

## Main problems

- Failure to explicitly address any of the Code of Ethics
- Fractured English
  - English structure
  - Tense agreement
- Lack of proofreading
- Strange and convoluted logic; digressions about things that weren't related to the problem.

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## Writing Math Well in Documents and Presentations



## Math *is* the language of engineering

- Statics:  $\sum_n \mathbf{F}_n = 0$
- Dynamics  $\sum_n \mathbf{F}_n = m\mathbf{a}$
- Heat Transfer (conduction):  $q_x = -kA \frac{\delta T}{\delta x}$
- Maxwell's Equations:  $\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0}$   
 $\nabla \cdot \mathbf{B} = 0$   
 $\nabla \times \mathbf{E} = -\frac{\delta \mathbf{B}}{\delta t}$   
 $\nabla \times \mathbf{B} = \mu_0 \left( \mathbf{J} + \epsilon_0 \frac{\delta \mathbf{E}}{\delta t} \right)$




- **Fourier Transform**  $X(\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t} dt$
- **Laplace Transform**  $H(s) = \int_{-\infty}^{\infty} h(t)e^{-st} dt$
- **Z-transform**  $X(z^{-1}) = \sum_{k=-\infty}^{\infty} x_k z^{-k}$
- **Differential Equations**

$$\sum_{k=0}^N a_k \frac{d^k y(t)}{dt^k} = \sum_{k=0}^M b_k \frac{d^k x(t)}{dt^k}, \quad \frac{d^0 y(t)}{dx^0} \triangleq y(t)$$
- ...and on and on.
- **Math is the language of engineering.**

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### Some text mistakes to avoid

- **Solve does not mean Evaluate**

$x = y - 5$ . Solving at  $y = 3$ , we have  $x = -2$ .

$x^2 = 4$ . Evaluating, we have  $x = \pm 2$
- **These are wrong! Swap Solve and Evaluate to correct!**
- The terms **equation** and **function** are not synonymous
- In math, **arbitrary** does not mean **at random**.

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## Use standard math expressions

- Written math is not the same as programmed math
- ...so while
  - $x = A \exp(-j \cdot 2 \cdot \pi \cdot k \cdot t)$  is valid MATLAB
  - $x = A e^{-j \frac{2 \pi k t}{T}}$  or  $x = A \exp\left(-j \frac{2 \pi k t}{T}\right)$  is proper math!
  - $\text{PSD} = (V^2/2) * \text{sinc}(\text{frequency} * \tau) .^2$  is valid MATLAB
  - $S = \left(\frac{V^2}{2}\right) \text{sinc}^2(f \tau)$
- Keep the equals sign out of non-formula text
  - $d$  = the distance between two points
  - Is fine for a MATLAB comment, but not for text or presentation

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## Writing (Typing) math

- Do not try to just change the font to a symbol font!
  - $Y = mx + b$
- Use an Equation Editor to create good math statements
  - Most industrial writing is done in Word, so this means Equation Editor or the MathType add in (which is what Dr. LaBerge uses!)
  - <http://www.dessci.com/en/products/mathtype/>
  - Most academic writing is **not** done in Word, so this means LaTeX (which is also useful in MATLAB plots!)
- $\mathcal{F}\left(\int_{-\infty}^t x(t) dt\right) = \frac{X(f)}{j2\pi f} + \frac{1}{2} X(0) \delta(f)$  would be nasty
- ...if you tried to do it by hand

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## Writing Good Math

- Good math follows a set of logical steps
- Make sure that in your writing or presentations the steps are clear
- ...and the logic is solid
- CMPEs study logic in CMSC203 and CMPE212
- It doesn't apply only to hardware and software...
- ...you need to apply logic to your writing as well.

## Other things

- Include your units, Define your terms!!

For RRC filtering and intermodulation orders  $m$  and  $k$  such that  $m, k \geq 2$ , we can approximate the voltage spectral density  $V_m(f)$  and  $V_k(f)$  by Gaussian functions

$$V_m(f) = a_m e^{-\frac{f^2}{2m\sigma^2}} \quad (1)$$

and

$$V_k(f) = a_k e^{-\frac{f^2}{2k\sigma^2}} \quad (2)$$

where  $\sigma^2$  is the mean-square bandwidth of the RRC function  $H(f)$ , as derived in the previous section. The  $(m+k)$ -th IM product is the convolution of these functions. In (13) and (14),  $a_m$  and  $a_k$  are the maximum amplitudes of the  $m$ -th and  $k$ -th order Gaussian, respectively. The units of the  $a_k$  are Volts <sup>$k$</sup> /Hz.

## Writing Math Well



- Be precise with your wording
- Define your terms
- Use an Equation Editor of some kind
- Be logical (with valid logic)
- Use standard forms
- Be neat!