Dynamic Characteristics in The Horizontal Direction for New Type SMB Using SC Bulk and SC Coil

* M. Komori, A. Wada, K. Asami, N. Sakai
Kyushu Institute of Technology,
Kitakyushu, Fukuoka, JAPAN
ABSTRACT

Superconducting magnetic bearings (SMBs) are usually composed of superconducting (SC) bulk and permanent magnet (PM). These SMBs are based on pinning forces between SC bulk and PM.

In this paper, new type SMBs composed of SC bulk, SC coil and PM are proposed. In order to compare SMB Type-I with Type-II, impulse responses in the horizontal direction are performed.
Displacement [mm] vs. Time [s] for various distances.

(a) 7mm
(b) 8mm
(c) 9mm

Fig. 4. Impulse responses in the horizontal direction for the SMB Type-I without SC coil at various distances of 7, 8 and 9mm.

Fig. 5. Impulse responses in the horizontal direction for the SMB Type-I with SC coil at various distances of 7, 8 and 9mm.
Fig. 6. Relationships between (a) stiffness and distance and (b) damping coefficient and distance for three cases.

Fig. 7. SMB Type-II.
Fig. 8. Impulse responses in the horizontal direction for the SMB Type-II without SC coil at various distances of 7, 8, and 9mm.

Fig. 9. Impulse responses in the horizontal direction for the SMB Type-II with SC coil at various distances of 7, 8, and 9mm.
Fig. 10. Relationships between (a) stiffness and distance and (b) damping coefficient and distance for three cases.

Fig. 11. SMB Type-I in the cases of Position-0, 1, 2 and 3.

Fig. 12. Impulse responses of SMBs in the cases of positions-0, 1, 2 and 3.
CONCLUSION

✓ It is found that the SMB Type-I is effective on stiffness.
✓ The SC coil of SMB Type-II is more effective on both stiffness and damping coefficient than the SMB Type-I.
✓ The stiffness doesn’t depend on the SC coil position. However the damping coefficient depends on the SC coil position so much.
✓ This is caused by the change in magnetic flux in the SC coil when the PM vibrates in the horizontal direction.