
A REVIEW ON USING MATLAB AS TUTORIAL SOFTWARE FOR IMPROVING STUDENTS' PERFORMANCE IN ENGINEERING MATHEMATICS

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Abstract-

MATrix LABoratory (MATLAB) is programming software becoming most popular choice for numerical analysis in many fields including engineering, statistics, economics, artificial intelligence and many more. Mathematics and physics courses are accepted as a fundamental groundwork for the study of engineering, and often are prerequisite courses for the basic engineering curriculum. There are numerous difficulties a teacher has to face to cultivate students attention and practical spirit to Engineering Mathematics. Matlab Software provides many mathematical functions, various graph plotting options and can be easily used for solving Matrix, Integration, Derivative, differential equations, Taylor's Maclaurin series and many more. This gives rise to have a Matlab as most effective Content Delivery Tool for engineering mathematics. Many colleges have already started teaching Matlab as foundation course. Using such a kind of effective demonstration of mathematics problems, students can take more interest and will pay more attention in studying engineering applied mathematics. This paper discusses the importance of Mathematics in Engineering courses. Further it gives a brief review on effects of using Matlab in Engineering Mathematic and also discusses few demonstrating problems in Engineering Mathematics.

Keywords- Matlab, Engineering Mathematics, Numerical Analysis, Students' Performance

-----INTRODUCTION -

A complete software package MATLAB and Simulink are effectively used for technical computing in educational institutes and industry both. A Student Version of MATLAB & Simulink avail all of the features of professional MATLAB, without any limitations, and also gives the full functionality of professional Simulink [1]. The Student Version gives an immediate access to high-performance numerical computing, modeling, and simulation power. Unlike other lower-level programming language such as C, C++, or FORTRAN; MATLAB allows to mainly focus on course work and applications rather than on tedious programming details. It provides huge set of library functions to solve many numerical problems in a fraction of the time.

MATLAB helps to better understand and apply concepts in various applications ranging from engineering and mathematics to chemistry, biology, and economics. Simulink is an interactive tool for modeling, simulating, and analyzing dynamic systems, including controls, signal processing, communications, and other complex systems [2]. The Symbolic Math Toolbox, also included with the Student Version, is based on the Maple 8 symbolic math engine and lets you perform symbolic computations and variable-precision arithmetic.

Engineering mathematics is a branch of applied mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Engineering mathematics consisted mostly of applied analysis, most notably: differential equations; real and complex analysis (including vector and tensor analysis); approximation theory; Fourier analysis; potential theory; as well as linear algebra and applied probability, outside of analysis [3]. These areas of mathematics were intimately tied to the development of Newtonian physics, and the mathematical physics of that period.

Mathematics and physics courses are accepted as a fundamental groundwork for the study of engineering, and often are prerequisite courses for the basic engineering curriculum. In a recent article in the New York Times,

Christopher Drew talks about “Why Science Majors Change Their Minds”. This article has covered students mindset towards theoretical study limited to academic examinations. Writer has clearly specified the reason of poor impact of theoretical study like Engineering Mathematics is due to lack of practical exposure. This be a sign of large number of students scoring lower grades in theoretical study primarily be deficient in of grasping those concepts. One of the important subject of Engineering is Applied Mathematics, students usually evade to learn in an outsized faction. Many researchers have surveyed on this issue signifying the need of practical approach for teaching Engineering Mathematics [4-7]. Various assessments were designed and carried out by numerous researchers to realize a scrupulous part of intricacy in learning engineering mathematics [8]. This paper illustrates many exercises of Matlab Programming through the use of computer means to optimize the teaching effect, strengthening the students' mathematical theory for understanding and improving theoretical concepts.

REVIEW ON MATLAB EFFECTS FOR ENGINEERING MATHEMATICS -

This section describes the mixture of existing approaches compared in this paper to uncover the difficulties of training students to Engineering Mathematics problems.

A performance of prerequisite courses like Physics and Mathematics on engineering courses is analyzed in [9]. According to the authors study; it is found that these subjects affect in large context and have significant relationship with engineering courses. They made analysis through which a minimum grade requirement is suggested to be imposed for these subjects so that students can easily get into further engineering courses. By conducting brief information investigation it was observed that students who earned high grades in these prerequisite courses also received higher grades in the subsequent courses.

Pure mathematics however accepted to be the source of core knowledge used in the field of applied mathematics and many. Applied mathematics is closely related to other mathematical sciences including Scientific computing, Computer science, Operations research and management science, Statistics, Actuarial science, Mathematical economics and Other disciplines [10]. Being applied, it raises some of the issues addressed in the philosophy of science. The advent of the computer has enabled new applications: studying and using the new computer technology itself (computer science) to study problems arising in other areas of science as well as the mathematics of computation; for example, theoretical computer science, computer algebra, numerical analysis.

In depth issues of transfer of mathematics to engineering, motivation, and retention is addressed by [11]. Wherein; authors discussed the laboratory design experiences for the course

covering engineering applications to algebra, linear algebra, trigonometry, sinusoids, differentiation, and integration. Pre and post attitude survey were carried out with various lab work comprising trigonometry lab, linear algebra lab, calculus (differentiation and integration) labs, and Matlab.

An individual who are recognized in mathematics are more likely to choose engineering careers [12]. The authors work reiterates the importance of mathematics to engineering career choices and furthers the discussion by looking beyond mathematics grades to ascertaining the importance of mathematics identity. Observations by authors draw a conclusion that self-perceptions of students' mathematics interest, mathematics performance, and mathematics recognition are significant predictors of the choice of an engineering career.

An entry test defined for new students in [13], will enable students profiling according to the ability of individual in mathematics, and would direct the instructors to endow with necessary remedial actions for the respective students. These authors have used Rasch measurement model to gauge the students' capability against the engineering mathematics.

The authors of paper [14], discussed the Matlab as teaching and learning aid for mathematics students. Various assignments in a small group of students has been carried out by the authors. As a result they analyzed that, use of Matlab enhances conceptual understanding of students in mathematics and improve their performance. These authors have designed fantastic learning activities for mathematics through Matlab programming.

Martin Grehana et. al. [15] did exercises on two groups possessing identical mathematical background at entry level to graduation. These researchers concluded with major causes following the different critical events in mathematical education, and the main categories of influence on student behaviour which emerged from the interview data were fear, social factors, and motivation.

DEMONSTRATING FEW ENGINEERING MATHEMATICS PROBLEM THROUGH MATLAB

This section of paper provides practical exposure on Matlab for Engineering Mathematics. Few important examples are discussed with its solution in Matlab. Demonstrated; how to write matrix and other equations in Matlab. Each solution is tested on standard Matlab Toolkit.

% How to write Matrix

B=[1:1:4; 2:1:5; 3:1:6]

B =

1	2	3	4
2	3	4	5
3	4	5	6

% Use of line Space

>> linspace (2, 9, 5)

ans =

2	3.75	5.5	7.25	9
---	------	-----	------	---

>> linspace (2, 9, 3)

ans =

2	5.5	9
---	-----	---

```
>> C = [ linspace(2, 9, 3) ; linspace(3, 9, 3); linspace(4, 8, 3)]
```

```
C =
```

2	5.5	9
3	6	9
4	6	8

```
% Use of zeros, ones, eye and rand
```

```
>> zeros (2, 3)
```

```
ans =
```

0	0	0
0	0	0

```
>> ones (3, 5)
```

```
ans =
```

1	1	1	1	1
1	1	1	1	1
1	1	1	1	1

```
>> eye(4)
```

```
ans =
```

1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

```
% difference between rand and randn
```

```
% randn gives random value in between -3 and 3
```

```
>> randn (3, 4)
```

```
ans =
```

2.76943702988488	0.725404224946106	-0.204966058299775
1.40903448980048		
-1.34988694015652	-0.0630548731896562	-0.124144348216312
1.41719241342961		
3.03492346633185	0.714742903826096	1.48969760778546
0.671497133608081		

```
% rand gives random value in between 0 and1
```

```
>> rand(3, 4)
```

```
ans =
```

0.0357116785741896	0.678735154857773	0.392227019534168
0.706046088019609		
0.849129305868777	0.757740130578333	0.655477890177557
0.0318328463774207		
0.933993247757551	0.743132468124916	0.171186687811562
0.27692298496089		

```
>> rand(3, 4)
ans =
    0.0357116785741896    0.678735154857773    0.392227019534168
    0.706046088019609
    0.849129305868777    0.757740130578333    0.655477890177557
    0.0318328463774207
    0.933993247757551    0.743132468124916    0.171186687811562
    0.27692298496089

% some operations on Matrix
% Matrix A
>> A=[1 2 3; 3 4 5 ; 6:1:8]
A =
     1     2     3
     3     4     5
     6     7     8

% min use to find min value and max use for finding maximum value in Matrix form each column
>> min( A )
ans =
     1     2     3
>> max (A)
ans =
     6     7     8
>> B = [3 4 5; 5 1 4; 6 5 2]
B =
     3     4     5
     5     1     4
     6     5     2
>> min ( B )
ans =
     3     1     2
>> max ( B )
ans =
     6     5     5

% Mean use to find mean value of each column
>> Median (A)
ans =
     3     4     5

% Median use to find median value of each column
>> Median( A )
ans =
     3     4     5
```

```
% std use to find standard deviation i.e.  $\sigma^2$  of each column of Matrix
% var use to find variance deviation i.e.  $\sigma$  of each column of Matrix
>> std ( A )
ans =
    2.51661147842358    2.51661147842358    2.51661147842358
>> var ( A )
ans =
    6.33333333333333    6.33333333333333    6.33333333333333
```

CONCLUSION -

From discussion in section 2, it is surveyed that Mathematics plays vital prerequisite for adoption to numerous engineering courses and for excelling students' performance in same. Many researchers have given experimental results that validate students who are skilled in mathematics would likely to get higher grades in subsequent engineering courses. The biggest issue to gain spirit and attention of engineering students to applied mathematics is addressed. Discussion upon which indicates the need of practical approach for teaching applied mathematics. Here also discussed few problems solution through Matlab Software for better understanding the in depth concepts of mathematics. Through this paper it is suggested to include Lab Based Tutorials for enhancing students' performance in engineering Mathematics.

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