Comment on Alfvén Surface Waves in Magnetospheric Plasma: Micropulsations and Particle Acceleration

A. Satya Narayanan[1]

Indian Institute of Astrophysics, Bangalore – 560 034, India

Abstract

The aim of this short note is to point out an error in the figure which analyses Alfvén Compressional Surface Waves in the review article by Uberoi [1].

Recently, Uberoi [1] wrote and excellent review article on Alfvén waves in Magnetospheric Plasma. In that article, the author emphasises the importance of surface waves including resonant absorption and compressibility effects. Section 3.2.2 which deals with Compressional Surface Waves along with the Figs 4, 5 and 6 is based on the paper Uberoi [2] (Uberoi [1] in the review article).

The relationship required for the existence of surface waves in terms of the densities can be written as

$$\frac{\rho_2}{\rho_c} = 1 + \left[\left(1 - \frac{\rho_1}{\rho_c} \right) \sin^2 \theta \right] \left(1 - \frac{\rho_1}{\rho_c} \cos^2 \theta \right)^{-1}.$$

The above relation corresponds to eq. (12) of Uberoi [2]. Here $\rho_c = k_{\parallel}^2 B_0^2 / \omega^2 \mu_0$, is the critical density at which the Alfvén wave speed equals the phase speed. Figure 1 is a reproduction of Fig. 5 of Uberoi [1]. In this figure, the plasma densities on either side of a step discontinuity along which a surface wave may propagate are plotted for various values of θ. It is shown that ρ_2/ρ_c has the same value equal to 2 for $\rho_1/\rho_c = 0$ and for different values of θ. It is clear from the above expression that at $\rho_1/\rho_c = 0$, ρ_2/ρ_c is a function of θ. This must show different ρ_2/ρ_c for different vaues of θ. This error has been corrected and the correct density surfaces along which the surface waves can propagate is shown in Fig. 2. This figure is different from the density surfaces shown in Fig. 1.

References

1. Uberoi, C., Physica Scripta **T60**, 20 (1995).
2. Uberoi, C., J. Geophys. Res. **94**, 6941 (1989).
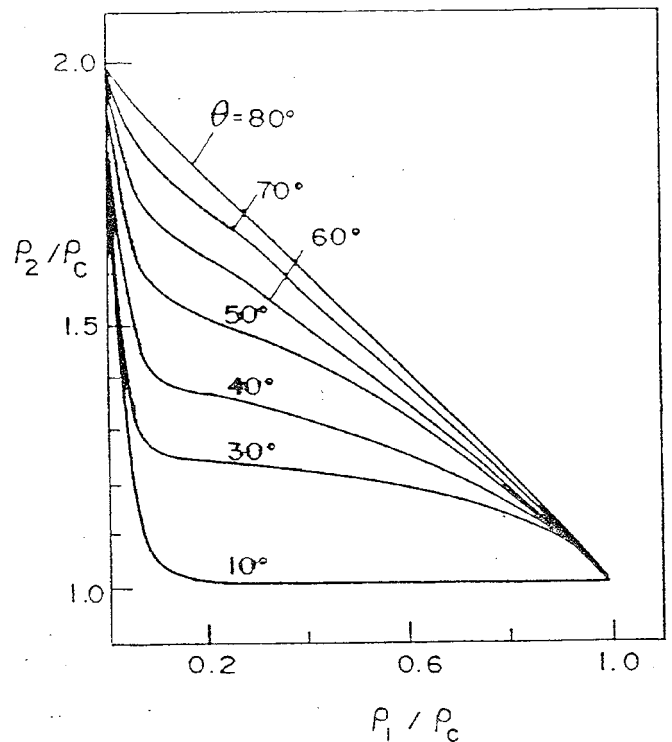
[1] e-mail: satya@iiap.ernet.in

Fig. 1. Plasma density relationship across a step discontinuity for various angles to the magnetic field (From [1]).
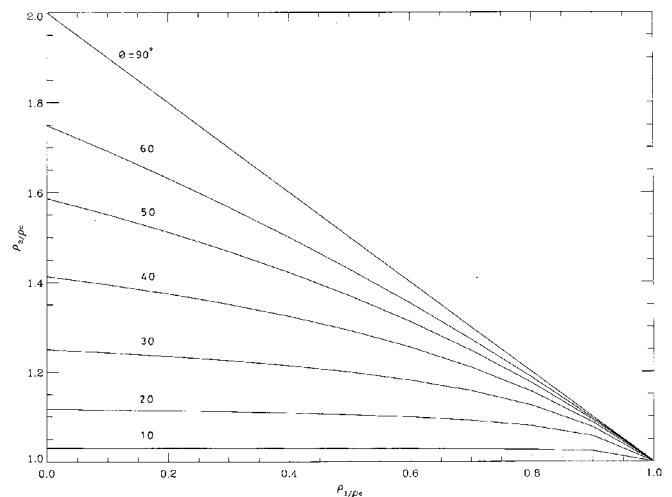

Fig. 2. Correct density surfaces along which surface waves can propagate.