

Results on research activity. Among earlier works, there is a solution of the non-invertibility problem on the knot 8_{17} proposed by R. H. Fox, standing as an unsolved problem for 50 years. This result was given by the studies of Alexander polynomial and hyperbolic 3-manifolds. There are also earlier works on quadratic forms of 3-manifolds, descriptions of surfaces in the 4-space (with T. Shibuya and S. Suzuki), and proposals for unknotted surfaces in the 4-space (with F. Hosokawa). I started a joint seminar "KOOK seminar". Under co-operations with KOOK Seminar members, "Knot Theory" (Springer Verlag Tokyo, 1990) was published in Japanese as the first book of the whole knot theory in Japan. Later, the English version "A Survey of Knot Theory" (Birkhäuser, 1996) was published abroad. It seems that it influences researchers of knot theory around the world. In topological imitations, I studied analogous properties and flexibility on the topology of a 3-manifold. By using this idea, the Simon-Wolcott conjecture and the Reni-Meccia-Zimmerman conjecture are solved. Recently, I published a paper on topological splitting of a closed 4-manifold with fundamental group \mathbb{Z} which I proposed on before and a paper confirming the smooth unknotting conjecture for a ribbon surface-knot (standing as an unsolved problem for 45 years). I have studied on complete invariants characterizing 3-manifolds for a long time (the first paper is written by myself and some papers as joint works with I. Tayama and a paper as a joint work with I. Tayama and B. Burton). By developing this idea, the set of 3-manifolds is described as a real analytic function and (by a joint work with T. Tayama) as a complex analytic function. As another work, there are papers on classifying 4D universes with every closed orientable 3-manifold embedded. In monographs in Japanese, "From linear algebra to homology", "Lecture on knot theory" and "Theory of knots" are written by myself, and "Knot Theory and Game" is written with A Shimizu and K. Kishimoto in relation to the game "Region Select" applying knot theory jointly developed and shown at the world same time in the Android market with two related patents. As scientific applications of knot theory and topology, there are two papers on a study of a model in psychology using a knot written by myself, one co-authored paper on constructing tangle models of prion proteins relating to Amyloid β , and papers on spatial graphs to apply to string-shaped materials called soft matters (Macromolecule, DNA, etc.). From April 2003 to March 2008, I was a program leader of the 21st COE program "Constitution of wide-angle mathematical basis focused on knots". With this, I could establish the predecessor institute of Osaka Central University Advanced Mathematical Institute (OCAMI) and an effort for introducing knot theory to school students and played a leading role in a study group of Osaka Kyoiku University. A record of this activity was published as the book "Teaching and learning of knot theory in school mathematics". In the academic year 2021, three papers (including one co-authored paper) and one review paper were published and one co-authored paper is to appear. There are the other 6 preliminary papers (including no co-authored paper).