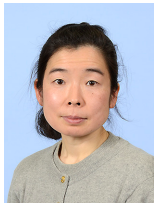
KAWAMURA, Tomomi Associate Professor



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Membership of academic societies:
The Mathematical Society of Japan

Research Interest:

- Knot theory
- Low dimensional topology

Research Summary:

Knot theory is a field of geometry and topology, where we are interested in the complexity of knots or links, i.e. simple closed curves in the space. Such complexity is expressed as numbers, polynomials, etc. We call these values by invariants of knots or links. I mainly research the between link diagrams and link invariants, for example, the number of crossing changes needed to unknot the given link. It is amazing that a lot of seemingly easy formulas are proved using advanced theories as singularity theory, contact geometry, gauge theory, or Khovanov homology theory.

The results in [1] of Major Publications are obtained from works due to Rudolph with related to 'Milnor's conjecture', solved by Kronheimer and Mrowka as researches on gauge theory. Their works relate to contact geometry and singularity theory. The articles [2, 3] are written on divide knots defined by A'Campo, a famous singularity theorist. Milnor's conjecture has been reproved combinatorially, using Khovanov homology theory established about 2000. The main result in [4] is partially reconsideration of the works in [1] after Khovanov homology theory. These results are improved in [5].

Recently, many researchers are interested in the relations between knot theory and the other theory: representation theory, number theory, chemistry, biology, etc. It is hard to catch up with such researches, though I am locking forward to further evolution.

Major Publications:

[1] T. Kawamura, On unknotting numbers and four-dimensional clasp numbers of links, Proc. Amer. Math. Soc. **130** (2002), no. 1, 243–252.

[2] T. Kawamura, Quasipositivity of links of divides and free divides, Topology Appl. **125** (2002), no. 1, 111–123.

[3] T. Kawamura, Links associated with generic immersions of graphs, Algebr. Geom. Topol. **4** (2004), 571–594.

[4] T. Kawamura, The Rasmussen invariants and the sharper slice-Bennequin inequality on knots, Topology **46** (2007), no. 1, 29–38.

[5] T. Kawamura, An estimate of the Rasmussen invariant for links and the determination for certain links, Topology Appl. **196** (2015), 558–574.

Awards and Prizes:

- 2003, MSJ Takebe Katahiro Prize for Encouragement of Young Researchers, Research on divide knots and four-dimensional estimates of unknotting numbers

Education and Appointments:

2000 Ph.D. in Mathematical Sciences, the University of Tokyo
2000 JSPS Research Fellowship, the University of Tokyo
2002 Research Associate, Aoyama Gakuin University
2007 Associate Professor, Nagoya University

Message to Prospective Students:

The students of the small group class I take charge of, usually read textbooks on knot theory and low dimensional topology. Here are examples:

1. V. V. Prasolov and A. B. Sossinsky, Knots, links, braids and 3-manifolds, AMS, 1997.
2. J. M. Lee, Introduction to topological manifolds, Springer, 2000.
3. L. H. Kauffman, Formal knot theory, Dover Publications, 2006.
4. J. S. Birman, Braids, links and mapping class groups, Princeton University Press, 1974.
5. P. Turner, Five lectures on Khovanov homology, arXiv preprint math/0606464, 2006.
6. D. Rolfsen, Knots and links, Corrected reprint of the 1976 original. Math. Lect. Ser., 7. Publish or Perish, Inc., Houston, TX, 1990.
7. L. H. Kauffman, On knots, Ann. of Math. Studies, 115, Princeton University Press, 1987.
8. A. Hattori, Topology (Japanese), Iwanami Shoten, 1991.
9. A. Kawauchi, Lectures on knot theory (Japanese), Kyoritsu Shuppan, 2007.
10. K. Kobayashi, Spatial graph theory (Japanese), Baifukan, 1995.
11. A. Kawauchi, K. Kishimoto, A. Shimizu, Knot theory and game : Mathematical world viewing from the game "Region Select" (Japanese) , Asakura Publishing, 2013.
12. A. Kawauchi, Knot theory (Japanese), Kyoritsu Shuppan, 2015.
13. T. Ohtsuki, Knot invariants (Japanese), Kyoritsu Shuppan, 2015.

They use not only main textbooks but also research papers and other books. They are expected to decide the theme of master's thesis by themselves, and read many articles where some errors or omissions exist occasionally. If you would like to start the study of knot theory quickly, I recommend you to learn fundamental group and homology from textbooks on beginning of topology in advance. I will also support your careful study on these.

I believe that you, a graduate student of Nagoya University, can manage to solve difficult problems and be glad to go a step further.