

Salutations

Intro and Disclaimer (1min 30sec)

Hello and welcome everyone to an Introduction to MATLAB. My name is Michael and I will be your host for today's workshop. I have been using MATLAB for my entire academic career and have even used it for work. I am currently coming in as a senior next semester and I think I have suffered enough to realize that there is always an easier alternative to a presented problem. Today's workshop will hopefully convince you to start learning MATLAB

In this workshop, you will be learning the benefits of MATLAB and how it can help with everyday problems while saving you a lot of time and head scratching.

Prior to starting, I would like to point out that this workshop is solely to introduce you to MATLAB and not to teach its fundamentals. I will be presenting various examples of the code, though it may be intuitive, I do not expect you to understand the code whatsoever, rather the code is there to display MATLAB's features.

However, if you are interested in learning MATLAB, I will be hosting workshops in the fall. Those workshops are called "Fundamentals of MATLAB" and if you attend just one of those workshops, I can guarantee you will be self-sufficient and, on your way, to creating more complex programs in just under two hours.

With that said, let us go ahead and get started...

Overview (1min)

Here are the topics we will be covering in today's workshop

- The Importance of having a programming language (Here, I will talk about why you should even have one in the first place and how it can benefit you)
- What is MATLAB (Here, I'll briefly introduce MATLAB and some of its essential uses)
- Why you should use MATLAB (Here, I'll be providing a complex problem that can only be solved using a computer language to prove why a programming language is essential)
- My experiences with MATLAB (As a student, I will be sympathizing with you on why this can benefit you in your academic career. Moreover, How I managed to utilize MATLAB to solve very complex problems. I will be showing examples of the codes I have used as well.)
- What MATLAB can be used for (A broader scope of the many projects and good that MATLAB has been used to benefit society)
- Questions (Culminate with a conclusion and ask for any questions pertaining to the presentation)

The Importance of having a programming language (5min)

To get my point across of how important it is to learn a programming language; we will start it off with two problems. If you can solve both problems before me, then you have proven to me that you can live your life without ever having to use a programming language. (Especially if you are an Engineer or scientist!)

As you have just witness, MATLAB solved a relatively long and time-consuming problem in under a minute! This is just the tip of the iceberg, there are a plethora of extremely difficult problems that exist out there that you have probably come across. Looking back to those problems, you could have solved them in a matter of seconds. Now that I have your attention, let me explain to you what MATLAB is

What is MATLAB (2min)

MATLAB stands for MATrix LABratory.

MATLAB is a higher level, object-oriented, top-down computing language built for Engineers and scientists. It is known for its extremely user-friendly interface, matrix-based language, comprehensive built in functions, effortless graphing capabilities, and overall easy to learn environment.

You can essentially utilize MATLAB to analyze data, develop algorithms, and create models and applications.

Now what makes MATLAB different from other computing languages...

Why you should use MATLAB (8min)

Well first off MATLAB is...

1. Convenient (The user could pull up MATLAB anytime, it is compatible with various operating systems such as Window, Linux, and, Mac, and can be easily downloaded on multiple devices. MATLAB also has something called MATLAB online which allows you to work on essentially any computer and save your work to a cloud.)
2. Easy to code (MATLAB has straight forward built in functions and visually pleasing interface, again it is a higher-level language, meaning that the user can easily talk to the computer than other lower level languages. MATLAB talks back to you if you have done something wrong and will help you fix the problem!
3. Quick learning curve (There is a reason why my MATLAB Fundamentals course have students leaving with the aptitude to embark on more complex programs. The code is very easy to understand and comprehend and to be expanded upon.)
4. Ability to process Large matrices (You will see an example later on in this presentation of such a large matrix)
5. Extremely friendly user interface and visualization (especially when it comes to 2-D and 3-D modelling. Let me show you an example.)
6. Large support for MATLAB (You can literally google anything!)
7. Supports many other things like (ONNX, PyTorch, LATEX, MXNet)
8. Plethora of toolboxes designed for any specified engineer(These tool boxes include things like the symbolic toolkit which allows you to declare something as a symbol and will let you integrate, take the derivative of or plot solution for said symbol in an equation. There are many more toolboxes tailored for different things.)
9. Continually updated and fitted to todays standard of an engineering and scientist
10. And employability. (My job at Sandia for example)

Overall, it is simply easy to use and is efficient for the user's time. It is one of the simplest and easiest language to exist to ease the most difficult and arduous tasks.

What I have used MATLAB for (5min)

1. My first encounter with MATLAB was when I was interested in detector modeling. I assisted in a graduated student's undergraduate research:
 - a. Co-Author, "Measurements of ^{252}Cf fission product energy loss through thin silicon nitride and carbon foils, and comparison with SRIM-2013 and MCNP6.2 simulations," Nuclear Instruments and Methods B, June 2019.
 - b. The graduate in charge of his own thesis had a GUI, this GUI was made in MATLAB and modeled fission products passing through a pinhole to the other side.
2. As a personal project I built a rugged peak finder. The program takes in a file from a fissions spectrum and applies a gaussian to the data to and finds relevant peaks. This is particularly important for characterizing radioactive sources.
3. In my partial differential course, we were to plot wave approximations of various functions
4. In my intro to numerical computations course, I had many projects involving MATLAB and having to solve certain problems in various ways with different methods, and have come across more efficient and faster programs that can solve a problem faster, with less code, and at less processing time.
5. Had to solve problems numerically so many times in my nuclear engineering courses. On example is to model the flux attenuation in a 2-D, commonly shaped reactor core.
6. Built a GUI for Sandia National Labs. I cannot say much but it would read in files containing tens of thousands of data points and plots a result in various conditions and variability with crossing the data.
7. In my Heat Transport course, I had to optimize and satisfy the pressure and flowrates of steam in at least 8 nodes or buildings with more than 2 branches.
8. I have just started on my undergraduate thesis on Stoke's Flow and I will eventually be modeling fluids traversing through various shaped orifices.
9. In repetitious regards, there have been many times I have been presented with a repetitive problem such as finding the molecular density of isotopes. I simply recall a program that does so and Walla! I am done.

There have been countless times MATLAB has saved my but especially when there is a time crunch present and the fact that MATLAB has provided productive results for me. As a student myself, I see this more over as a productive tool for breaking down what can be a complex and arduous problem to something that is purely simple.

Now what if you are not a nuclear engineer or an applied mathematics major like me, then I will honestly tell you that you are not limited, you need MATLAB more than I do! Here are some examples that MATLAB has been used for...

What MATLAB is used for or what it can be used for: (2min)

- Develop cyber-physical systems
- Remote search and rescue
- Self-sufficient highways

- Efficient clean energy
- Launching with automated code
- Robots performing life-saving tasks in hazardous conditions
- Improvement of heart transplant outcomes
- Predict weather
- Eliminate jet lag
- Detect toxins
- Dissolve gridlocks
- Identify cybercriminals
- Purify water
- Repair genes
- Sequester carbon
- Grow nano skin
- Create biofuel
- Rewire the brain
- Explore mars
- Deep Learning
- 3D Modeling and Simulations
- AND SO MUCH MORE....

With everything said, MATLAB is an essential tool for any engineer or scientist. It has many capabilities to tackle difficult problems, nonetheless, could save your time! MATLAB is extremely marketable and utilized broadly within the work force. I am here to present this workshop for you for a reason and that is to solely benefit you and to not make the same mistakes I have made throughout my academic career.

Questions (Remainder)