Influence of the edge plasma profile and parameters on the coupling of an ICRH antenna. Application to ITER.

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The coupling to the fast wave of an ICRH antenna is principally determined by its distance to an optimum plasma density correlated to the cutoff one and by the density gradient between this optimum density and the bulk plasma [1]. This explains the differences in coupling for the various heating and current drive phasings as predicted for different plasma edge profiles considered for ITER. For a given electron density edge profile the ion mix, the steady magnetic field and the frequency are also influencing the coupling performances. Simulation by the code ANTITER II shows that these quantities affect the coupling mainly by influencing the position of the cutoff and the optimum density in the profile, the cutoff corresponding to the most excited $k_{//}$ of each phasing case. A significant perturbation of the coupling with edge power deposition can occur when the Alfvén resonance $k_0^2\varepsilon_1-k_{//}^2=0$ (k_0: vacuum propagation constant) lies in the edge profile: i.e. (i) for a frequency f smaller than the lowest ion cyclotron frequency of the different species, (ii) near the ion-ion hybrid resonances or (iii) near the lower hybrid resonance.
The results are applied to different ICRF scenarios considered for ITER at full and half toroidal field.

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