

## Abstract for our study

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

Let  $l = l_1 \cup l_2 \cup \dots \cup l_\mu$  be a collection of straight lines in  $\mathbf{R}^2$ . Each line is of the form  $l_i = \{(x, y) \in \mathbf{R}^2 | a_i x + b_i y + c_i = 0\}$ . Let  $L_i = \{(x, y) \in \mathbf{C}^2 | a_i x + b_i y + c_i = 0\}$  and we have  $L = L_1 \cup L_2 \cup \dots \cup L_\mu$  in  $\mathbf{C}^2$ . This is called a real line configuration in  $\mathbf{C}^2$ . The complex projective plane  $\mathbf{CP}^2$  is the quotient space of  $\mathbf{C}^3 - \{0\}$  by identifying  $(x, y, z)$  and  $\lambda(x, y, z)$  for complex numbers  $x, y, z$  and  $\lambda$ . Let  $\mathcal{L}_i = \{[x, y, z] \in \mathbf{CP}^2 | a_i x + b_i y + c_i z = 0\}$  and we have  $\mathcal{L} = \mathcal{L}_1 \cup \mathcal{L}_2 \cup \dots \cup \mathcal{L}_\mu$  in  $\mathbf{CP}^2$ . This is called a real line configuration in  $\mathbf{CP}^2$ .

First we describe our study on a real line configuration  $\mathcal{L}$  in  $\mathbf{CP}^2$ . 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 a 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 7 components.

Next we describe our study on a real line configuration in  $\mathbf{C}^2$ . For a real line configuration  $L$ , we construct a ribbon surface-link which has the same group as  $L$ . If  $L$  is a central or general position line configuration, the constructed ribbon surface-link has the minimum genus.

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

First we describe our study on 2 component links. We give a formula to express the first homology groups of the  $\mathbf{Z}_2 \oplus \mathbf{Z}_2$  branched coverings of  $L = K_1 \cup K_2$  in terms of those of three smaller cyclic branched coverings.

Next we describe our study on a table of manifolds. A. Kawachi defined a well-order in the set of links which induces a well-order in the set of 3-manifolds. In fact, he enumerated the first 28 prime links and the first 26 manifolds. We extended the table of links and enumerated the first 443 prime links. Our argument enables us to discover 7 omissions and 1 overlap in Conway's table of prime links of 10 crossings. Next step is to enumerate the exteriors of links and we enumerated the first 142 exteriors.