Article Review and Annotation


The author and maintainer of this wonderful site is a Protocol Software Engineer at Anritsu, Ottawa, Canada Area specializing in telecommunications.

This is a remarkable set of rich resources for engineering education and we note the strong conviction of the author(s) as to the role of differential equations in engineering, for from the introduction we quote:

“I would say to many of friends and juniors working in engineering area. ’If you are good at two topics, Matrix and Differential Equations, you would be good at ANY of the engineering field.’ Of course, just being good at math would not automatically lead you to success in the field, but we cannot deny the fact that mathematical understanding is very crucial in most of engineering.

“In this page, I would like to explain the basic concept of differential equation and it's applications as easy as I can do, but in some cases it is hard to avoid tackling the mathematical equations directly.”

There are many engineering specialties offered at this site and all re rich in illustrations, example, narrative in support of theory and practice. However, what is best is the flow of the narrative and the rich illustrations and step-by-step. Example after example are offered from many fields of engineering and pharmacokinetics as well with Governing Law principle first and then a gentle building of the differential equation with examples to show the model in action.

The site is also rich with a very remarkable Personal Interest page in which the author(s) give a list of questions and resources as well as favorites that will fascinate and drawn in the reader.

“Following are some of the questions I spent most of my time, contemplating, reading, watching when I am not working on engineering/techy stuffs. These are more for myself not to forget about the thread of my thought. Just in case there is somebody who is seeking to have the answer to the same questions… or have interests in the similar topics in this page, just try to use these as a kind of keywords to search more information in your search engine. I am also using this page as a keyword finder for further search. Now as I get older, I found myself more absent-minded. My brain requires more frequent 'refresh' or sometimes 'rebooting' :)”
We illustrate (with a screen capture) the flare offered in this one example (or the first part of this one example) on a Vehicle Suspension System in which the differential model is built carefully and meticulously.

< Example : Coupled spring - Vehicle Suspension System >

You can practice what you learned from the previous two examples and this is the one that can be easily extended for a real life problem. You can easily apply this example to model a suspension system of a vehicle.

It may look a little bit scary, but the logic of the modelling is always the same however complex system it is.

Do you remember the logic (process)?

i) Break down the system into each component. (When you see this kind of spring-mass system, each Mass is the building block of the system).

ii) Draw the arrows (vectors) to represent the direction of Forces being applied to each component.

iii) Write down mathematical formula for each of the arrows (vectors).

iv) Combine all the component formula into a single differential equation

Now let's start with the first component. Can you identify the component? M1 is the first component. Mark all the springs, damper and applied force for the component as shown below.

Now draw arrows (vectors) to represent forces being applied to the component (Mass) as shown below.

\[ -k_1x_1, \quad -k_{d1}\frac{dx_1}{dt}, \quad k_3(x_2 - x_1), \quad k_{d3}\left(\frac{dx_2}{dt} - \frac{dx_1}{dt}\right) \]

Now combine each component formula into single differential equation as shown below.

\[ M_1\frac{d^2x_1}{dt^2} = -k_1x_1 - k_{d1}\frac{dx_1}{dt} + k_3(x_2 - x_1) + k_{d3}\left(\frac{dx_2}{dt} - \frac{dx_1}{dt}\right) + f(t) \]