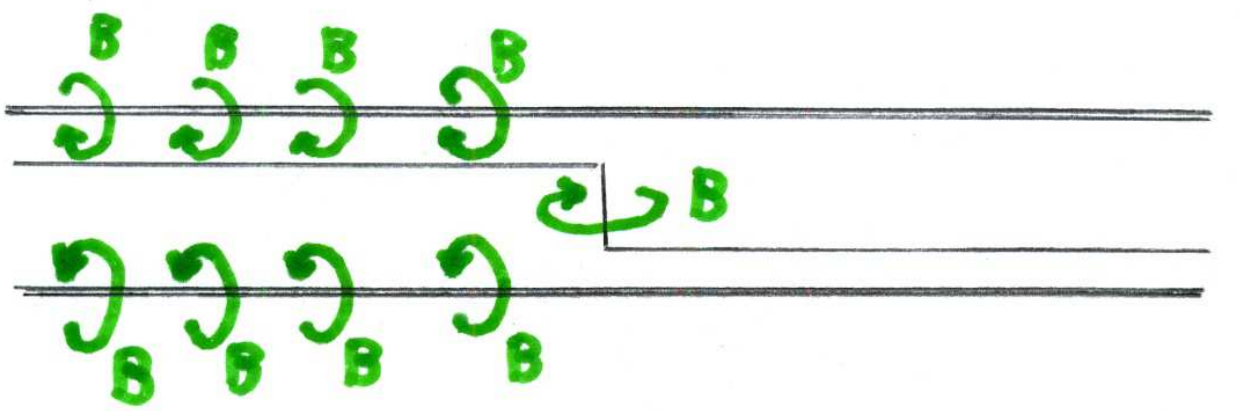
The Second Catt Question

First Question and relevant animation for second at http://www.ivorcatt.co.uk/cattq.htm



Second question. Does the dD/dt displacement current at the front edge of the step [Note 1] travelling along at the speed of light guided by two conductors cause magnetic field? Is that field in the horizontal plane? But a TEM wave only has field in the vertical plane. See relevant animation at http://www.ivorcatt.co.uk/cattq.htm and the diagrams below;

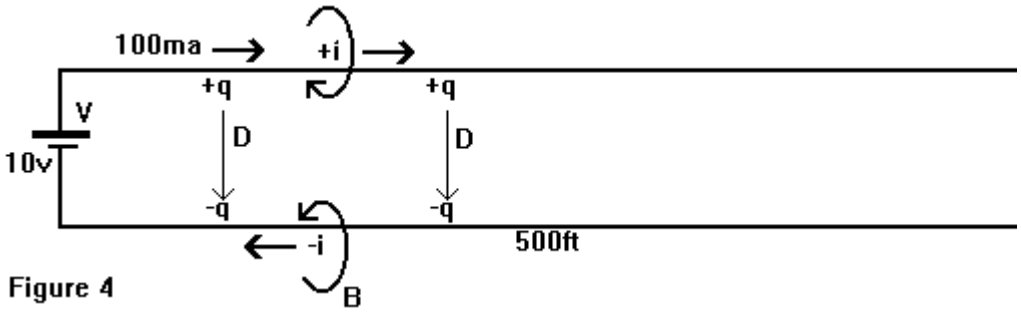
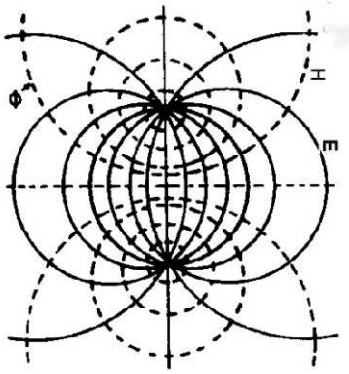


Figure 4

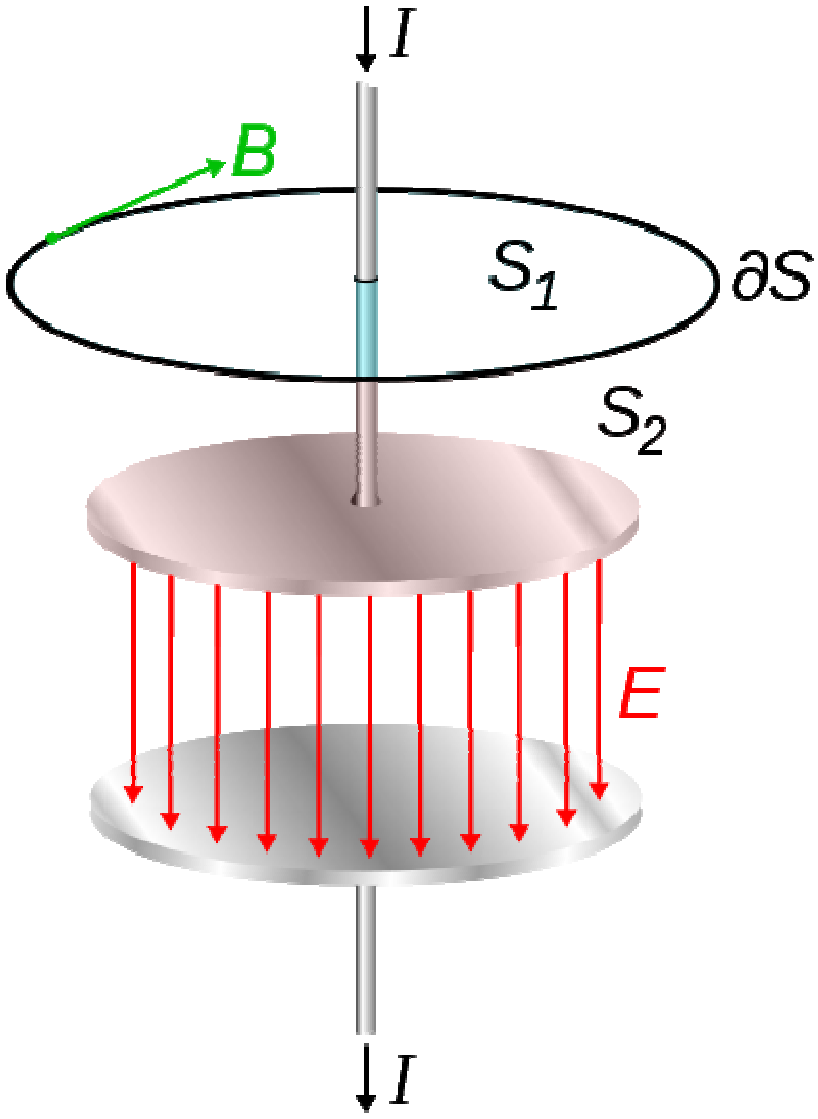
Figure 5

Turning through 90 degrees, we get this;



Lines are the electric field; dotted lines are the magnetic field.

By definition, for a TEM Wave, or “Transverse Electromagnetic Wave”, these electric and magnetic fields are in the vertical plane. But dD/dt is in the vertical plane, as here in Wikipedia http://en.wikipedia.org/wiki/Displacement_current , creating a horizontal magnetic field.



(For E, read dD/dt.)

Ivor Catt. 25 February 2012

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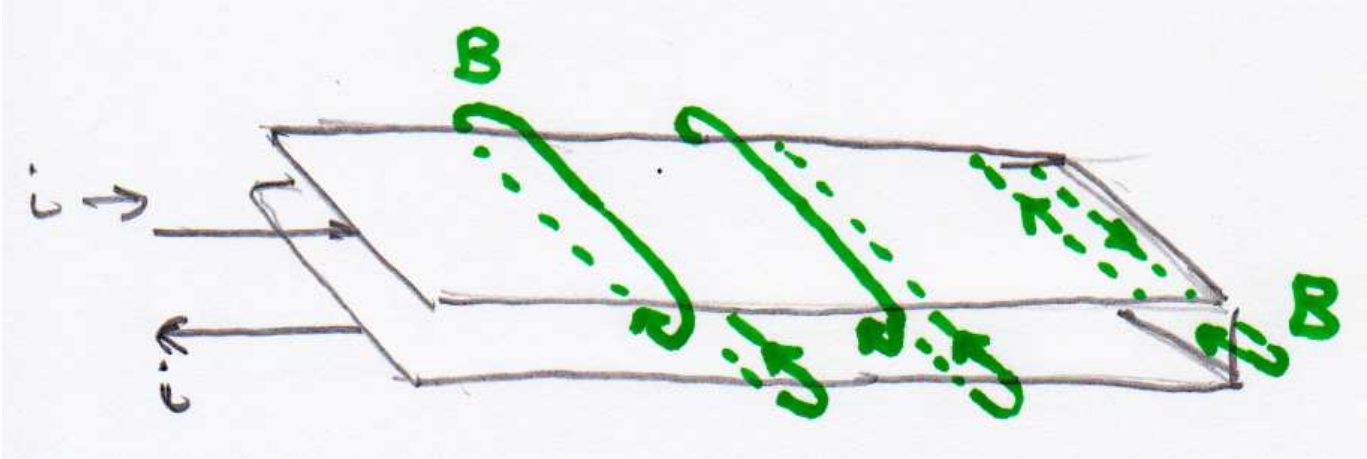


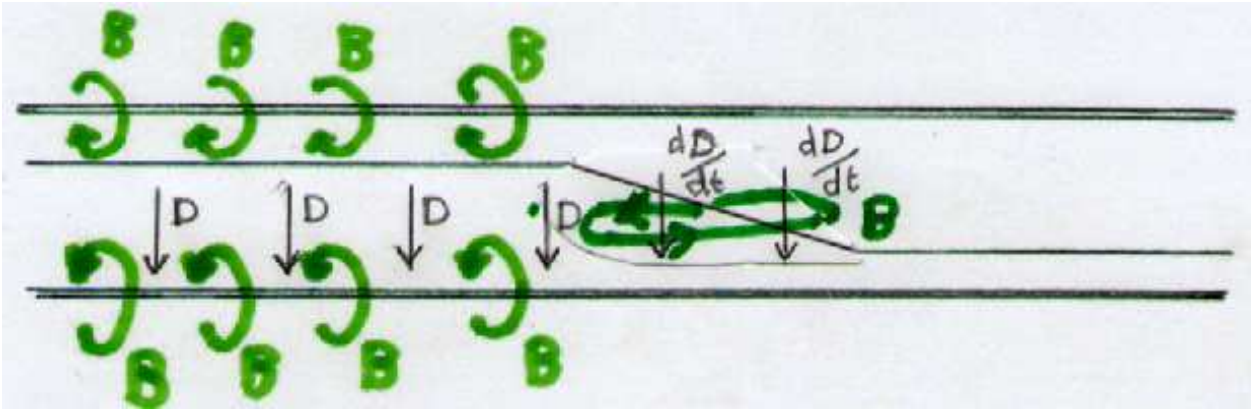
Consider two very long flat plates made up of a single plate bent through 90 degrees twice. Deliver electric current into the top plate and take it from the bottom plate. The resulting magnetic field pattern will curl round the edge of the plates as shown.

Now instead of sending steady current as above, send a TEM step into a pair of infinitely long flat plates, as in cattq - http://www.ivorcatt.co.uk/cattq.htm This is illustrated here - http://www.ivorcatt.co.uk/x22j.pdf

The magnetic field pattern is similar, so the displacement current has associated with it magnetic field curling round at its edge, ***in the forward direction***.

Ivor Catt 23 March /30 March 2012

Note 1. It may be easier for the reader to consider the case when the step has a rise time of 1nsec. Travelling at the speed of light, the rising slope is one foot long. Throughout this one foot, the vertical electric field is increasing. There is a dD/dt, and so a magnetic field is created by the dD/dt displacement current. As shown in the Wikipedia figure above, this results in a magnetic field in the horizontal plane, some of it in the forward direction. But a TEM Wave does not have a forward magnetic field. Ivor Catt 17 November 2012



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-----Original Message-----
From: Brian Josephson
Sent: Thursday, March 22, 2012 9:40 PM
To: Ivor Catt
Cc: Jonathan Post
Subject: Re: Second Question
--On 22 March 2012 18:54:47 +0000 Ivor Catt <icatt@btinternet.com>
wrote:
> The displacement current is in a vertical direction. This causes
> magnetic field in a horizontal plane, some of it lateral, some of it
> in the forward direction. Concentrate on the forward direction.
> We are dealing with a Transverse Electromagnetic Wave, which by
> definition only has magnetic field in a transverse direction. Thus,
> we must either remove displacement current from classical
> electromagnetism, or remove the TEM Wave.
??? No. None of it is in a forward direct, it is transverse. This is
the problem if you work with simplified physics rather than follow the
maths. Any textbook on em theory will write down the solutions of M's
equations (which include the displacement current in the eqn. involving
curl H) and from this you can clearly see that a TEM wave is consistent
with the equations. You do not have to remove either the disp. current
or the TEM wave.
I can't find any very tidy treatment but here is one web page that
gives the derivation:
<www.ece.msstate.edu/~donohoe/ece3324notes10.pdf>
Brian
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* * * * * * * Prof. Brian D. Josephson :::::::: bdj10@cam.ac.uk