

Results on research activity (Akio Kawauchi)

Among earlier works, there is a solution of the non-invertibility problem on the knot 8_{17} , a problem in Fox Problem List, which was first raised by J. W. Alexander in classifying knots and thus standing as an unsolved problem for 50 years. 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 on the whole knot theory in Japan. Later, English version "A Survey of Knot Theory" was published abroad (Birkhäuser, 1996), appearing that it influences researchers of knot theory around the world. I studied analogous structures and flexibilities of the topology of given 3-manifolds and links as topological imitations, led to the solutions of Simon-Wolcott conjecture and Reni-Meccia-Zimmerman conjecture. I studied complete (but hard to calculate) invariants characterizing closed orientable 3-manifolds. The first paper is written by myself, and the other papers except for a joint paper with Tayama and B. Burton are written as joint works with I. Tayama. By developing this idea, the set of closed orientable 3-manifolds could be described as a real analytic function and (by a joint work with Tayama) as a complex analytic function. As scientific applications of knot theory and topology, there are papers with the following topics: "Knot model in psychology", "Constructing tangle models of prion proteins relating to Amyloid β " (a joint work with K. Yoshida), "Spatial graphs applying string-shaped materials", "Complexities of knitting patterns", and "Knotting probabilities of spatial arcs". As another work, there are papers on classifying 4D universe with every closed orientable 3-manifold embedded. As books 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. 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", leading to establish Osaka City University Advanced Mathematical Institute (now Osaka Central University Advanced Mathematical Institute). In cooperation with the knot educational research group of Osaka Kyoiku University introducing knot theory to school students, the book "Teaching and learning of knot theory in school mathematics" was published as co-editor with T. Yanagimoto. Recently, by reexamining a series of past surface-knot theory studies, papers solving Smooth Unknotting Conjecture for a surface-link and 4D smooth Poincaré Conjecture positively could be written up together with papers lead to a new solution of 3D Poincaré conjecture, a solution of J. H. C. Whitehead conjecture and a solution of Kervaire conjecture on weight of free product with infinite cyclic group.