The Effects of Aspect Ratio in Magnetic Field Structure around the outermostsurfaces of L=1 Helical Systems

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We have studied the compact L=1 helical axis systems applying the control methods of effective toroidal curvature term defined as the sum of usual toroidal curvature term and one of the nearest satellite harmonics of helical field term [1]. The small field periods number and low coil aspect ratio system is desirable for nuclear fusion device construction. On the contrary, particles transport properties of compact system become worse due to large usual toroidal effect. We have improved particles transport by controlling the effective curvature term. But their effects are more limited than that of large aspect ratio cases [2]. The remarkable features of magnetic field properties between high and low helical coil aspect ratio systems have been examined by using the spectral mode analysis methods. And magnetic field structures around the outermostsurfaces of several systems which are different pitch modulation $\alpha^*$ and coil aspect ratio, have been studied by examining the Lyapunov characteristic exponent. As the result, desirable properties of magnetic field of low aspect coil systems with negative $\alpha^*$ have been confirmed from the viewpoint of particle confinement.