan))

10:30 – 11:00 Tatsuya Tate (Tohoku Univ., Japan)

Spectral properties of magnetic Laplacian on a catenoid

11:00 – 11:30 Kiyonori Gomi (Tokyo Inst. Tech., Japan)

Homological bulk-edge correspondence for Weyl semimetal

11:30 – 12:00 Shinichiroh Matsuo (Nagoya Univ., Japan)

Mod-two APS index and domain-wall fermion

(60 mins break)

Invite talks (chair: Koya Shimokawa (Saitama Univ., Japan))

13:00 – 13:30 Gerd E. Schroeder-Turk (Murdoch Univ., Australia)

Bicontinuous minimal and cmc structures: inspiration from biology for nano/micro engineered materials

13:30 – 14:00 Takeshi Aoyagi (AIST, Japan)

High-throughput prediction and optimization of stress-strain curve of thermoplastic elastomer

14:00 – 14:30 Hiroshi Morita (AIST, Japan)

Descriptors of higher-order structures of polymeric materials in the point of view of network and interface

(30 mins break)

Invite talks (chair: Seiichi Takami (Nagoya Univ., Japan))

15:00 – 15:30 Hirofumi Yoshikawa (Kwansei Gakuin Univ., Japan)

Development of Functional Materials Based on MOF Topology

15:30 – 16:00 Tatsuhiko Ohto (Osaka Univ., Japan)

First-Principles and Geometric Modelling of Functions of Graphene

16:00 – 16:30 Masakazu Matsumoto (Okayama Univ., Japan)

The polymorphism of ice

(30 mins break)

Plenary talk (chair: Yoshinori Matsuo (Kyoto Univ., Japan))

17:00 – 18:00 Masaki Oshikawa (Univ. Tokyo, Japan)

Topological constraints on the low-energy spectrum of quantum many-body systems

Plenary talk (chair: Takeshi Aoyagi (AIST, Japan))

18:00 – 19:00 Koya Shimokawa (Saitama Univ., Japan)

3-dimensional topology and polycontinuous pattern

(15 mins break)

Plenary talk (chair: Motoko Kotani (Tohoku Univ., Japan))

19:15 – 20:15 Shinji Tsuneyuki (Univ. Tokyo, Japan)

Computational materials science from first principles, from data, and in between

28 September (Tue)

Invite talks (chair: Tetsuo Deguchi (Ochanomizu Univ., Japan))

10:30 – 11:00 Katsumi Hagita (NDA, Japan)

Analysis of Morphology and Network of Polymer Materials with Aggregated Nanoparticles

11:00 – 11:30 Mariko Ito (Rikkyo Univ., Japan)

Relationship between multifractal and physical properties of microphase separated structure in block copolymers

11:30 – 12:00 Yasuyuki Tezuka (Tokyo Inst. Tech., Japan)

Topological Polymer Chemistry Designing Complex Graph Constructions

(60 mins break)

Invite talks (chair: Takeshi Aoyagi (AIST, Japan))

13:00 – 13:30 Yoshiyuki Kageyama (Hokkaido Univ., Japan)

The shape change and work behavior of bistable self-oscillatory photochromic material in an aqueous condition toward a microrobot

13:30 – 14:00 Ken Kojio (Kyushu Univ., Japan)

A Network Structure and Mechanical Properties of Elastomers during Uniaxial and Biaxial Deformation Modes

14:00 – 14:30 Tetsuo Deguchi (Ochanomizu Univ., Japan)

Exact evaluation of the position fluctuation of a cross-link and the scattering function for various phantom networks

14:30 – 15:00 Toshiharu Saiki (Keio Univ., Japan)

Natural intelligence with colloidal particles

(15 mins break)

15:15 – 16:45 Poster Session

(15 mins break)

Plenary talk (chair: Koji Hashimoto (Kyoto Univ., Japan))

17:00 – 18:00 Yasuhiro Hatsugai (Univ. Tsukuba, Japan)

Use of Bulk-Edge Correspondence for Material Design: between math and physics

Plenary talk (chair: Koya Shimokawa (Saitama Univ., Japan))

18:00 – 19:00 Stephen Hyde (Univ. Sydney, Australia)

Tangling and knotting of secondary and tertiary folds of single-stranded RNA by duplexing

(15 mins break)

Plenary talk (chair: Koji Hashimoto (Kyoto Univ., Japan))

19:15 – 20:15 Yoshimasa Hidaka (KEK, Japan)

Higher group symmetry and axion electrodynamics

29 September (Wed)

Invite talks (chair: Takaaki Ohnishi (Rikyo Univ., Japan))

10:30 – 11:00 Akihisa Ichiki (Nagoya Univ., Japan)

Acceleration of Markov chain Monte Carlo method and its physical origins

11:00 – 11:30 Yoh-ichi Mototake (Inst. Stat. Math., Japan)

Topological data analysis of pattern dynamics in material science

11:30 – 12:00 Takuya Yamamoto (Hokkaido Univ., Japan)

Topology-based properties of cyclic polymers at interfaces

(60 mins break)

Invite talks (chair: Tetsuo Deguchi (Ochanomizu Univ., Japan))

13:00 – 13:30 Kenji Urayama (Kyoto Inst. Tech., Japan)

Nonlinear Mechanical Properties of Near-Critical Polymer Gels

13:30 – 14:00 Yuta Tsuji (Kyushu Univ., Japan)

Reactivity and Properties of Metal Clusters

(15 mins break)

Invite talks (chair: Hisashi Naito (Nagoya Univ., Japan))

14:15 – 14:45 Kazutoshi Inoue (Tohoku Univ., Japan)

Arrangement of atomic polyhedra in tilt grain boundaries

14:45 – 15:15 Yohei Sakurai (Saitama Univ., Japan)

Maximal diameter theorem for directed graphs of positive Ricci curvature

(15 mins break)

Invite talks (chair: Hosho Katsura (Univ. Tokyo, Japan))

15:30 – 16:00 Yoshinori Matsuo (Kyoto Univ., Japan)

Higher-order topology from 5D Weyl semimetal

16:00 – 16:30 Taro Kimura (Univ. Bourgogne, France)

Non-Hermitian system and Ginsparg-Wilson fermion

(30 mins break)

Plenary talk (chair: Akihisa Ichiki (Nagoya Univ. Japan))

17:00 – 18:00 Yoshifumi Amamoto (Kyushu Univ., Japan)

Mesoscopic Structure-Property Relationship of Polymeric Materials Based on Data Science

Plenary talk (chair: Motoko Kotani (Tohoku Univ., Japan))

18:00 – 19:00 Mikito Koshino (Osaka Univ., Japan)

Physics of graphene: unusual properties from novel geometric structures

19:00 – 19:10 Closing

Poster Session

P-01 Ryo Okugawa (Tohoku Univ., Japan)

Diagnosis of Non-Hermitian topological band structures with inversion symmetry

P-02 Shoto Aoki* and Hidenori Fukaya (Osaka Univ., Japan)

Chiral Fermion on Curved Domain-wall

P-03 Takuma Isobe, T. Yoshida, and Y. Hatsugai (Univ. Tsukuba)

Non-Hermitian topological band structure derived from the generalized eigenvalue problem with indefinite Hermitian matrices

P-04 Tsuneya Yoshida (Univ. Tsukuba, Japan)

Topological band theory for classical diffusion phenomena and the game theory

P-05 Shin Hayashi (Tohoku Univ., Japan)

Topological invariants related to corner states

P-06 Yuki Yamazaki*¹, Shingo Kobayashi, and Ai Yamakage¹

¹(Nagoya Univ., Japan), ²(RIKEN)

Response of Majorana Electric Multipoles to Strain in Topological Crystalline Superconductors

P-07 Shintaro Murakami and Toshiharu Saiki (Keio Univ., Japan)

Investigation of eigenmode-based coupled oscillator solver applied to Ising spin problems

P-08 Ryo Sakurai, Takuma Aoyama, Naoto Yamada, and Kenji Urayama

(Kyoto Inst. Tech., Japan)

Peculiarity in Nonlinear Stress Relaxation of Near-Critical Gels under Stretching Deformations

P-09 Naoki Sakata (Saitama Univ., Japan)

A mathematical model of polycontinuous patterns and their stabilization

P-10 Ryosuke Kawatoko*, Tomoko Kajiwara, Aya Fujimoto, Ken Kojio, and Atsushi Takahara

(Kyushu Univ., Japan)

Molecular aggregation structure of poly(methyl methacrylate) under elongation tests

- P-11** Kakeru Obayashi*, Chien-Wei Chu, Ken Kojio, and Atsushi Takahara
(Kyushu Univ., Japan)
Analysis of microphase-separated structure of polyurethane adhesive layer of the single lap joint using X-ray scattering
- P-12** Vladislav Egorov*,¹ and Hiroshi Koibuchi²
¹(Cherepovets State Univ., Russia), ²(Nat. Inst. Tech. Sendai, Japan)
Finsler geometry simulation of PVDF deformation in external electric fields
- P-13** Ananda Kaffle, Kakeru Obayashi, and Ken Kojio* (Kyushu Univ., Japan)
Structural Changes in Polyurethane Elastomers under Uniaxial and Biaxial Deformation
- P-14** Kosuke Ono (Tohoku Univ., Japan)
Distributions of 2 and 3 dimensional arithmetic discrete sets
- P-15** Takumi Gomyou (Nagoya Univ., Japan)
Spectral embeddings of the C₆₀ fullerene and some other Archimedean solids
- P-16** Kento Okuda (Kyushu Univ., Japan)
Uniqueness of local minimizers for crystalline variational problems
- P-17** Masashi Yasumoto (Kyushu Univ., Japan)
Construction and deformation of discrete surfaces via integrable transformations
- P-18** Shintaro Akamine (Nihon Univ., Japan)
Reflection Principles for Minimal and Maximal Surfaces
- P-19** Noriaki Yoshihara, Rikuto Takai, and Seiichi Takami* (Nagoya Univ., Japan)
Production of ZrO₂ nanocomposite films as a minimal surface
- P-20** Toshiaki Taira*,¹ Akira Endo¹, and Seiichi Takami²
¹(AIST, Japan), ²(Nagoya Univ., Japan)
Metal-coordination-driven self-assembly of an N-heterocyclic carbene-based surfactant
- P-21** Toshihiko Oka*,¹ N. Ohta¹, and Stephen Hyde²
¹(Shizuoka Univ., Japan), ²(Sydney Univ., Australia)
POLAR-NONPOLAR INTERFACE OF BICONTINUOUS CUBIC PHASE IN NON-IONIC SURFACTANT/WATER SYSTEMS

Committee:

Motoko Kotani (Tohoku Univ., Japan, Chair)
Hisashi Naito (Nagoya Univ., Japan, Co-chair)
Mikio Furuta (Univ. Tokyo, Japan)
Koji Hashimoto (Kyoto Univ., Japan)
Koya Shimokawa (Saitama Univ., Japan)
Takeshi Aoyagi (AIST, Japan)
Seiichi Takami (Nagoya Univ., Japan)
Takaaki Ohnishi (Rikyo Univ., Japan)
Akihisa Ichiki (Nagoya Univ., Japan)

Contact:

Hisashi Naito (`naito [at] math.nagoya-u.ac.jp`)