Letter to the Editor-in-Chief of "Inverse Problems" Prof. S R Arridge


T. Nara, T. Furuichu and M Fushimi write on page 4: "However, equation (1.12):

\[ \exp (-F) h_2 = \frac{i\omega\mu_0}{4} \partial_x (H^+)^2 \]

is incorrect in that the dimensions of the left and right hand sides are different. In fact, they are \(L^2MT^{-3}I^{-2}\) and \(L^{-2}MT^{-3}\), respectively, where \(L, M, T\) and \(I\) are the dimensions of length, mass, time, and electric current, respectively. Accordingly, equation (1.13) is incorrect."

The statements of T. Nara et al are erroneous. Calculating dimension of the left hand side of (1.12) in the same SI system we have

\[ [h_2] = \left[ \frac{\omega\mu_0 H^+}{\partial_x H^+} \right] = \sec^{-1} m [\mu_0], \]

where \([v]\) means dimension of a physical quantity \(v\). Equation \(\exp (-F) = (\partial_x H^+)^2\) is obtained by exponentiation of the dimensionless equation \(F = -2 \log \partial_x H^+\) (two lines above). Therefore

\[ [\exp (-F)] = \left[ (\partial_x H^+)^2 \right] = m^{-2} [H]^2, \]

where \([H] = Am^{-1}\) is the dimension of the magnetic field \(H\). It follows that dimension of the left side of (1.12) is \(\sec^{-1} m^{-1} [\mu_0] [H]^2\). The right hand side of (1.12) has the same dimension

\[ \left[ \omega\mu_0 \partial_x (H^+)^2 \right] = \sec^{-1} [\mu_0] m^{-1} [H]^2 \]

Q.E.D. Now check correctness of (1.13). We have

\[ [\mu_0] = m^{-1} H, \ \kappa = \sec^{-1} [\varepsilon], \ [\varepsilon] = m^{-1} F \]
where \( H \) and \( F \) mean Henry and Farad respectively. This yields

\[
[\lambda] = [\kappa]^{-1} = [\omega \varepsilon]^{-1} = \text{m sec F}^{-1}
\]

and

\[
\left[ \frac{\omega \mu_0}{(\partial \zeta H^+)^2} \left( \frac{1}{\pi \zeta} + \partial \zeta \left( H^+ \right)^2 + f \right) \right] = m^2 [\omega \mu_0] = \text{m sec}^{-1} \text{H}
\]

The right hand sides coincide since

\[
H = \text{sec}^2 \text{F}^{-1}.
\]

Concerning the informative part of the paper I note that T Nara and coauthors use essentially the method of my paper: reduction to a problem of complex analysis. I will not comment this paper in more details.

I ask the Editorial Board to publish my response to the critics of T Nara and coauthors.

P.S. I am surprised that I was not informed on the earlier step of the publication of this paper containing such a criticism and IP has published the paper of T Nara et al that could damage the scientific reputation of any side.

Best regards,
sincerely

Prof. Victor Palamodov