§62. Prevention of Current Imbalance in Superconducting Cables

Ninomiya, A.(Seikei University)
Yamaguchi, S

Superconducting cables which are composed of many superconducting strands have the serious problem concerned with the current distribution of its strands. It says the current imbalance problem. In general, it is said that this problem depends on the dispersion of inductance distribution in superconducting cables. However, it does not become clearly the relation between the degree of current imbalance and the dispersion of each inductance in the cables.

Therefore, we have investigated experimentally the current imbalance problem. The first purpose of the experiment is to find out the most important factor for the prevention of current imbalance. And then, it becomes clearly the relation between the degree of current distribution and the dispersion of main factor for the current imbalance. So, we built nine coils with 27 strands and carried out the measurement of inductance distribution and calculated the current distribution and magnetic coupling coefficient between its strands. The accuracy on the inductance measurements are four digits enough to estimate the current imbalance. These coils are different from the coil parameter such as coil diameter and height, twist pitch of strand and strand diameter etc.. These parameters are summarized in Table1.

Fig.1 to Fig.3 shows the current distribution of each coils and the standard deviation of magnetic coupling coefficient between its strands. From Fig.1, it is found that larger dispersion coils for the current imbalance are coil5, coil6 and coil8. However, these coils are the smallest dispersion coils for the inductance distribution as can be seen in Fig2 and Fig3. And also, the magnetic coupling factor of them are more than 0.985 and other coils are below 0.985. Therefore, it is found that the prevention of current imbalance in superconducting cables is effective to reduce the magnetic coupling factor.

Table1 Parameter of nine coils

Bobbin Diameter [mm]	Strand diameter, Twist pitch[mm] Twist direction		
	0.26mm ϕ 15×30×45 S*Z*S	0.12mm ϕ 15×30×45 S*Z*S	0.12mm ϕ 12×12×16 S*Z*S
50	Coil-1	Coil-2	Coil-3
100	Coil-9	Coil-4	Coil-5
150	Coil-7	Coil-8	Coil-6

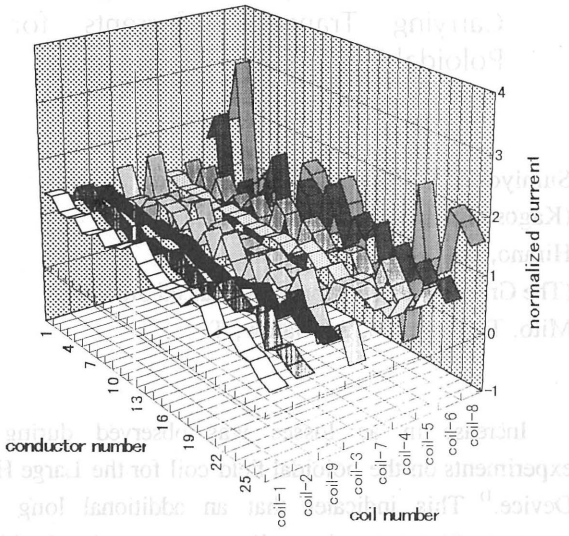

Fig..1. Current distribution of each coils

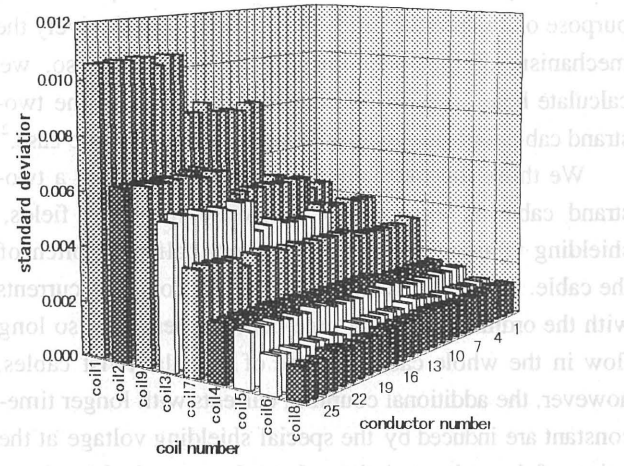

Fig.2. Standard deviation of magnetic coupling coefficient

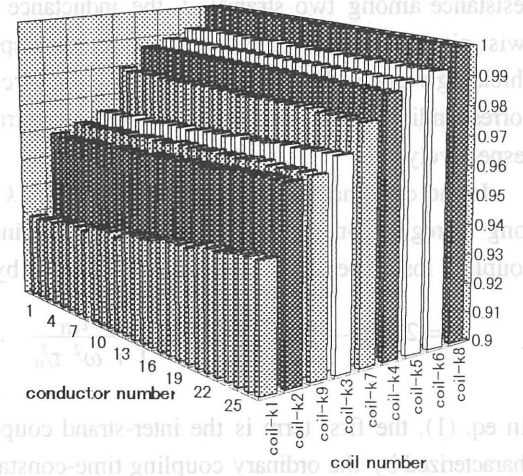

Fig..3. Magnetic coupling coefficient of each coils