From: David Cook <david.m.cook@lawrence.edu>
Date: April 10, 2007 5:45:14 PM EDT
Subject: Another step towards the contribution of Group 3

Greetings again,
I thought I could just dump the attached word file into the body of this email but I find I still don't understand why some lines REFUSE to rewrap and others will rewrap quite nicely in my email program. I am instead attaching the word document with the hope that you all can read it. Someday I will figure out how in the world to make programs realize that I really know what I want to do and turn off their irritating habit of trying always to second guess me. (Sorry. Thanks for listening to that flame. That issue is why I prefer LaTeX and a good text editor to any of the commercially available word-processing programs---and LaTeX is free!)

Take a look at the attached. I will try to have a follow up in a week or so. In the meantime, please send me any further thoughts that you have.
<**file: compositegroup3.doc**>

From: Michael Gray <gray@american.edu>
Date: April 12, 2007 11:38:25 AM EDT
Subject: Re: Another step towards the contribution of Group 3

I believe that there's not enough time in the E&M course for extensive programming, so I think a computational system is better for a module base. Here at AU, we teach a one-semester course in intermediate E&M that covers the first seven or eight chapters in Griffiths (3rd ed.). This requires the students to go flat out all semester just to do the physics. I'm a MATLAB user in my computational physics stuff because it gets the student past a lot of work that's not related to physics.

This does mean, of course, that there may be some departments that can't use such a module, but, as David points out, this may become less of a problem in the future. And it's also a plus for students going out into industry after graduation since use of computational systems are widespread there. Programming is important in industry, also, but I believe this course is so demanding that it's not a good candidate for heavy-duty programming.

I'd also like to second Jan's comments about the field theoretic importance of mastering vector field theory in this course. This course is very important from that perspective. To support this, I'd like to propose that we consider a preliminary module to strengthen both the vector field theory and computational background. The text below describes what I have in mind.

*(See **file: Vector Field Introduction Module.doc**)*
[If anybody has trouble with the Word document, I can transmit a text file.]

On Kelly's proposals dealing with the atomic models, I like to cover this kind of material in the electrostatic fields in matter topic. Since this topic requires talking about models of matter, internal fields, induced charges, and polarization, it seems like a natural for a module of this kind. In fact, I think a good module in electric fields in dielectrics would be a real blessing since many instructors I know tend to skip a lot of this chapter, even though it's very important in industrial contexts.

From: David Cook <david.m.cook@lawrence.edu>
Date: April 16, 2007 5:57:26 PM EDT
Subject: An attempt at synthesis

I have attempted to assemble a summary of much of what has been said in our several emails of the last week-plus. The doc file is attached. Please look this summary over and send me any additional comments or suggestions for its further refinement.

-- **File: Group3Summary->16apr.doc**

From: Jan Tobochnik <jant@kzoo.edu>
Date: April 17, 2007 7:56:07 AM EDT
Subject: Re: An attempt at synthesis

Dear David,
Thanks for your useful summary. One additional question which might be part of the questions you already have is the following: Are there computational techniques that make any of the usual analytical techniques outdated or such that less emphasis should be placed on certain analytical techniques? Here is an example from classical mechanics. AJP gets lots of submissions on analytical approximations to the period for a pendulum at large angles. Since this is trivial to do numerically, I always wonder why one should bother with the analytical work. A corollary of this question is should the E&M course set of topics(and maybe even the theme of the course) be different if one includes computational techniques?

One topic that is not explicitly stated is visualization of time dependent fields from accelerated charges. Although this is a tough problem and maybe most people never get to this part of the course, it is pretty interesting.

From: David Cook <david.m.cook@lawrence.edu>
Date: April 17, 2007 10:13:23 AM EDT

Jan:
Thanks for the suggestion of the broad question of whether computational approaches might in some cases replace rather than supplement traditional analytic approaches. I have actually wondered the same thing you have with respect to the large-amplitude pendulum. I agree that visualization of time-dependent fields is an interesting problem---but this is the point at which my question about what is "intermediate" comes into play. I don't think I would regard time-dependent fields as an intermediate topic, but my opinion might be colored by the maverick structure of the Lawrence physics curriculum, which exploits our three-term calendar.

From: "R. M. Panoff, Ph.D." <rpanoff@shodor.org>
Date: April 17, 2007 10:25:18 AM EDT

There is also a small but intense group looking at older "analytic" methods that were bogged down because ultimately one had to do a non-analytic integral. Some of those could be ripe for numerical solution. And there are other methods that were suggested over the last 100 years that often were abandoned because of the amount of computation involved. I think it could form a rich set of explorations.

From: Jan Tobochnik <jant@kzoo.edu>
Date: April 17, 2007 10:37:29 AM EDT

Dear David,
Although I am not sure, this might be an example where computation could change an

advanced topic into an intermediate one. I have in mind using Feynmann's approach in his Lectures.

From: "R. M. Panoff, Ph.D." <rpanoff@shodor.org>
Date: April 17, 2007 10:44:40 AM EDT

agreed. As an example, we have lots of students solving laplace equations by relaxation. Repetitive averaging is tedious and would be prohibitively so if not for rapid computation, but it is rather easy to understand.