

MATLAB: Perfect Tool for Technical and Real Time Challenges

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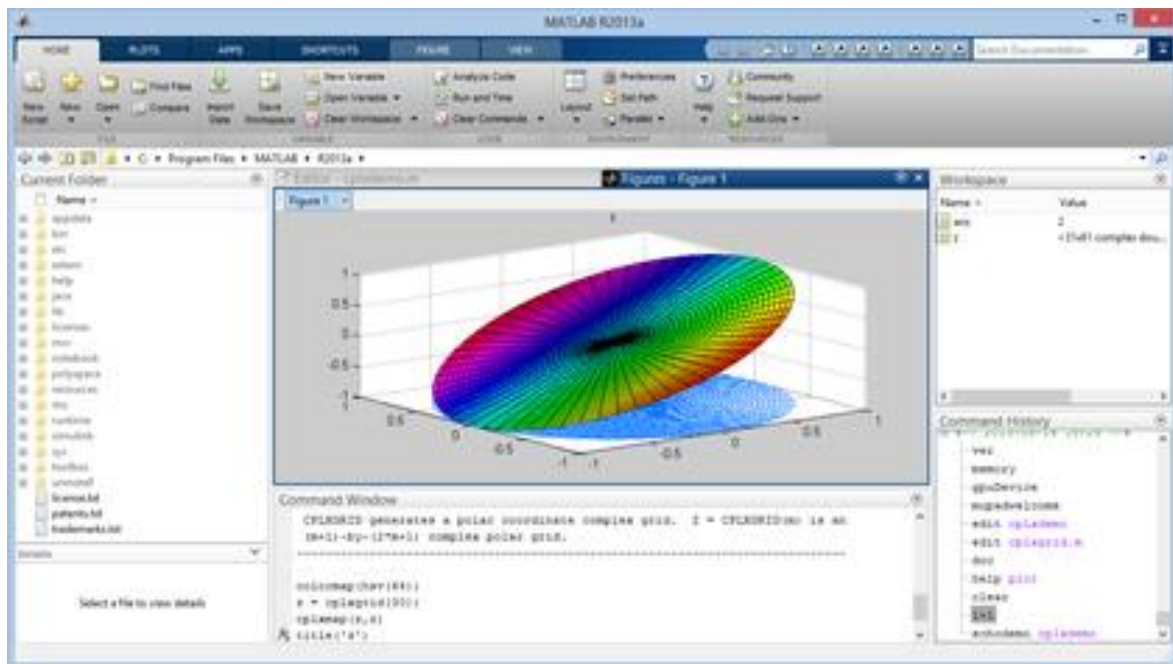
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Abstract - Today's scenario requires a software capable of doing multi-tasks in single software that is much more advance terms of usability, ease of use, hardware compatibility and good performance. So answer to this is MATLAB that is an epitome of numerical computing environment MATLAB allows MATRIX manipulations , plotting of functions and data ,implementation of algorithms ,creation of UI and interfacing with programs written in other languages including C,C++,JAVA, Fortran & Python. The recent advancements in MATLAB have made it much more user friendly and compatible with most of tasks performed in daily life like-data analysis, machine learning, IOT (Internet of things), motor and power control ,medical devices. This paper emphasizes on MATLAB and it's applications in various situations like in medical fields, racing tracks, neural networks or numerical computation performed by engineering students.

Keywords - MATLAB, UI, IOT, SIMULINK, TRD

I. INTRODUCTION

MATLAB is a proprietary language prepared by MathWorks which is basically intended for numerical computing but with an additional package SIMULINK, it adds graphical multi-domain simulation and model based design for dynamic and embedded systems. MATLAB has an edge over the other softwares in terms of its ease of usability, students from background of engineering, science and economics can very well use it due to simple UI and compatibility with different languages like C, C++ etc. In 2004, nearly one million users were accounted for using MATLAB across industry and engineering colleges and this user count has rose abruptly from 1 million to 4 million in 2015 because of Robust & secure software , easy to learn and user UI and economical trial and paid packages of MATLAB. With the latest version 9.2 R2017a of MATLAB, MATLAB Builder products can deploy MATLAB functions as library files which can be used with .NET or JAVA application building environment.



II. SYSTEM CONFIGURATION

MATLAB is considered to be a heavy software which means it requires good system configuration on which it is to be operated. It requires 2GB space for itself on hard disk and 6-7GB for its installation files and 2GB of RAM and

with SIMULINK 4GB of RAM is required .MATLAB runs on 64 bit windows efficiently on Microsoft windows 2003 or later.

III. HARDWARE SUPPORT

MATLAB extends its support to the hardware by connecting with popular hardware like ARM, ARDUINO, RASPBERRY, ANDROID, XILINX, STMICROELECTRONICS. You can also live stream data to and from hardware and also generate C, HDL or PLC code from MATLAB and SIMULINK and run them on microprocessors.

IV. INTERFACE WITH OTHER LANGUAGES

MATLAB can call functions and subroutines written in the programming languages C or Fortran. A wrapper function is created allowing MATLAB data types to be passed and returned. The dynamically loadable object files created by compiling such functions are termed "MEX-files" (for MATLAB executable). Since 2014 increasing two-way interfacing with Python is being added. Libraries written in Perl, Java, ActiveX or .NET can be directly called from MATLAB but calling MATLAB from JAVA is bit

complicated and so is done with the help of package sold by MathWorks separately.

V. SIMULINK

Simulink which is developed by MathWorks, is a graphical programming environment for modeling, simulating and analyzing multi domain dynamic systems. Its primary interface is a graphical block diagramming tool and a customizable set of block libraries. So in order to analyze data easily, graphical look is the most preferred which is provided by SIMULINK. SIMULINK is tightly integrated with MATLAB environment and either can drive MATLAB or be scripted from it. Simulink is widely used in automatic control and digital signal processing for multi domain simulation and Model-Based Design. Like we have Simulink model of wind turbine below made from latest SIMULINK Vr.8.7. Also use of MATLAB & SIMULINK in preparing neural network training module.

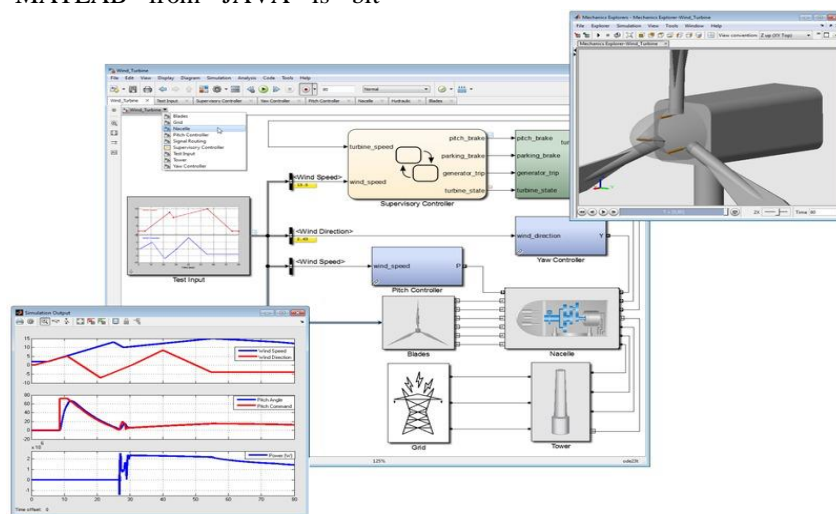


Figure 1

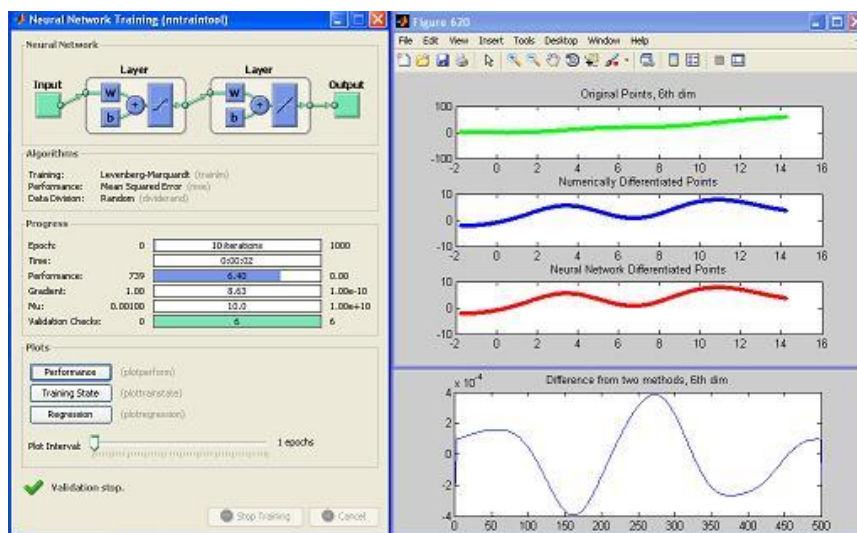


Figure 2

VI. APPLICATIONS

A. REAL TIME CHALLENGES

TRD (Toyota racing development) makes faster and more efficient engineering decisions on race tracks through MATLAB. Engineers of Toyota use MATLAB as workhouse for viewing, sharing and processing the data .So this is how MATLAB makes these three tasks easy for them while they are testing vehicles on track.

1) CHALLENGE

Access and analyze vast quantities of test data and make intelligent engineering decisions quickly.

2) SOLUTION

Use MathWorks tools to import the data, perform the analysis, visualize the data, and process the results.

3) RESULTS

- reduction in analysis time
- reusable analysis results
- successful performance on track

For different race track surfaces, should the car's suspension be changed for better responsiveness, or the shocks adjusted for better road feel? So to answer questions like these, which can mean the difference between first and second place on the race track, engineers must quickly interpret vast amounts of test data. Toyota Racing Development's (TRD's) Race Vehicle Engineering group uses MATLAB® to analyze and process test data for all of Toyota's racing initiatives, including the NASCAR Craftsman Truck series. So a Toyota personnel said this in regard of MATLAB Tool. "Everything that I want in an engineering package is there in MATLAB, and it's very accessible," says Skip Essma, senior race vehicle engineer at Toyota Racing Development. "MATLAB gives the best combination of ease of programming and access to powerful routines, techniques, and visualization tools."

B. IN MEDICAL FIELDS

With the technology based era MATLAB has its wide range application in medical field like Model-Based Design enables medical device engineers to introduce and integrate agile approaches into their existing software development workflows by cleanly separating the design phase from the implementation steps. Also with the recent advancement, wearable and apps are shaping the future of medication which use MATLAB to process , analyze and derive the proper results of patients disease. For instance - Motion analysis sensors and apps can precisely capture, measure, or record users' movements. These devices provide doctors, researchers, and patients with biometric data that would otherwise be difficult to collect, such as minute changes in a patient's breathing pattern, gait, and range of motion. So next Issue of analyzing the detected information is completed by developing smart algorithms for which MATLAB is most efficient. By developing smart algorithms, engineers and scientists can help doctors, researchers, and patients manage the large amount of biometric data generated by wearable devices. Smart algorithms make it possible for users to visualize their data and gain new insight into their, or their patient's health.

For example, engineers at iSonea developed acoustic respiratory monitoring algorithms in MATLAB® to help diagnose asthma in patients. Users breathe into the device, which analyzes the sound and detects wheeze patterns. MATLAB enables us to rapidly develop, debug, and test sound-processing algorithms, and MATLAB Coder simplifies the process of implementing those algorithms in C. There's no other environment or programming language that we could use to produce similar results in the same amount of time."



Figure 3

B. NUMERICAL COMPUTATION

MATLAB reduces numerical computational complexity because of ease of using simple variable and with easy commands all the desired numeric are performed easily. With arrays, loops, approximations and errors using MATLAB becomes very easy to perform numerical integration, differentiation, solve linear or non linear equations, regression and interpolation functions in MATLAB. So with MATLAB numerical methods to solve engineering problems are very easy and efficient in results.

Most simple syntax for addition of two matrices-

```
>>X=[1 2 ;3 4]
>>Y=[2 2;3 3]
>>X+Y
>>[3 4;6 7]
```

VII. CONCLUSION

With a very vast library and application in almost every aspect whether its engineering, medical, automation, science MATLAB proves to be efficient and responsive, so MATLAB should be a must learning language in engineering curriculum with students learning its wide application and developing something more innovative by using its library, SIMULINK and offered packages.

VIII. REFERENCES

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Ketan Sharma is pursuing bachelor's degree in Electronics and Communication from CCET[Affiliated to PU (Panjab University)], Chandigarh, India. His area of expertise is Nano - Electronics and Simulation in MATLAB. Currently, he is Joint-Secretary of Student Council, CCET with an aim of improvise students subjective curriculum and their practical learning skills.