

turns through which the tube  
threads its way. It is in the same  
units as Magnetic Potential just as  
EMF is in the same units as Electro-  
Potential.

$$EMF \times \text{Total Electric Flux} = \text{Energy}$$

$$MMF \times \text{Total Magnetic Flux} = \text{Energy}$$

EMF is a very different thing from <sup>el</sup> Pot. Difference

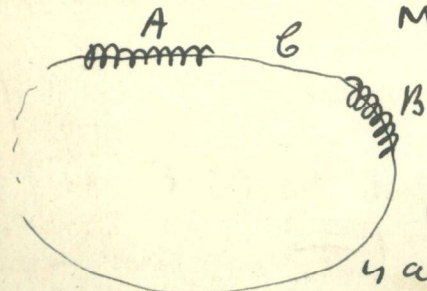
MMF . . . . . Magnetic " "

We speak of the MMF gradient (that is, per  
centimetre) as we speak of the EMF per  
C.M. of a wire moving in a field. (This is a  
very diff. thing from the P.D. at the ends of  
1 cm of wire)

For example there is a  
M.M.F. gradient at A  
or B but not at C  
The Mag. Pot. Diff.

between the ends of A  
is a very different thing

from the MMF at A or which A produces  
At C there is no MMF but there is  
Magnetic Potential difference.



31, BRUNSWICK SQUARE.  
W. C.

12/53

8<sup>th</sup> Dec 1891

Dear Fitzgerald,

Make up one or two interesting  
easy practical problems using Total  
Spherical Harmonics for <sup>Electro</sup> Magnetic  
problems that we have them. I will  
if you like send you <sup>five or</sup> six copies of the  
paper for students (when I receive  
them from T + F). There must be  
mistakes in the paper - kindly tell  
me. I know there must be mistakes  
because I never yet wrote a paper  
without more than one mistake

Are you poking fun in  
your enquiry about Magneto-induction



force? Is it the word 'force' that  
you object to? Give us a better  
one.

12/53

Unit magnetic pole is a simple looking  
but deceitful thing much disliked  
by "the practical man" whom you  
scorn; but who is like Rague Rider-  
hood & earns his bread with the  
sweat of a mental brow & ought  
to be largely respected

What work is done ~~to~~ on unit pole in  
going all round one solenoid? I don't  
know unless the medium is all air

If it is iron in places, you will tell  
me there is a superficial distribution  
of magnetism or some other abomin-  
ation & then I say that the unit  
pole is your own property & so is  
surface magnetism & you can say

what you please about a unit pole  
going through the iron as the boy  
said about the man & the two  
cats tied up in a bag & thrown  
into a pond.

Give me your unit pole & tell me  
that iron is exactly like air except  
for its greater permeability - then  
the work done on unit pole in one  
complete circuit is a very different  
thing numerically from the magnetic  
work done. In a medium all of  
permeability  $\mu$  your  $\sqrt{-1}$  (unit pole)  
will have work done on it equal to the  
 $M.M.F.$   $\times \mu$  in one round.

The total M M F in any  
complete magnetic tube or solenoid  
is  $\frac{10 An}{4\pi}$  if An is the ampere



but I can get no 'forwards'. I can get it into Riccati form, but this is of no use

Is there anybody about you who can do things of this kind without trouble? I have spent a whole day at it.

A series is of no use to me

I finish this letter nearly a week after beginning it. I began to state to you the Pillar problem & stopped writing & indeed I have done very little else than work on this problem all week - neglecting my duties.

Yours Ux

Wm Penny

12/53

31, BRUNSWICK SQUARE.

W. C.

When you ask the views of 'the practical man', I give you my own views. Are they very wrong in your opinion? Assuredly I am anxious to learn & to teach others, but you higher Gods on Olympus only wreath your brows in critical frowns very seldom - You usually only laugh & don't help us.

In my paper on Struts, <sup>& Ties</sup> I would have talked of your balloons - but of course I didn't, nor of any such subject.

Have put aside the Ewing experiment - see a more convenient season being very busy.



That hedgehog Transformer was sent me by Carl Russell whose great & triumphal defence against his wife's charges created so much excitement last week. He seems a very good fellow. 12/53

It may or may not be quite wrong for me to tell you that you were elected by ballot unanimously as our next president of the Physical Society by the council. But the meeting was not numerously attended & things need not be definitively fixed till the next meeting. Our reasons were - your present examinership necessitates your presence in

London. At a future time you are not so likely to be often in London.

Is the following problem <sup>not</sup> too difficult?  
 A <sup>vertical</sup> column of uniform section fixed at the bottom, loaded only with its own weight - what may its height be?  
 Cross Section A. Moment of inertia of section I  
 Average value of  $y$  from 0 to  $x$  ~~is~~  
 $\int_0^x Ay \cdot dx \cdot w = \text{Bending Moment at } P = M$  Say  
 $y = \frac{w}{\epsilon I} = wt$  per unit volume  
 $M = \epsilon I \frac{d^2 y}{dx^2}$

In solving the problem of a uniform column carrying its own weight (solved above - inately but want it more accurately) I have to integrate

$$\frac{d^2 y}{dx^2} + \frac{wA}{\epsilon I} x y = 0 \quad \left| \begin{array}{l} \text{where } \frac{wA}{\epsilon I} \text{ is const} \\ \text{call it } n^2 \end{array} \right.$$

The symbolic form of it is, if  $x = \epsilon^0$

$$y + \frac{n^2}{D(D-1)} \epsilon^{3\theta} y = 0$$