

## Abstract for our study

### 1. Our study on line configurations in complex planes

First, We proved the following results concerning the first Betti numbers of abelian coverings of  $\mathbf{CP}^2$  branched over real line configurations:

- (1) An estimate of the first Betti numbers .
- (2) A characterization of central and general position line configurations in the terms of the first Betti numbers of abelian coverings.
- (3) The first Betti numbers of the abelian coverings of the real line configurations up to 7components.

Next, for a real line configuration  $L$  in  $\mathbf{C}$ , we construct a ribbon surface-link which has the same group as  $L$ . We proved that if  $L$  is a central or general position line configuration, the genus of the constructed ribbon surface-link is the smallest of all the genera of the ribbon surface-links with the same group as  $L$ .

### 2. Our study on links in the three dimensional sphere

For a 2 component link  $L$  in  $S^3$ . We give a formula to express the first homology group of the  $\mathbf{Z}_2 \oplus \mathbf{Z}_2$  covering branched over  $L$  in terms of those of three smaller cyclic branched coverings.

### 3. Our study on 3 manifolds

Professor Kawauchi defined a well-order on the set of links, which induces a well-order on the set of link groups, and which eventually induces a well-order on the set of 3-manifolds. In fact, he enumerated the first 28 prime links, the first 26 prime link groups and the first 26 closed connected orientable 3-manifolds. We extended the prime link table from 28 to 444, the prime link group table from 26 to 400 and the manifold table from 26 to 346.

Professor Kawauchi also suggested a formula assigning a complex number to a link (or a 3-manifold) and defined a holomorphic function by using the numbers. We plotted the 444 prime links (or 346 manifolds), as mentioned, in the complex plane and computed the numerical data.