Corrections to “Lower Bounds on Q for Finite Size Antennas of Arbitrary Shape”

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Published in:
IEEE Transactions on Antennas and Propagation

Link to article, DOI:
10.1109/TAP.2017.2679074

Publication date:
2017

Document Version
Peer reviewed version

Link back to DTU Orbit

Citation (APA):

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Equations (24) and (25) in Appendix B of [1] should respectively read as

\[
\int_{V_\infty} - (\nabla G_1)G_2^* - \hat{r} e^{jk(r_1-r_2)-\hat{r}} \frac{16\pi^2}{|r_1|^2} dV = - \frac{r_{12}}{|r_{12}|} \frac{\cos(k|r_{12}|)}{8\pi} \nabla \times \left( \frac{\sin(k|r_{12}|)}{|r_{12}|^3} - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- \frac{j}{8\pi k^2} \left( \sin(k|r_{12}|) - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- \frac{1}{8\pi k^2} \left( |r_1|^2 - |r_2|^2 \right) \frac{r_{12}}{|r_{12}|^2} \left( \frac{k^2 \sin(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- 3 \left( \frac{\sin(k|r_{12}|)}{|r_{12}|^3} - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

(1)

and

\[
\int_{V_\infty} j(\nabla G_1)G_2^* - \hat{r} e^{jk(r_1-r_2)-\hat{r}} \frac{16\pi^2}{|r_1|^2} dV = j \frac{r_{12}}{|r_{12}|} \frac{\cos(k|r_{12}|)}{8\pi} \nabla \times \left( \frac{\sin(k|r_{12}|)}{|r_{12}|^3} - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- \frac{r_{12}}{8\pi k^2} \left( \frac{k \sin(k|r_{12}|)}{|r_{12}|^3} - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- \frac{1}{8\pi k^2} \left( |r_1|^2 - |r_2|^2 \right) \frac{r_{12}}{|r_{12}|^2} \left( \frac{k^2 \sin(k|r_{12}|)}{|r_{12}|^2} \right)
\]

\[
- 3 \left( \frac{\sin(k|r_{12}|)}{|r_{12}|^3} - \frac{k \cos(k|r_{12}|)}{|r_{12}|^2} \right)
\]

(1a)

\[
= J \frac{r_{12}}{2} \Re \{G_{12} \} - \frac{1}{2k^2} \Im \{ \nabla G_{12} \}
\]

\[
- \frac{r_1 + r_2}{2k^2} \Im \{ \nabla G_{12} \cdot \frac{r_{12}}{|r_{12}|^2} \}
\]

\[
+ \frac{|r_1|^2 - |r_2|^2}{2k^2 |r_{12}|^2} \Im \{ r_{12} k^2 G_{12} + 3 \nabla G_{12} \}.
\]

(1b)

All other results in [1] do not involve the coordinate-dependent terms (those with \( r_1 + r_2 \) and \( |r_1|^2 - |r_2|^2 \) multipliers), in which the error actually occurs, and thus, are not affected. The contribution of the coordinate-dependent terms is insignificant for \( ka < 0.5 \), whereas for larger \( ka \), where the contribution gradually increases, the \( Q \) itself becomes too low to be reliably related to the bandwidth.

Further numerical results exemplifying and substantiating the general applicability of a procedure for determining the lower bound on \( Q \) outlined in Section V in [1] can be found in [2].

The expressions for the stored energies and the radiated power of arbitrary electric and magnetic currents presented in [1] (Tables I and II) can also be used for computing the \( Q \) of electrically small antennas loaded with magneto-dielectric materials, as demonstrated in [3] in the context of a surface integral equation method.

ACKNOWLEDGMENT

Prof. M. Gustafsson and Prof. B.L.G. Jonsson are acknowledged for tracking down the source of the error.

REFERENCES

