May 4, 2015

Abstract

1 General

We marked corrections suggested by the reviewer 1 in blue, by the reviewer 2 in red, and some extra corrections made by us that can be important in green.

More important corrections include

- changed the wording in the abstract
- corrected the definition of the cold plasma dielectric tensor, to match the convention $\partial_t \to -i\omega$ (it had to be hermitian conjugate; this had been done everywhere, the corresponding corrections had been made in Table 1 and some figures)
- corrected the definitions of α, δ to comply with the definition of the cold plasma dielectric tensor of Stix

  (more precisely, removed terms $\frac{\omega^2}{c^2}$ in front of them)
- corrected the formulation of the lemma 2.3 on the well-posedness and added a remark after the lemma on the sign of ν.
- Section 4.1.1: corrected assumption on smoothness of E_y^ν in the section 'Numerical Experiments'.
- shortened slightly the section on limiting amplitude for a non-resonant case.

2 Response to the reviewer 1

All the corrections are marked in blue.

A. General issues.

1. We agree with the remarks of the reviewer. We included a short introduction into the physics of the problem, which hopefully will facilitate in reading the article.

- Concerning Sections 4.1.2, 4.3.1: We define more precisely the hybrid resonance now, which in fact requires that α vanishes, and δ does not (while in Section 4.3.1 δ vanishes as well). To give a hint on singularity of equations, we cite an article where a simple model problem is considered.

- The notation: from now on $\varepsilon_\omega^\nu(\mathbf{r})$ denotes the cold plasma dielectric tensor, similarly we denote its parameters. We added explicitely dependence on space in parameters that depend on the spatial variables.
- The case $\omega = \omega_c$: Indeed, $\epsilon_\infty < \infty$ if $\omega_c^2 \neq \omega^2$, but formally one also needs to require the boundedness of ω_p^2. Therefore we added an assumption in the end of the Section Frequency Domain Study on the coefficients of the dielectric tensor, and made a remark on the absence of the cyclotron resonance. The formulation of Lemma is correspondingly corrected.
- The limiting amplitude/absorption principle:

  A brief description of what limiting absorption and limiting amplitude principles had been added in the end of the introduction.

2. 'The reduction to a 1d problem is not clearly justified': indeed, we changed this in the introduction by adding an assumption on N_e, B_0, and changed the wording in the introduction to underline that the 1D case is the one of interest.

B. Specific remarks:

- p1, abstract: changed
- p2: in the frequency domain the problem is regularized by a choice $|\nu| > 0$, independently of the sign of ν. It is interesting however that for a fixed ω the limits $\lim_{\nu\to 0\pm}$ do not result in the same solution. In the time domain the sign of $\nu > 0$ is indeed of crucial importance for the stability, as well as in Lemma 2.1, provided that λ in the frequency of the antenna is larger than zero. We added a remark on this before Section 2.1
- p2, after (1): L is just a non-negative real number. We found it more convenient to place the point of the isolated hybrid resonance in $x = 0$. For $\nu \neq 0$ the energy decays, we added this in the introduction.
- p3: this should be now fixed in the whole of the article.
- p3 eq (4): the notation had been changed
- p4, top: we changed the notation
- p4, eq. (5) fixed
- p4, eq. (8): changed the notation in eq (8), though a more general result in Lemma 2.1 is formulated with u, v.
- p4: we changed α_ν to β_ν not to confuse with α in the dielectric tensor. The index ν just underlines the dependence of the angle β_ν on ν (indeed, the coercivity result as it is stated, holds for this specific value of β_ν defined in the end of the proof of the lemma).
- p. 5: indeed, we changed this
- p.6: changed
- p 6: Ex changed
- p 8: 'our' code, changed

- p.8: fixed section number
- p.8 eq (12): added $\nu = 0$ + explanation
- p.8: added the Airy equation and pointed out the analyticity of the Airy equation. Additionally added a remark on the behaviour of the Airy function to justify the choice of the right boundary condition $\partial_x E = 0$.
- p.8: the citation had been fixed; we expect E_y to be analytic in this case (since we want it to be equal $\mathrm{Ai}(x)$, this is pointed out right now), and E_x thus is smooth.
- p9, Figure 3: fixed the captions. This had been done for other figures as well. The values $E^c_{x,y}$ had been defined in the caption.
- p9 on top The title of Section 4.1.2 had been changed to Solution of a Frequency-Domain Problem with Resonance
- p9 Equation (15,16): changed
- p9 after (17): it is really necessary to assume that H^2-norm that is bounded, for using the inequality (25). We fixed an assumption on E_y, which was incorrect before.
- p10 before and after Table 1 : fixed
- p 11 Figure 4: fixed
- p11 Figure 5: Agree, fixed. We added a remark in a caption to Figure 4 as well.
- p12
- p12 Section 4.3: this explanation had been moved to the introduction
- p12 Section 4.3.1

  True, but in this case there is no resonance, since $\delta(x) \equiv 0$. Hence $E_x = \frac{i\delta}{\alpha} E_y \equiv 0$, and E_y solves the Airy equation in the frequency domain. We added a small remark to Section 4.3.1 to underline this.
- p12 Equation (23): it had been removed
- p14 Figures 8 and 9

  Added the captions
- p15 in Conclusion

  Indeed $P1$
- references: corrected

3 Response to Reviewer 2

- p2: We tried to change the wording in the introduction to make it more clear what is a hybrid resonance. The singularity appears for $\nu = 0$, provided that the diagonal part of the dielectric tensor vanishes and the non-diagonal part does not.

- 'matricial' had been changed to 'matrix'.

- p6, 3.1.

  We employed the Yee scheme to discretize the problem in the time domain, and the finite element scheme solely for the frequency domain, and considered them independently. We added a remark on that in the very beginning of Section 3.

- p10: mesh multiple times finer. It should be said exactly how many times.

  We added a remark that it was at least two times for very fine meshes, and more for coarser ones.

- p.12: fixed the typos.