Comment

Evanescent waves do contribute to the far field

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(Received 2 April 1999; revision received 28 July 1999)

In a series of papers [1], it has been claimed that evanescent waves contribute to the far field of a radiating dipole, i.e. that the amplitude of the sum of the evanescent waves decreases as 1/r with increasing distance, r, from the dipole. In spite of the fact that three recent papers [2] have demonstrated that these claims are incorrect and that they contradict well-established results relating to the far-zone behaviour of the angular spectrum representation of wavefields [3], the author continues to repeat this claim, most recently in a note with the title 'Evanescent waves do contribute to the far field'. It is the purpose of this note to point out an error in the previous publications [1] which has led to this erroneous conclusion.

In the previous papers [1] the author makes use of the angular spectrum representation of the Green dyadic, which he then evaluates on the z axis. Next he replaces the axial distance z with the radial distance r and claims that the resulting expression is valid throughout the whole field. This claim is false because the z direction plays a preferential role in the angular spectrum representation of the field. More specifically, the representation of the field in terms of propagating and non-propagating (evanescent) waves requires the choice of a special direction, in this case the z direction. Therefore the spherical symmetry of the problem is broken when one considers only a subset of the contributing waves, here the evanescent waves. Whilst the results given in [1] are correct along the z axis, they are wrong in all other directions. Xiao’s analysis gives incorrect results not just in the far-zone, but indeed throughout the whole space except along the z axis; in particular, the propagating and evanescent-wave contributions employed extensively by the author in the near field are incorrect.

Although the incorrectness of the claims made in [1] is evident both on simple mathematical and physical grounds, interested readers can find a rigorous derivation of the far-field contribution to the electromagnetic Green’s tensor from evanescent waves in a recent publication [4] which likewise contradicts the claims that evanescent waves contribute to the farfield.

Acknowledgments
This investigation was supported by the National Science Foundation and the New York State Foundation for Science and Technology.

References