01/04/98

Phil:

I have had a bit of time to look over your 12/19/97 epistle,

The copy I have has the top of the pages clipped - but I can make out most of it.
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See page 2
I think the words ...... is zero.... have been left out of the line just above
2. Vector Fields in R3
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See page 5.
I could not find a definition of $\omega^{(1)}$
but I gather it is related to the imaginary part.
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The Bateman format is equivalent to
$A = \alpha(x,y,z,t)d\beta(x,y,z,t) - \beta(x,y,z,t)d\alpha(x,y,z,t)$
with
$F = 2d\alpha\wedge d\beta$
and $\alpha = \alpha_{\mathrm{real}}(x,y,z,t) + \sqrt{-1}\,\alpha_{\mathrm{imag}}(x,y,z,t)$ and $\beta = \beta_{\mathrm{real}} + \sqrt{-1}\,\beta_{imag}$
both complex.numbers on $\{x,y,z,t\}$.

The Bateman constraint is (the six equations) that:
$\nabla\alpha \times \nabla\beta = \pm\sqrt{-1}/c\{\alpha(x,y,z,t)\nabla\beta(x,y,z,t) - \beta(x,y,z,t)\nabla\alpha(x,y,z,t)\}$

This reduces to your time harmonic formulation (4.3)
subject to the gauge constraint that the 4 potential $\phi = 0$.

The Bateman solutions are such that:
1. the complex squares for the fields are zero.
2. Both the two Poincare invariants are zero
3. Both the 3-forms of torsion and spin vanish identically.
4. there is no radiated power in the sense that $ExH = 0$
The Bateman conditions are a definite topological constraint on the Maxwell system.

RMK