Matrix solution of coupled kinetic Alfven waves in a tokamak plasma

C. M. Ryu\textsuperscript{1}, A. Panwar\textsuperscript{1}, M. Shahzad\textsuperscript{1} and H. Rizvi \textsuperscript{1,2}

\textsuperscript{1} Pohang University of Science and Technology, Pohang, South Korea.

\textsuperscript{2} Theoretical Plasma Physics Division, PINSTECH P. O. Nilore, Islamabad, Pakistan

We have studied Alfven waves coupled poloidally due to the toroidal effect in a tokamak plasma, by directly solving the matrix Alfven wave equation [1-3]. A computer program named as the kinetic Alfven eigenmode solver (KAES) has been developed for this purpose. Using this code, several interesting features of RSAEs, KAEs and KBAEs are examined. The existence criteria for reversed shear Alfven eigenmodes (RSAEs) in the presence of a parallel equilibrium current have been examined [2]. The difference between the numerical and analytical critical values are small for low frequency RSAEs, but it increases as the frequency of the mode increases, being greater for higher poloidal harmonic modes. The regime for the kinetic Alfven eigenmodes (KAEs) to exist is then examined considering non-ideal effects of the parallel electric field and finite ion Larmor radius. In the case of finite plasma pressure, even and odd kinetic beta-induced Alfven eigenmodes (KBAEs) come into existence due to the plasma geodesic compressibility [3]. The KBAE frequency increase with the increase in the plasma $\beta$ and the ion Larmor radius ($q_i$). The damping of KBAEs increases with the finite Larmor radius, but decreases with the plasma beta. Finally, excitation of KBAEs by resonating hot ions in the presence of energetic particle drive is examined. A summary of the above studies is presented from a unified point of view.

References