Maplesoft
Mathematics • Modeling • Simulation
A Cybernet Group Company

Engineers - Stop using Excel Before You Make an Expensive Error

Introduction

An engineer has an ethical duty to actively identify and minimize sources of risk. However, one particular, but significant, source of risk is often ignored. That's Microsoft Excel – a surprisingly common tool for engineering calculations.

Spreadsheets bring many advantages, and Excel can be a great tool, but for some tasks is not the right choice. When it comes to engineering calculations, the risks far outweigh any perceived benefits. **That's because Excel can lead to frustrating errors, lost productivity and, potentially, grave errors.**

This whitepaper explores why Excel is such a popular calculation tool, and, on the flip-side, why you should stop using Excel for anything more than bookkeeping.

Why do Some Engineers Keep Using Excel for Calculations?

Familiarity. You might think you know how to use Excel well, even though remarkably few actually do. It feels comfortable and familiar, so why would you want to learn anything new?

Ubiquity. Excel exists on virtually every computer. You can almost guarantee that everyone else has Excel installed, so deployment appears to be "free".

No additional cost. While you personally might want to purchase better calculation software, your budget may be limited, or persuading management is a hassle.

These are all perfectly valid and defensible reasons to continue with Excel, but before we examine why you should stop using Excel, let's consider the unique requirements of engineering calculations.

What are the Characteristics of Engineering Calculations?

Engineering calculations aren't just equations that you plug numbers in to. They have a set of unique qualities that need to be identified so we can define what is needed of supporting technology. It's important to understand that the nature of engineering calculations often requires more than a spreadsheet tool:

- Calculations are based upon the applied math learned at University, often augmented by empirical relationships derived through data analysis.
- Calculations need to be audited and verified, sometimes for regulatory compliance.
- Engineers work in teams and distribute calculations to clients, so calculations need to be shared and easily understood.
- Units are often a fundamental part of calculations.
- Equations might need to be derived or rearranged before numbers can be plugged in.
- Advanced mathematical routines might be need for matrix computation, differential equation solving, or other number crunching.

Why Should Engineers Stop Using Excel?

In the previous section, we identified the characteristics of engineering calculations – hopefully, you drew some connections to your own work. Let's now examine why Excel does not address the fundamental needs of engineering calculations:

Equations are hidden. You don't see them on the spreadsheet. You have to click a cell to see the often indecipherable equations.

Equations are inline. They're hard to read and understand.

Variable names are usually cell references. The vast majority of Excel users do not give cells meaningful names, so formulas contain cryptic cell references.

No order to the calculations. Trying to understand a complex Excel calculation is an exercise in frustration. Moving around from row to column to cell without any logic or order can quickly be disorientating. This makes Excel spreadsheets very difficult to understand, share and extend.

No support for units. You have to put unit conversion factors in manually and this often leads to undocumented numbers appearing out of nowhere in a formula.

Plots are limited. You can't get compelling visualizations that engage your audience and encourage them to learn more about or clearly understand your data.

Math functionality is limited. Everything from equation solving to matrix computation and beyond is weak. This means that the analytical ceiling is low – you can't do anything too complicated in Excel.

Microsoft is not an engineering calculation company. They don't understand how engineers think or act; therefore the needs of an engineer aren't met within the software.

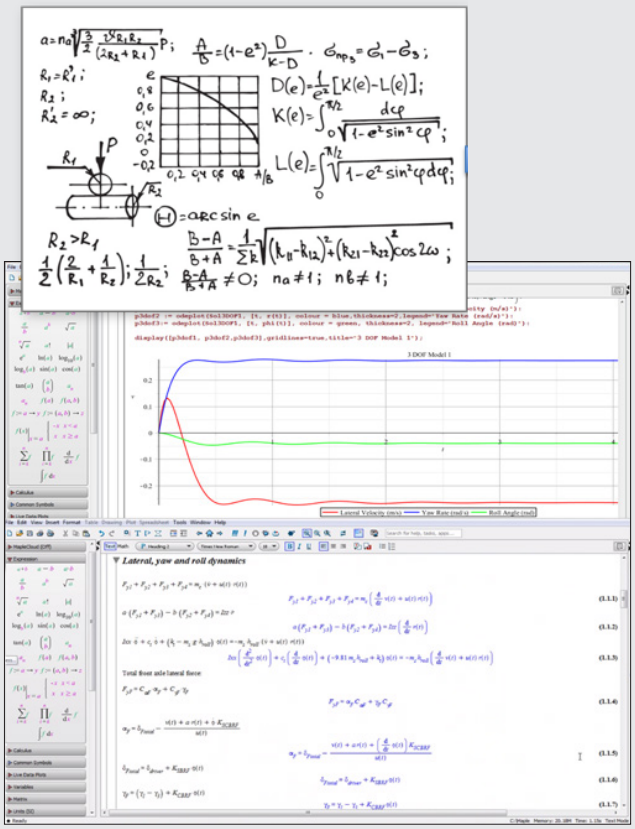
When engineers leave, knowledge leaves with them. Excel is not built to document or manage engineering calculations.

Fundamentally, all these reasons are a source of risk that compound project-after-project, year-after-year. And while Excel can be useful for simple computations, it doesn't provide the abilities to make calculations a robust, long-standing asset in a company.

Manage Engineering Calculations with Maple

Maple helps you perform and document engineering calculations in a way that can be audited, verified and shared.

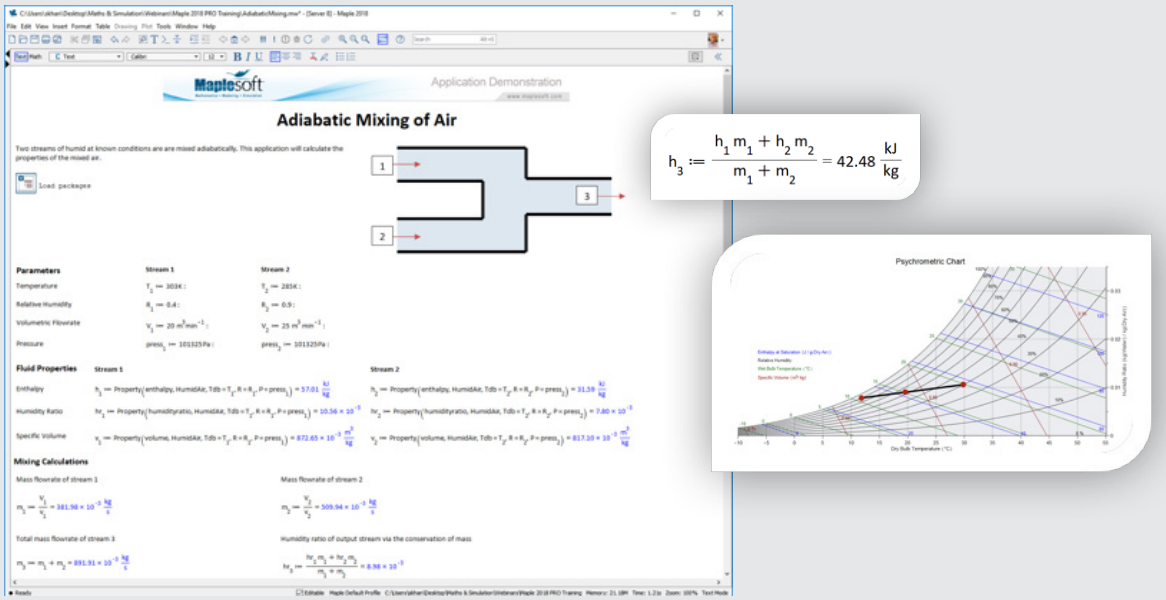
- Equations are presented in natural math notation.
- Units flow from parameter definition, equations, analysis, and all the way through to plots.
- Plots and visualizations are visually compelling, and strike the right balance between aesthetics and information.
- Documents can mix text, graphics and plots, with live calculations.
- You can do everything from simple design calculations and data analysis to symbolic math and programming.
- Maple is developed by Maplesoft - an engineering calculation company.



Maple functions as a documentation system, ensuring that calculations are understood and accessible across an organization.

These features make calculation errors far less common, and far easier to identify if they do occur. This increases the reliability of your engineering calculations.

Overall, Maple functions as a documentation system, ensuring that calculations are understood and accessible across an organization. Using natural math notation, engineers can perform their calculations just as intuitively as by hand, while using plots, diagrams, and text to create mathematical documents that are report-ready. Employing a tool that automatically takes care of common tasks frees up an engineer's time to develop specific solutions, explore new design ideas, and collaborate with others.



Plots and visualizations are visually compelling, and strike the right balance between aesthetics and information

So What Should I Do?

While spreadsheets are convenient, they are highly error prone. Choosing another calculation tool, especially when you've been using Excel for a long time, is a trade-off between costs and benefits. The ideal tool for engineering projects is one that can handle complex calculations across a broad range of subject areas, but ask yourself these questions:

- Do the benefits of better calculation tools outweigh the potential total cost of ownership?
- Does the time spent in tracking down an error in Excel outweigh the licensing fee of another calculation tool?
- How much time have you already lost because an Excel calculation was incorrect?
- If you were to switch to other software, what is the payback period?

Your decision may sway one way or another, but you can't afford not to ask yourself these questions. That's because if you insist on using Excel, you'll eventually make an expensive error.

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