User Guide

COSMATT™

Compro's Online Servo Motor Analysis & Training Tool

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COSMATT - User Guide

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Getting started with COSMATT

1. About

Compro's **O**nline **S**ervo **M**otor **A**nalysis & **T**raining **T**ool (COSMATT), is a digital-first, servo-sizing e-Learning course with advanced analytical content. It explains how servo systems work and how to select and optimise electric servo system components.

2. Who is this Course for?

If you are involved in ***Servo System Sizing*** this course is a must for you. The course can also be taken by enthusiasts, professionals or anybody interested in learning about Servo Systems and their sizing.

Prerequisites

The course assumes that the reader is familiar with the basic concepts of high school level mathematics and basic engineering. These include the concepts of Motion Equations, Electrical Quantities, Force, Mass, RMS Calculations, etc. However, we do have a chapter in the Course to brush-up your knowledge of basic Fundamental topics. This chapter helps in providing a primer on the topics that are needed for this course.

3. Version

Version - 1.0.0

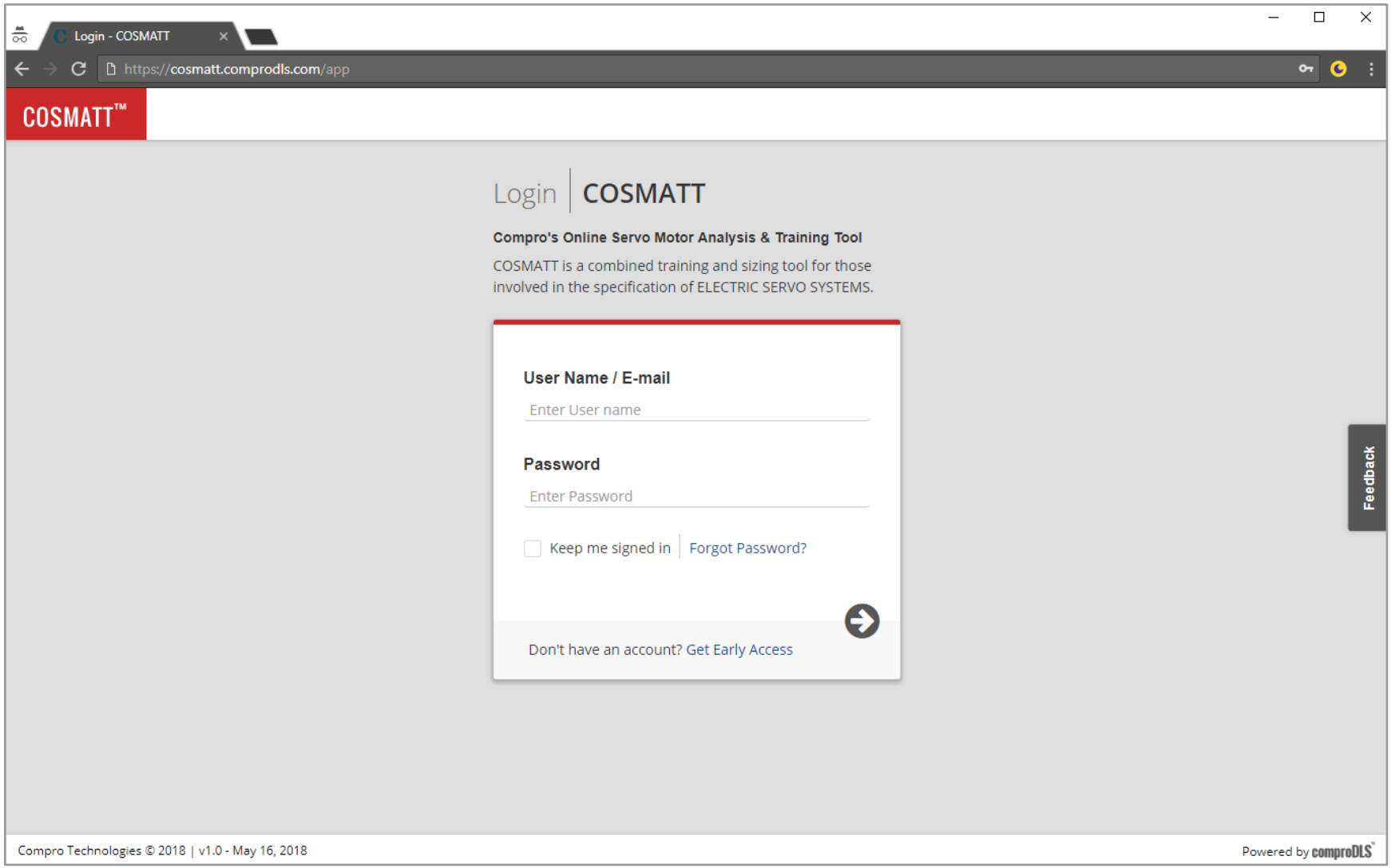
4. System Requirements

Browser Support	• Google Chrome (version 66 and above) • Mozilla Firefox (version 60 and above) • Microsoft Edge (version 20)

	• Microsoft Internet Explorer 11 • Apple Safari (version 11.0.1 and above)
Device Support	Desktops and Laptops * Tablet and Mobile devices are currently not fully supported in version 1.0.0.
Resolution Support	Minimum resolution supported is 1024x768
Operating System	Windows 7+ and Mac OS X 10+

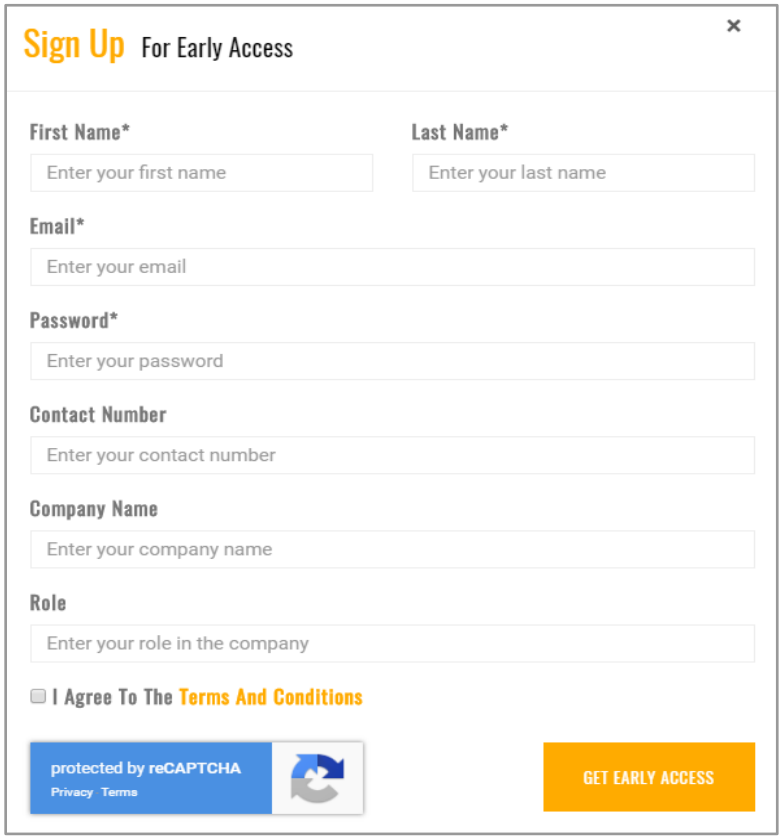
Getting Access

COSMATT URL - https://cosmatt.comprodls.com/app



Signing Up

COSMATT is currently available only to our select Corporate partners. Check with your IT Department if they have access or write to us at cosmatt@comprotechnologies.com and we will be happy to check it for you.
Need early access? Click on “Don’t have an account? Get Early Access” link on the login page, fill in your basic contact info and we will get in touch to sign you up.



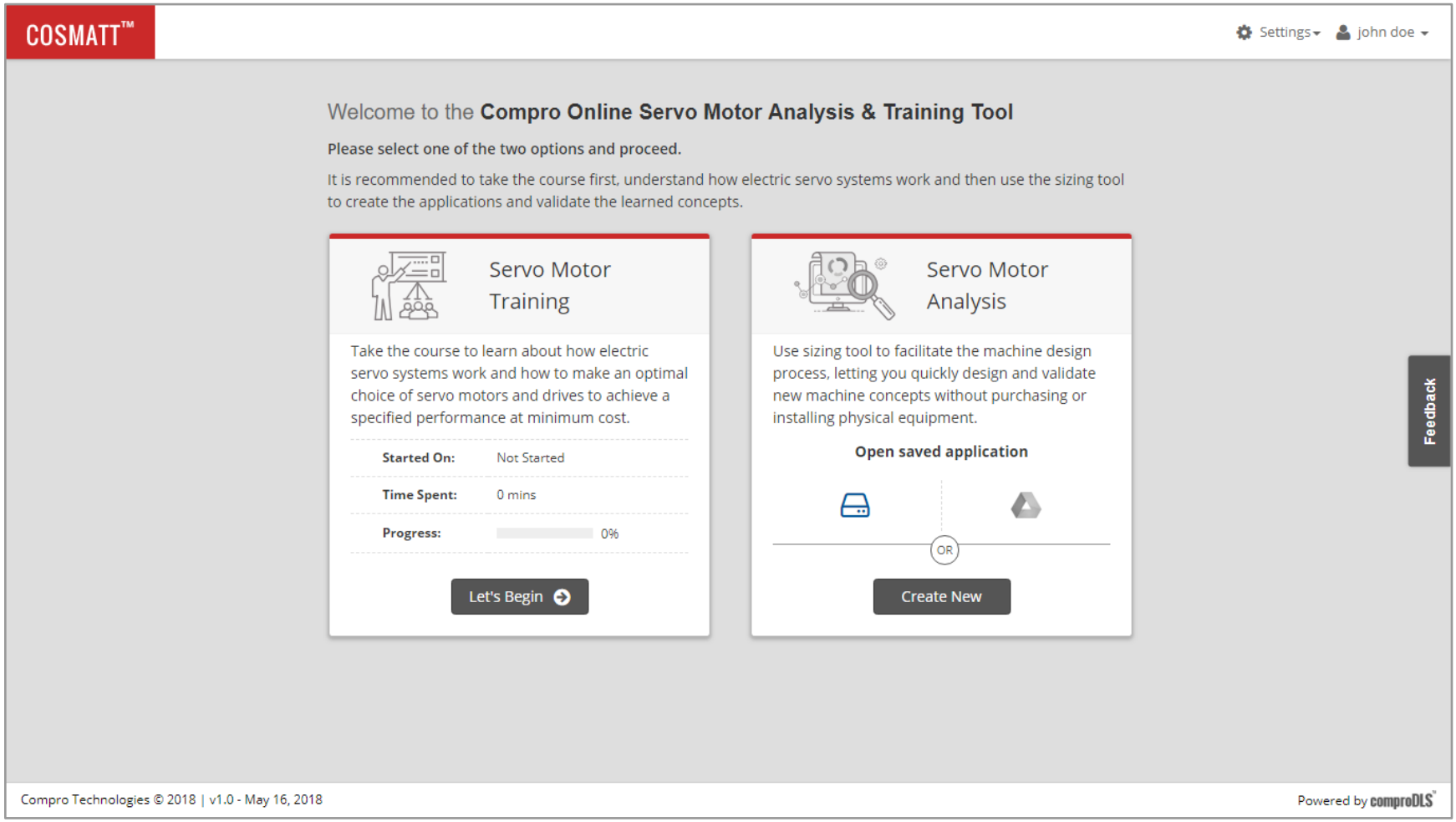
Logging In

In case you already have access, enter your username and password and click to log into COSMATT.

Starting with the Course

Once you Login, you will land on COSMATT home page

Home Page

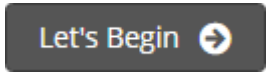


COSMATT as a tool consists of two parts, *Servo Motor Training* and *Servo Motor Analysis.*

Servo Motor Training is a course that trains you on servo motor concepts and once you have understood the concepts, you can use the *Servo Motor Analysis* tool to facilitate machine design.

Once you have logged in, the Home page gives a brief introduction of the two parts along with some relevant data. You can choose from the two options to get started.

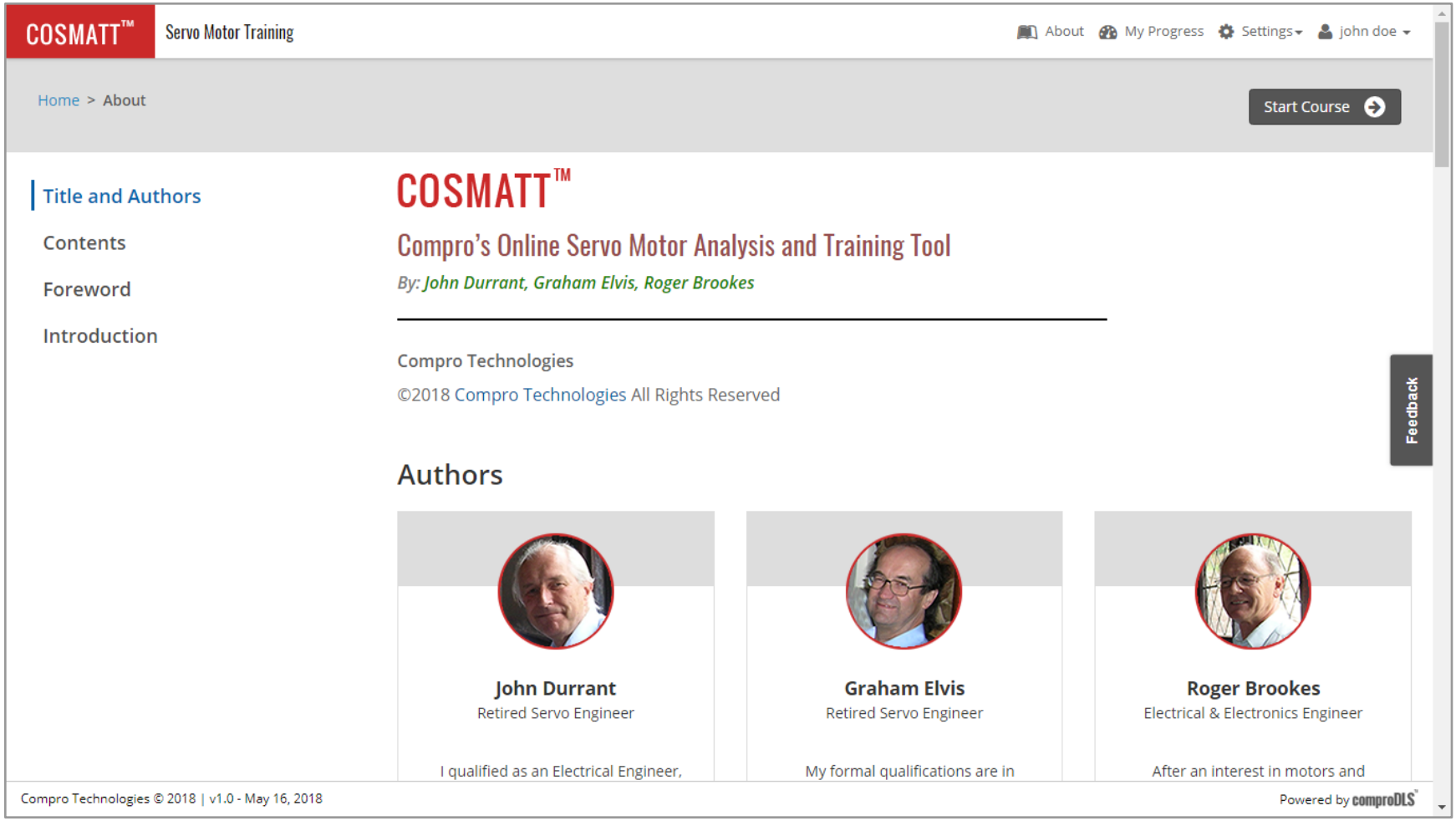
It is recommended to take the course first, understand how electric servo systems work and then use the sizing tool to create the applications and validate the learned concepts.

Click on the 

to start the course.

About page

“About” page introduces the course - Authors, Content, Foreword, Introduction and the learning objectives of the course.



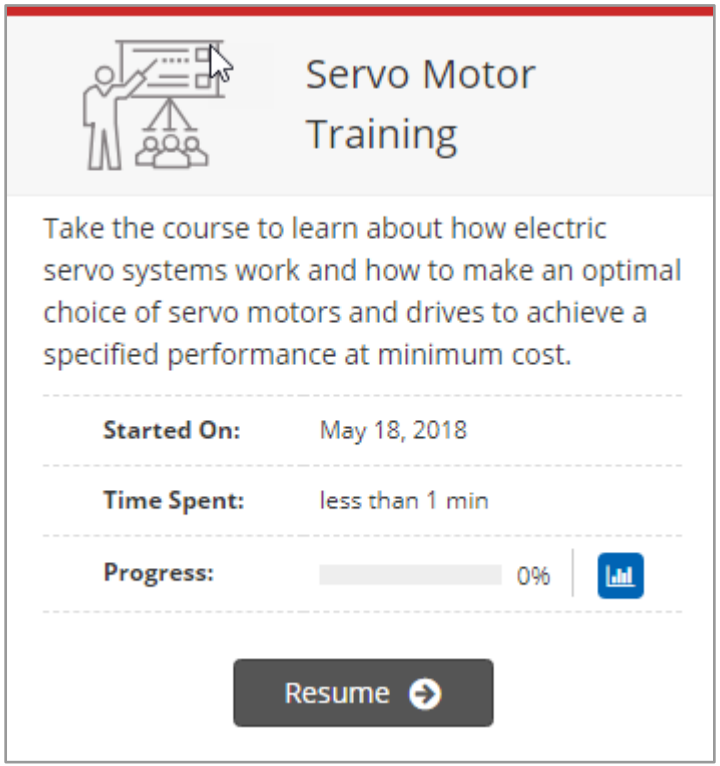
Click on “Start Course” button to start the course.

Already Started? - Resume where you left off

COSMATT saves your last visited course topic and when you return, it resumes from that point.

In the Serve Motor Training section, a summary of your engagement with the course is provided along with a link to detailed analytics.

You can click on Resume button to continue reading from where you left off.



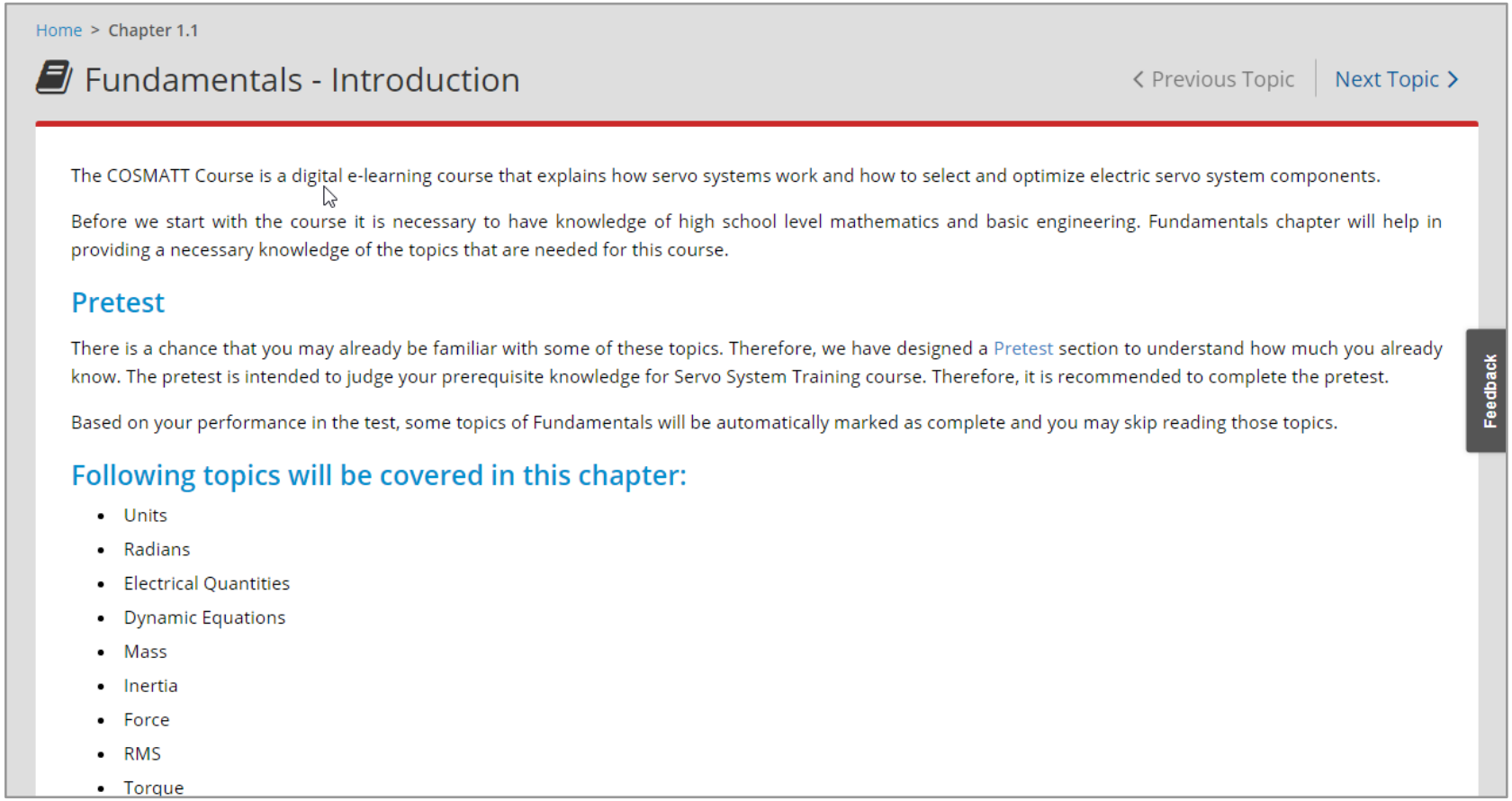
Servo Motor Training Course Reading Page

The courseware reading page is divided into two main parts,

1. Table of Contents - Left pane of the reading page, which allows navigation between course topics.

Use the icon to open the Table of Contents pane and or icon to close this pane. Clicking on the arrowhead icon beside every topic expands the topic to display the associated sub topics.

2. Content Viewer - Main area which displays the content of the topic selected in the Table of Contents pane.



How to go about the Course

Course Structure

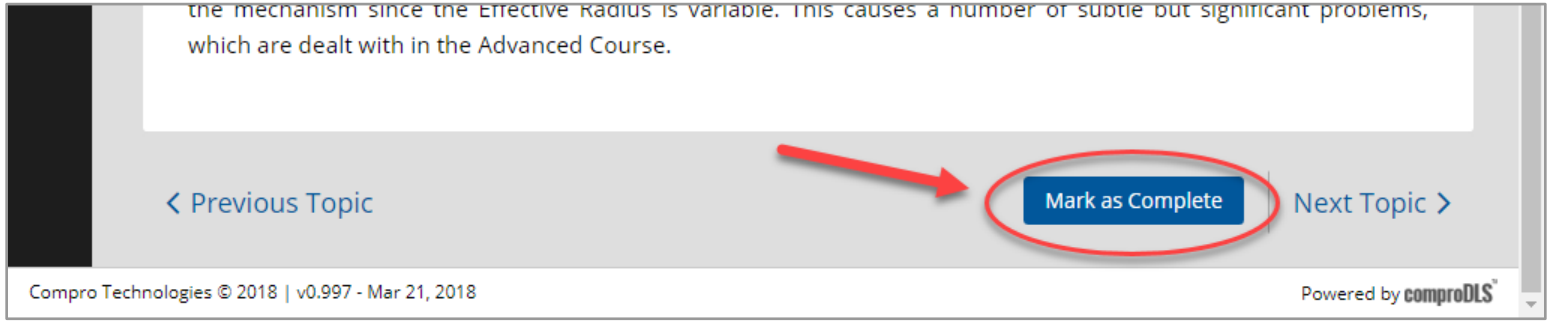
Servo Motor Training course has a hierarchical learning path with 8 Chapters. Each chapter is subdivided into topics. You can review the Chapters and associated topics in the “Table of Contents” pane.

Navigate Between Topics

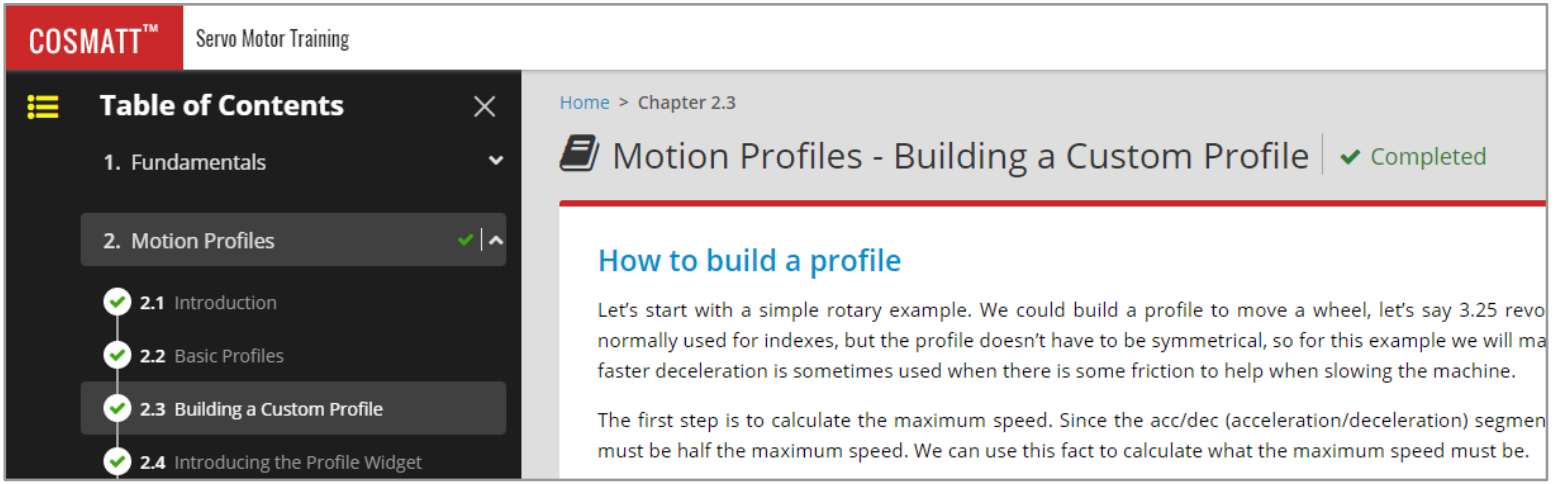
Clicking a topic in the Table of Contents pane, will select that topic. Contents of the selected topic will be displayed in the Content Viewer. In addition to the Table of Content pane, you can sequentially navigate the among the course topics by using < Previous Topic and Next Topic > buttons at the bottom of the Content Viewer.

Mark A Topic As Complete

Once you have read through a topic and want to mark a topic as done, you can click on the “Mark as Complete” button at the bottom right of the Content Viewer.



This will mark that topic as done for your future reference. Once a topic is marked as complete, a green tick will appear against that topic in the header and in Table of Contents.



Track Status of Each Topics

Each topic inside the TOC has a state associated with it. These are -

1. Unvisited - This signifies that the topic marked has not been visited yet. It is represented by a hollow circle.

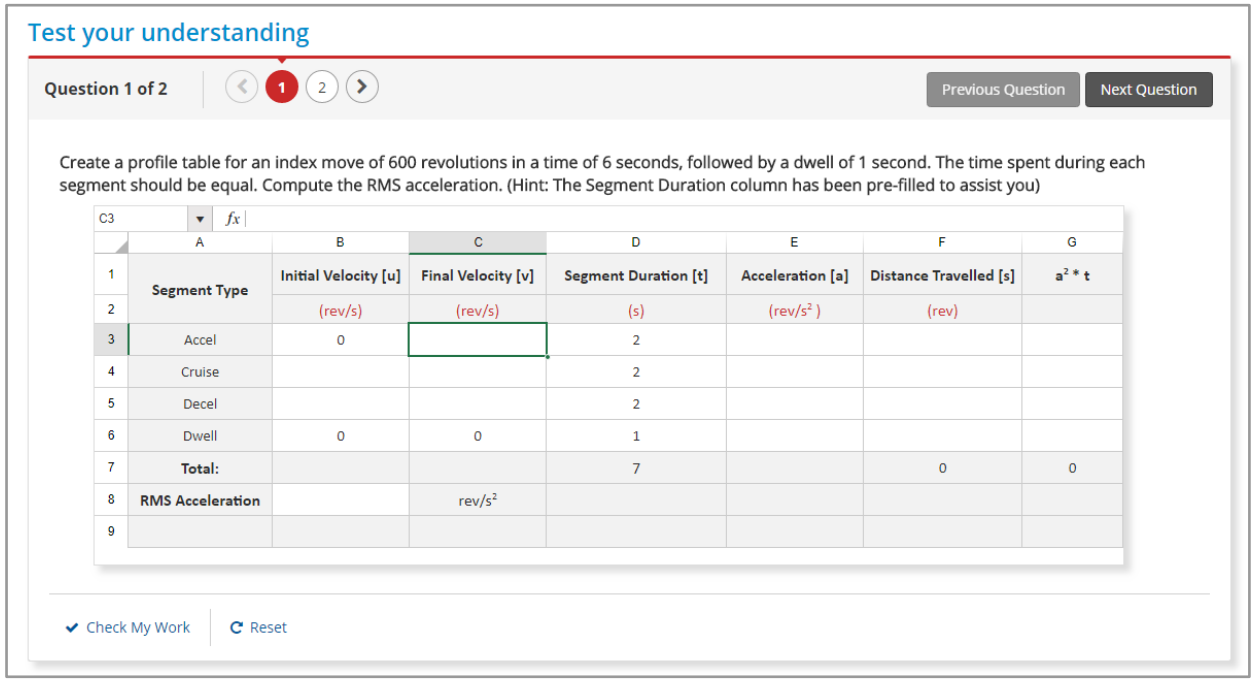
2. Visited - This signifies that the topic marked has been visited by the user. It is represented by a filled circle.

3. Completed - This signifies that the topic marked has been completed by the user. It is represented by a big filled circle containing a tick-mark.

Work on an Assignment

Test Your Understanding

Each topic is provided with textual content and a set of practice questions (*"Test Your Understanding")* at the end of the topic, which helps in testing your knowledge of the material. It is recommended to attempt all the practice questions so that the concepts learned in the material are firmly grasped.



Navigating between Questions

You can navigate between the questions through "Next Question" and "Previous Question" buttons or through the carousel located at the top of assessment widget.

Check My Work

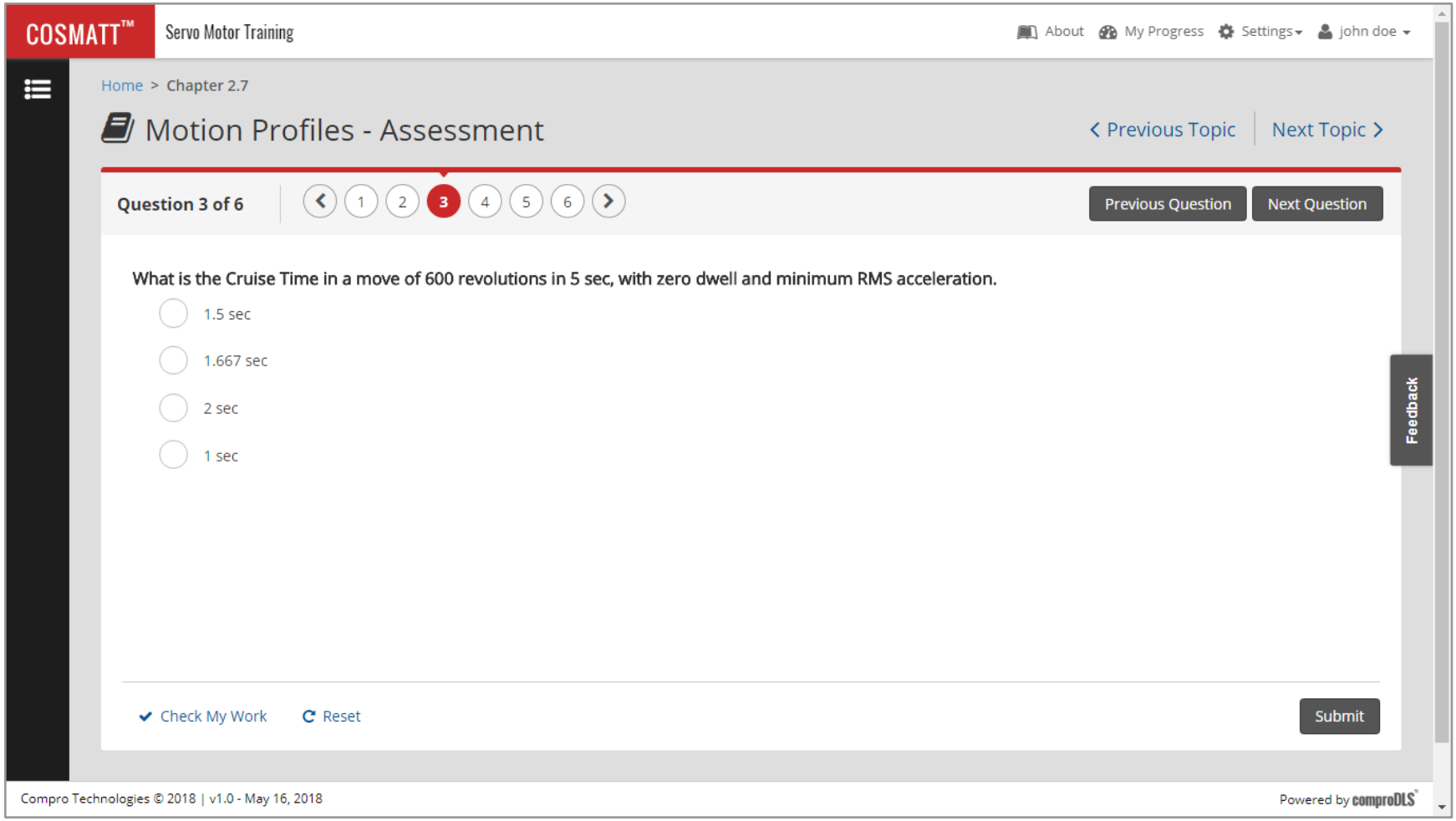
Clicking *"Check My Work"* will help you to check your current question. It also highlights the correct and incorrect entries with a hint / correct value for incorrect entries.

Reset

Clicking *"Reset"* will help you to reset your question to the initial state.

End of Chapter Assessment

A summative Assessment, with a set of questions, is provided at the end of each chapter, to assess your knowledge and understanding of the chapter.



Submitting an Assessment

Clicking *"Submit"* button will submit your assessment. An Assessment can only be submitted once, therefore, it is recommended to take the assessment only after a thorough understanding of the full chapter.

Interactives

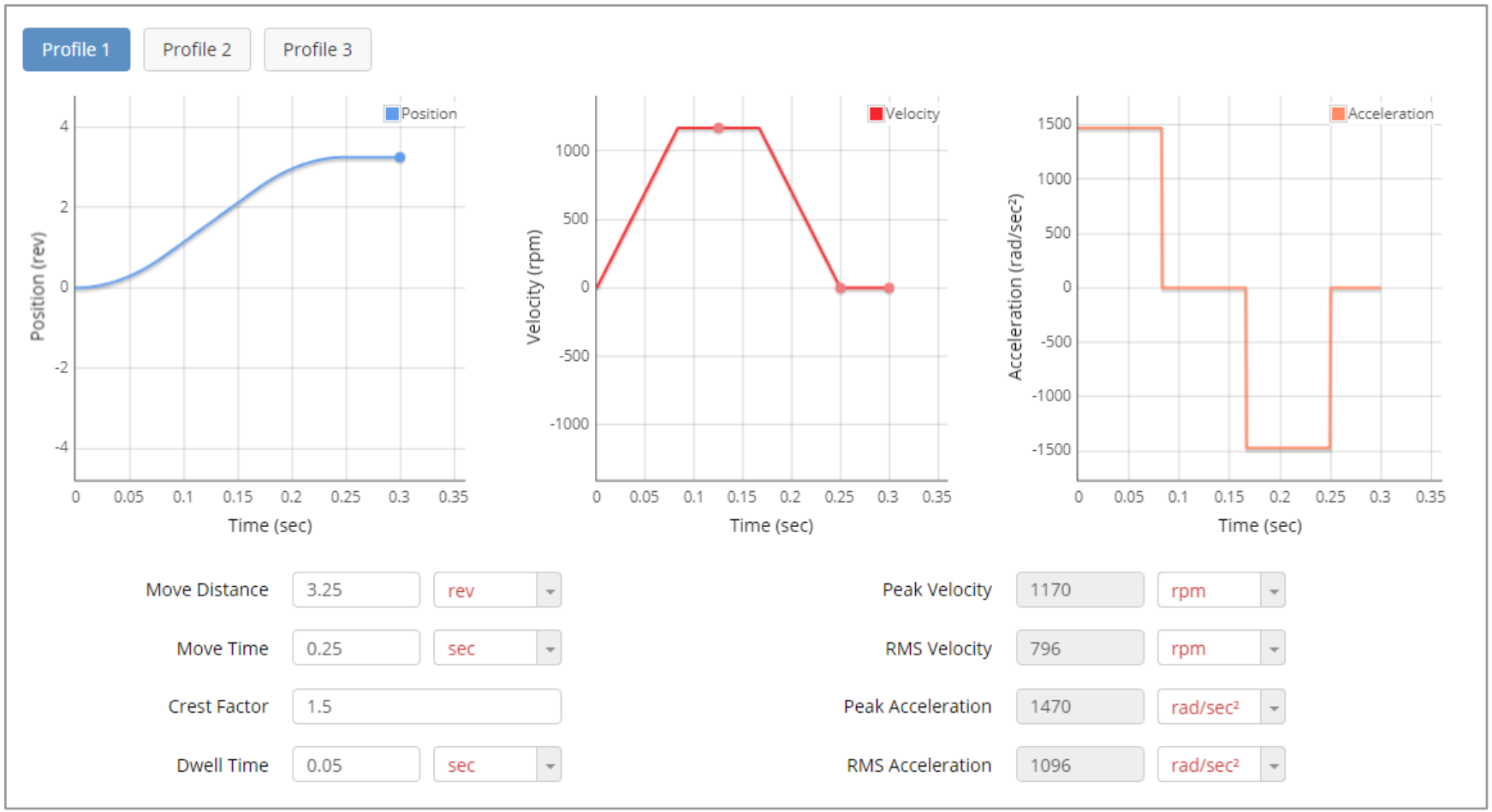
COSMATT supports a host of interactives / widgets embedded within the content for an immersive experience.

Using COSMATT widgets, you can tweak the input parameters to get the desired results with the widget helping you in the calculations and guiding you to understand the advanced concepts.

The different widgets included in COSMATT are:

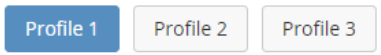
Profile Editor widget

The Profile Editor widget is a tool that helps in building motion profiles in response to given move requirements. This widget is introduced in Chapter 2, Section 2.4 - *Introducing the Profile* Widget.



Predefined Profiles

Use the three buttons available at the top of the widget to choose from “ready to use” Motion Profiles.



Profile 1 is a “1/3, 1/3, 1/3” Trapezoidal profile
Profile 2 is a Triangular move profile

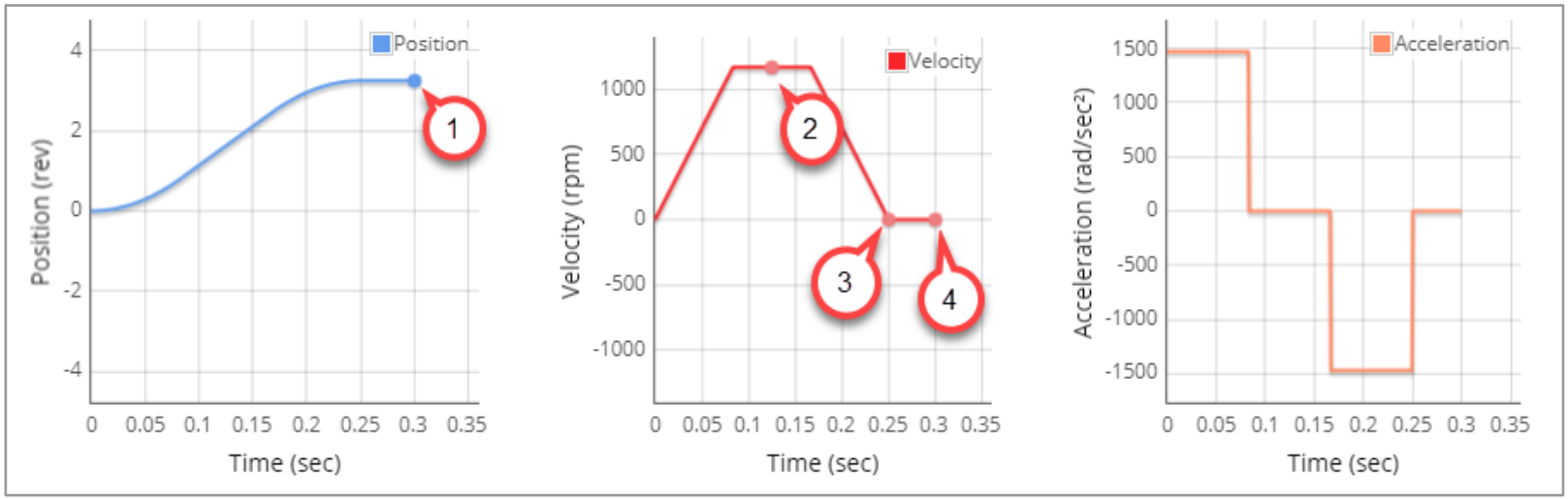
Profile 3 shows an instantaneous acceleration / deceleration profile

Profile Graphs

Profile Graphs provides a graphical representation of the motion profile in response to the input parameters provided. It shows 3 types of graphs, namely -

a. Position vs. Time
b. Velocity vs. Time
c. Acceleration vs. Time

Profile Graphs are interactive. You can adjust the move requirements by dragging / adjusting the the *drag-points* available on the graphs.



- Use position drag-point (Labelled as 1) to change the value of Move Distance
- Use Crest Factor drag-point (Labelled as 2*)* to change the value of Crest Factor
- Use Move time drag-point (Labelled as 3*)* to change the value of Move Time
- Use Dwell drag-point (Labelled as 4*)* to change the value of Dwell Time

Move Requirements

Enter your move requirements in the bottom-left portion of the widget. The input fields define -

a. Move Distance - Total distance for the motion profile
b. Move Time - Total time for the motion profile
c. Crest Factor - The ratio of the peak to average velocity (analogous to the Crest Factor of an electrical waveform = Peak/rms)
d. Dwell Time - Total dwell time, if any, for the motion profile before the motion profile repeats.

By changing the input values, you can see instantaneous changes in the “Profile Graph”

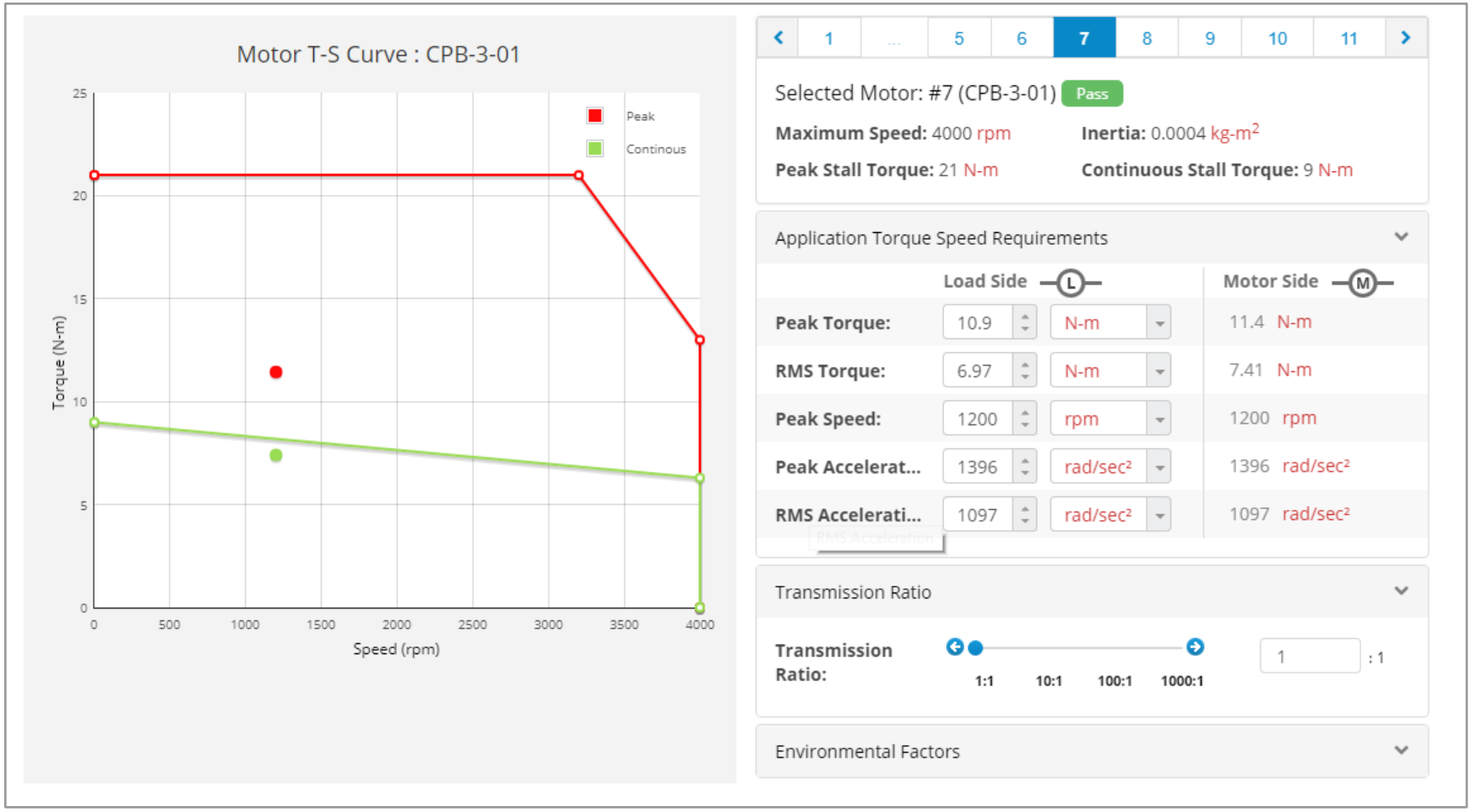
Output Parameters

The bottom-right portion of the widget presents the calculated output of Motion Profile widget. These are non-editable entities.

a. Peak Velocity - Highest velocity obtained by the profile
b. RMS Velocity - RMS velocity calculated from the profile
c. Peak Acceleration - Highest acceleration obtained by the profile
d. RMS Acceleration - RMS acceleration calculated from the profile

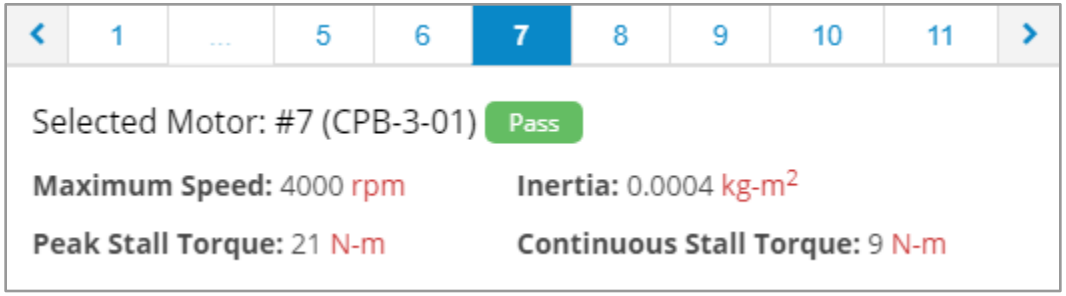
T-S Curve Widget

Torque-Speed Curve Widget allows checking of application torque-speed requirements against a motor’s capability via the Torque-Speed curve of the motor. The widget is introduced in *Chapter 4, Section 4.5 - Introducing the T-S Widget*.



Motor Selection

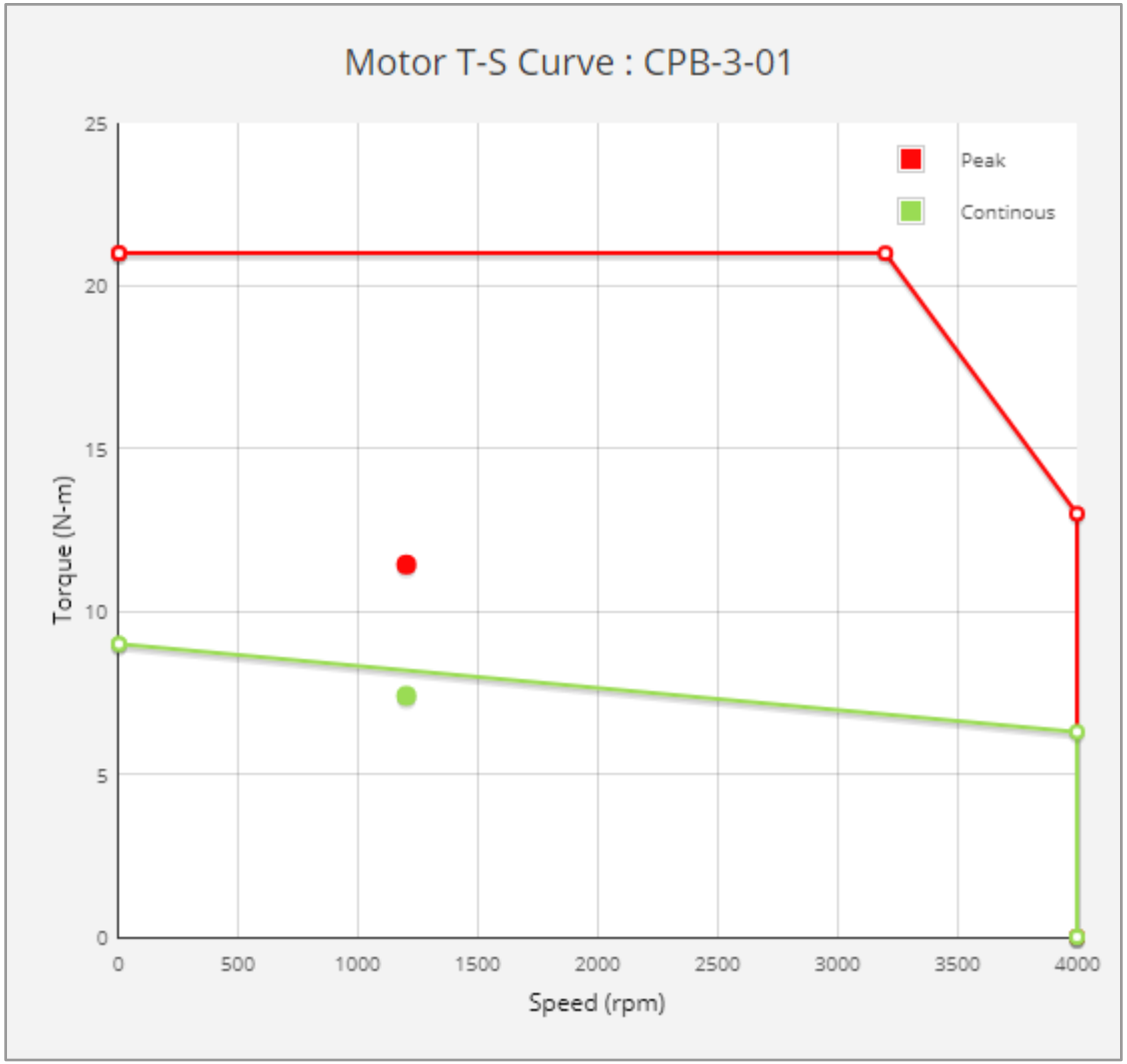
Use the carousel available at the top of the widget to select a motor from a range of sample Compro motors. This section also displays the specifications of the selected motor.



Motor Status (Pass / Fail) is displayed alongside the selected motor number. “Pass” represents that the selected motor is suited to the given application requirements, whereas the “Fail” represents that the selected motor is not suitable for the given application requirements.

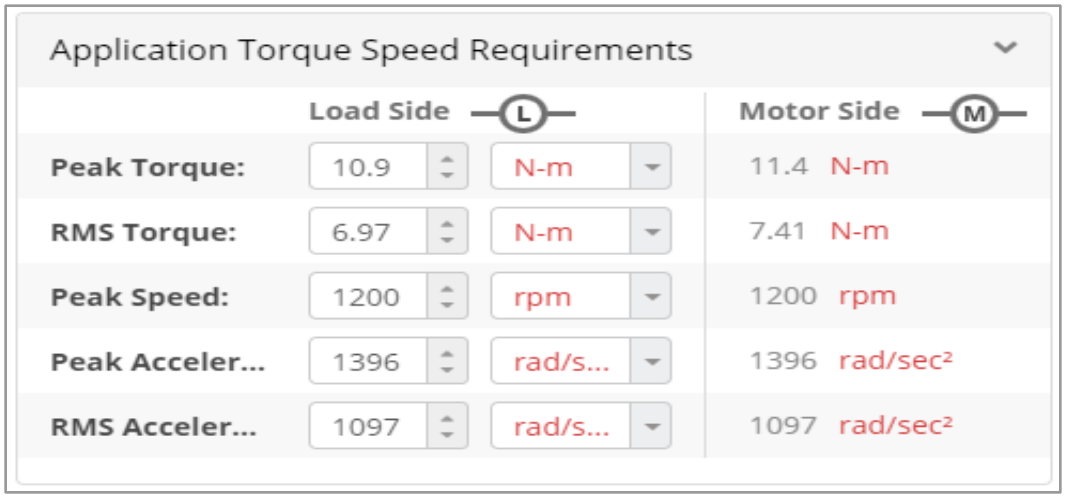
Motor TS Curve

Motor TS curve is populated for the selected motor in the left portion of the widget.


Motor T-S Curve : CPB-3-01
Peak
Continous
Torque (N-m)
Speed (rpm)
0
5
10
15
20
25
0
500
1000
1500
2000
2500
3000
3500
4000

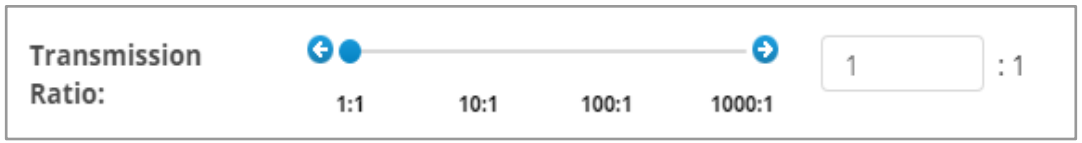
Application Torque-Speed Requirements

The requirements section is divided into two parts, Load Side and Motor Side. Load side parameters are the application requirements based on the move profile and load. The Motor side parameters are the requirement as seen by the motor (which includes the motor inertia).



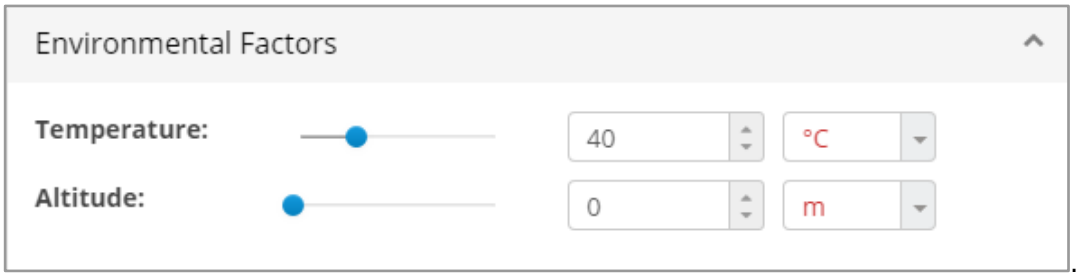
Transmission Ratio

You can see the impact of transmission ratio on application requirements by changing its value using the Transmission Ratio slider. The transmission slider works on a logarithmic scale. The slider has has a range from 1 to 100. For each step the ratio is 1.071519305 raised to the power x, where x is the scroll bar value, hence 1.071519305^{100} gives a ratio of 1000. The scroll bar steps in values of 10 if you click within the bar, and values of 1 using the arrows at the end..



Environmental Factors

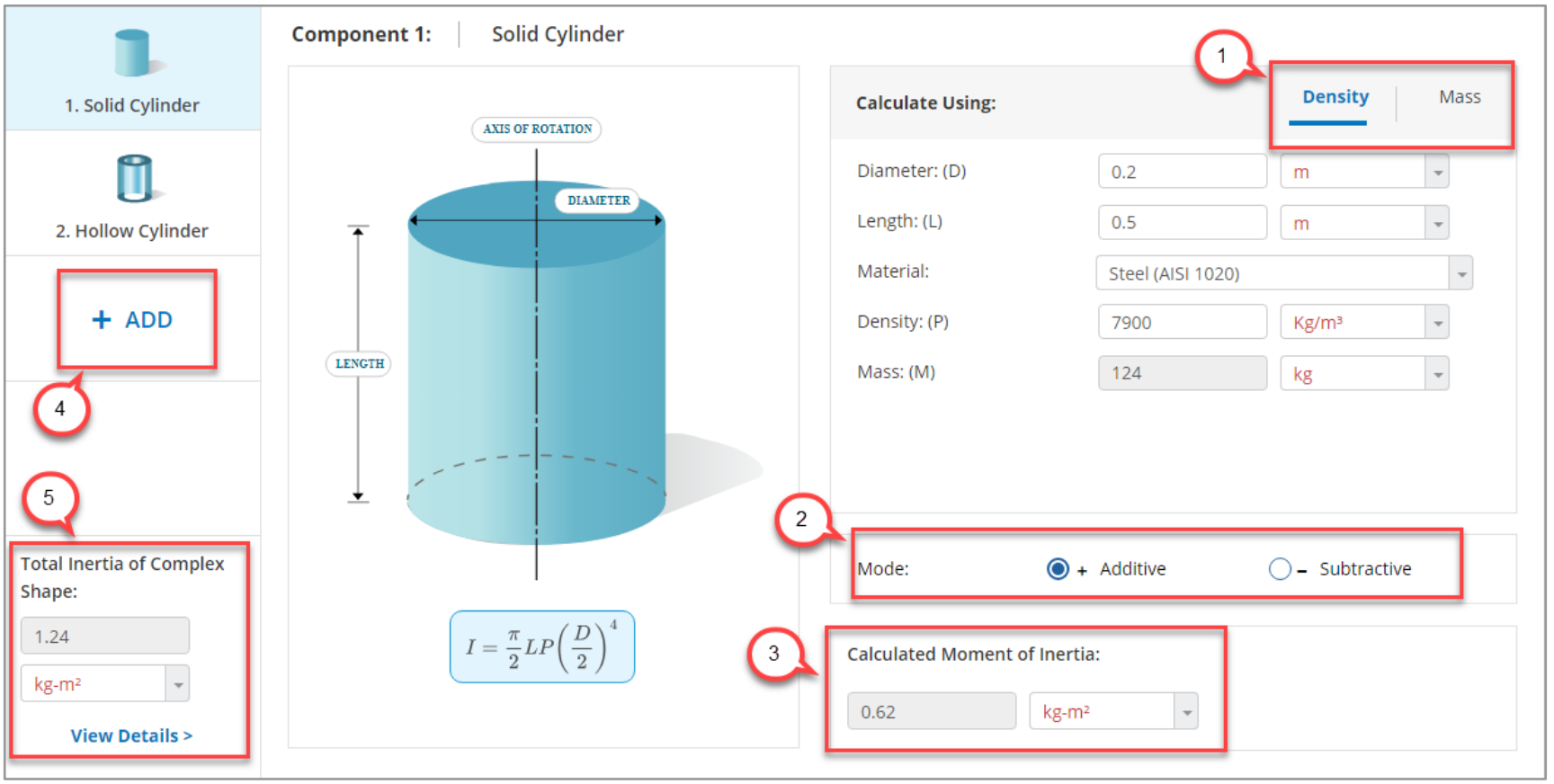
This allows you to tweak Ambient Temperature and Altitude. The Environmental Factors pane is collapsed by default. Click icon to expand the Environmental Factors pane:



Inertia Calculator Widget

Load inertia associated with the motor can be difficult to calculate, especially if the shape is complex and a lot of calculations are involved. To deal with this problem, an interactive Inertia Calculator Widget is available in COSMATT that provides the inertia of individual components as well as the total inertia of the shape.

This widget is introduced in Chapter 3, Section 3.3 Inertia Calculator. Inertia Calculator Widget is depicted in the figure below -



Calculating Inertia

You can calculate the Inertia of a component either by Density or Mass of the component. Select the type - Mass or Density (Labelled as 1) - that you would like to use to calculate inertia. Enter values of the following parameters to calculate the associated inertia:

- **Diameter (D)** - This is the diameter of the cylinder. When calculating inertia for a hollow cylinder, you also need to enter inner and outer diameter as defined in the Element Image window
- **Length (L)** - This is the length of the cylinder. This parameter is not required when calculating based on mass.

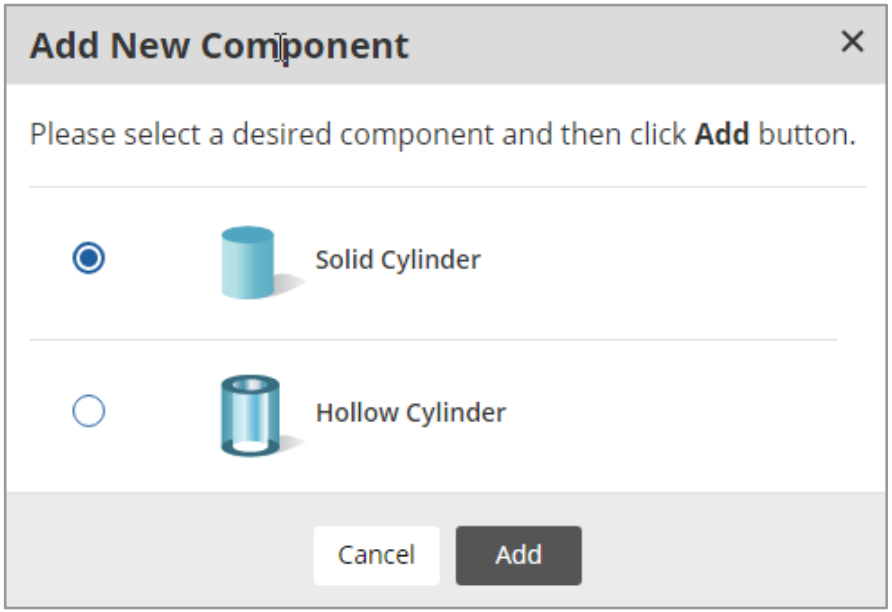
- **Material** - Choose the material of the cylinder from the pull-down menu. If Other is selected as the material type, the density value also needs to be entered. This parameter is not required when calculating based on mass.
- **Density (P)** - When the cylinder material is not available in the Material pull-down menu, the density value must be entered here. This parameter is not required when calculating based on mass or when the material is selected from the pull-down menu.
- **Mass** - This is the cylinder mass. This parameter is not required when calculating based on density.

Inertia of Selected Component

Moment of Inertia of selected component is displayed at the bottom of the widget (Labelled as 3)

Adding A Shape

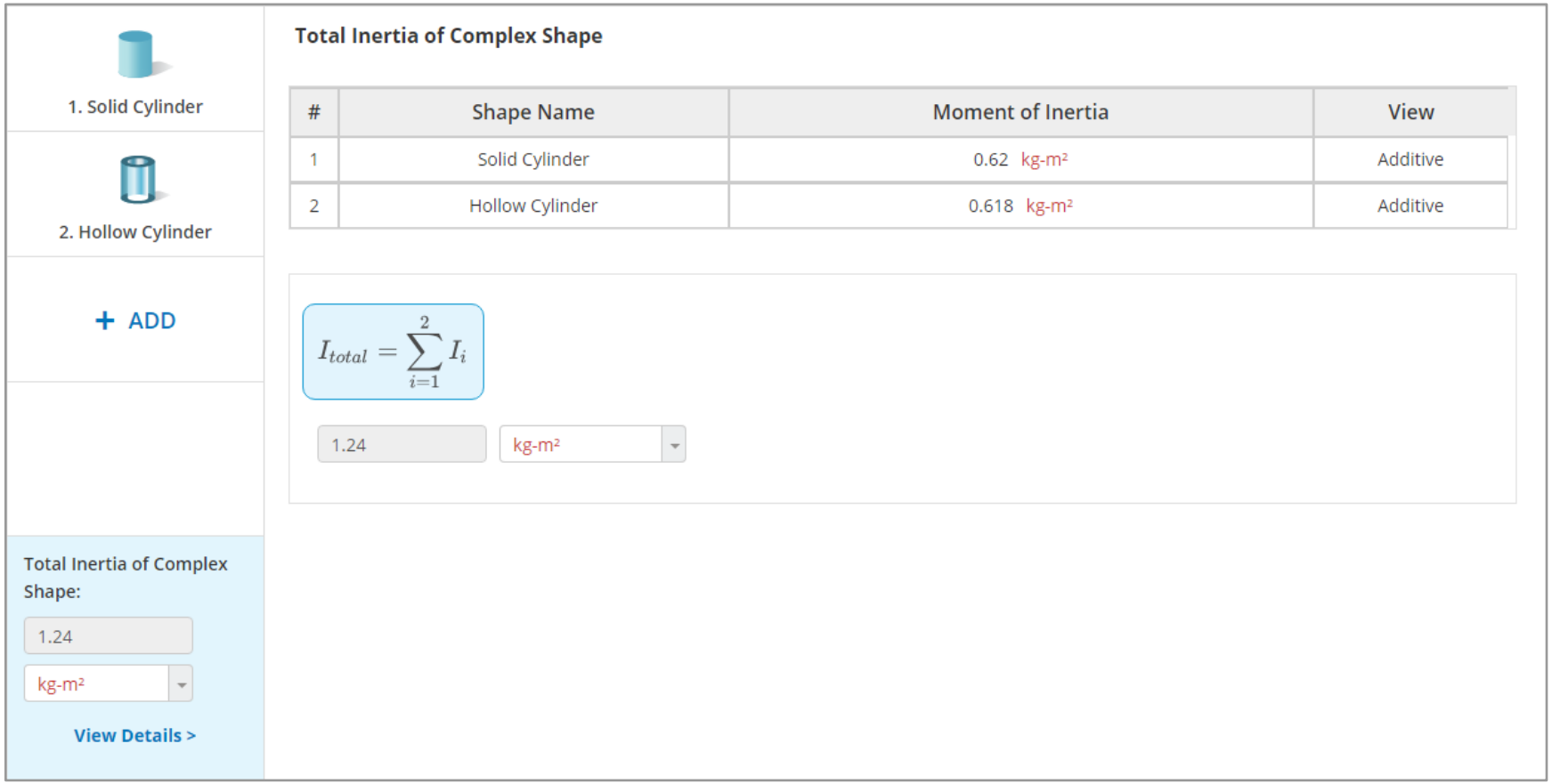
Click Add button (label 4) to add an inertia component at the bottom of the Components List. You have the option of adding a solid cylinder or hollow cylinder.



Click Add button after selecting the desired component.

Total Inertia of Complex Shape Details

Total inertia of the shape is displayed at the bottom left of widget (labelled as 5). Click View Details link to navigate to the details view.



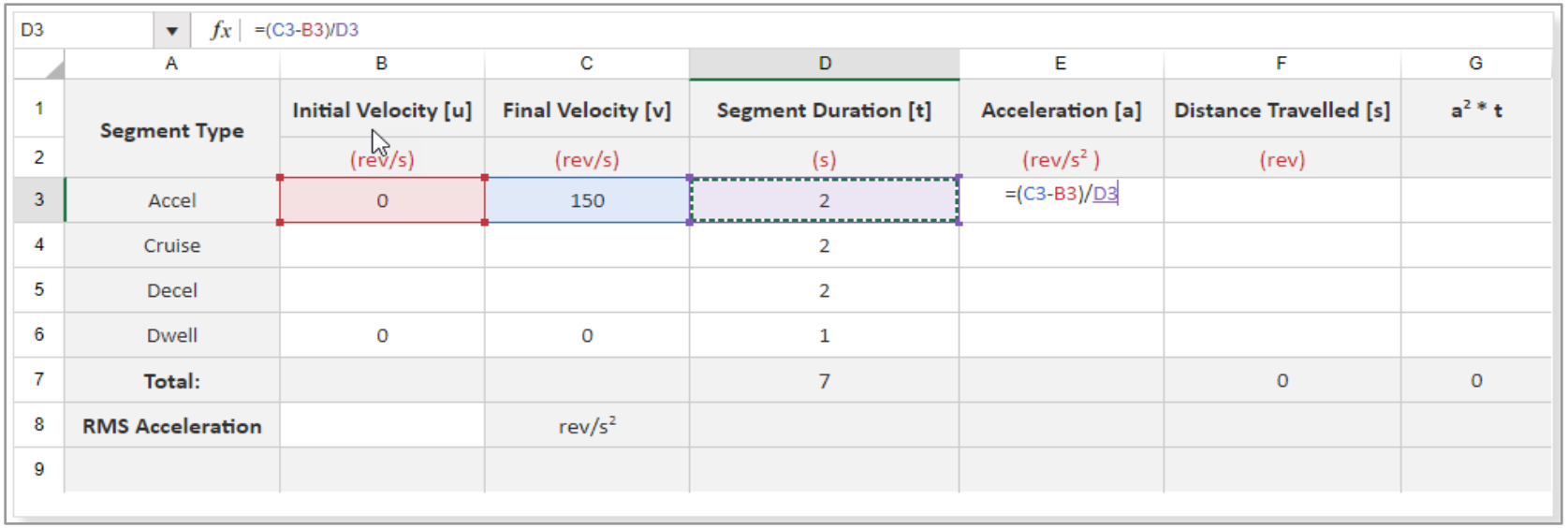
Spreadsheet Widget

Spreadsheet widget has been used throughout the course. Spreadsheet widget has all Excel-like features such as inserting formulas, drag and fill handles, etc.

Spreadsheet Widget is powered by Compro's LeonardoDLS, which is a complete, feature-rich, spreadsheet application for the web.

Segment Type	Initial Velocity [u]	Final Velocity [v]	Segment Duration [t]	Acceleration [a]	Distance Travelled [s]
	(rev/s)	(rev/s)	(s)	(rev/s²)	(rev)
Accel	0	20	0.09	222	0.9
Cruise	20	20	0.075	0	1.5
Decel	20	0	0.085	-235	0.85
Dwell	0	0	0.05	0	0

Spreadsheet Widget in Read-Only Mode



Spreadsheet Widget in Read-Write Mode

In read-write mode, the Gray cells represents non-editable cells, whereas the white cells are editable where the user can enter / change the value.

Supported Features in read-write mode:

1. Supports MS Excel's formulas for entering cell values.
2. Allows copy and paste of data from MS Excel workbook to / from the widget.
3. Allows autofill of data using drag handles similar to Excel workbook.

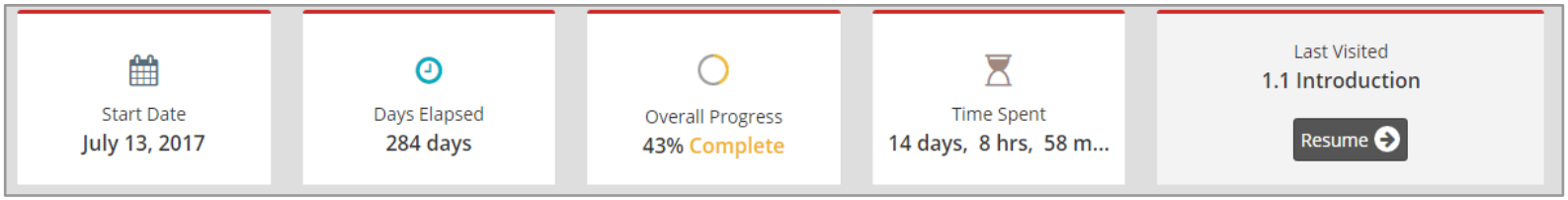
Track Your Progress

A detailed information of your engagement with the course can be seen at “My Progress” page. You can navigate to this page by clicking the “My Progress” link available in the header of the site.

My Progress page can be broadly classified into 4 parts -

1. Course Status Summary

The top-most section of this page provides a summary of course status



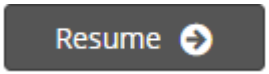
a. Start Date - This indicates the date when you started the course.

b. Days Elapsed - This indicates the number of days elapsed since the course start date.

c. Overall Progress - This indicates your overall progress for the entire course. The overall progress of the course is calculated using the progress of “Reading”, “Assessments” and “Practice” which are individually described under the Progress section of this document.

d. Time Spent - This is the total time spent by you on the course which is equal to the sum of time spent during each session.

e. Last Visited - This indicates the course topic where you left off during your last visit.

Click the 

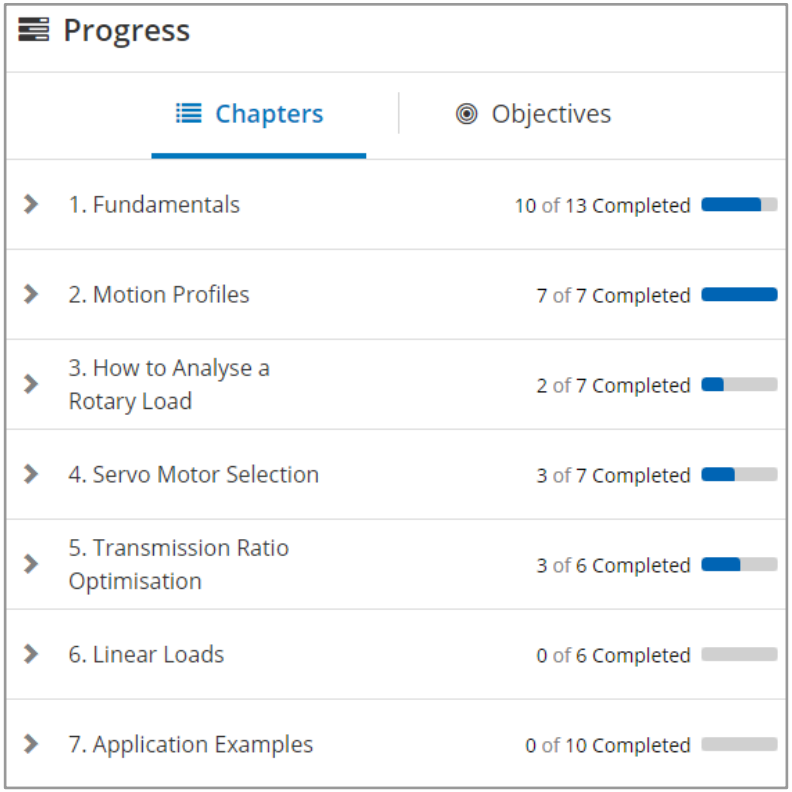
button to continue reading from where you left off.

2. Progress

This part indicates detailed progress of the course. It is shown with two tabs that display different progress aspects of the course -

a. Chapters Progress

This part displays the progress made on the individual chapters of the course.

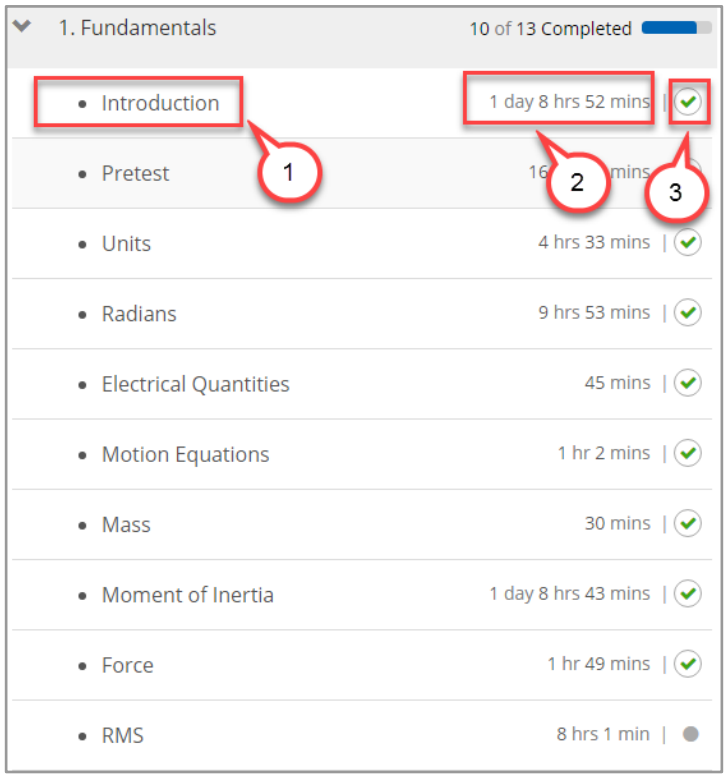


Completion status of each chapter is displayed along with the number of topics that are completed in this chapter.

Here:

- Label 1 represents a course chapter
- Label 2 represents the number of topics (of this chapter) completed out of total topics
- Label 3 represents percentage progress

Click › icon to see the topic-wise progress of the chapter:



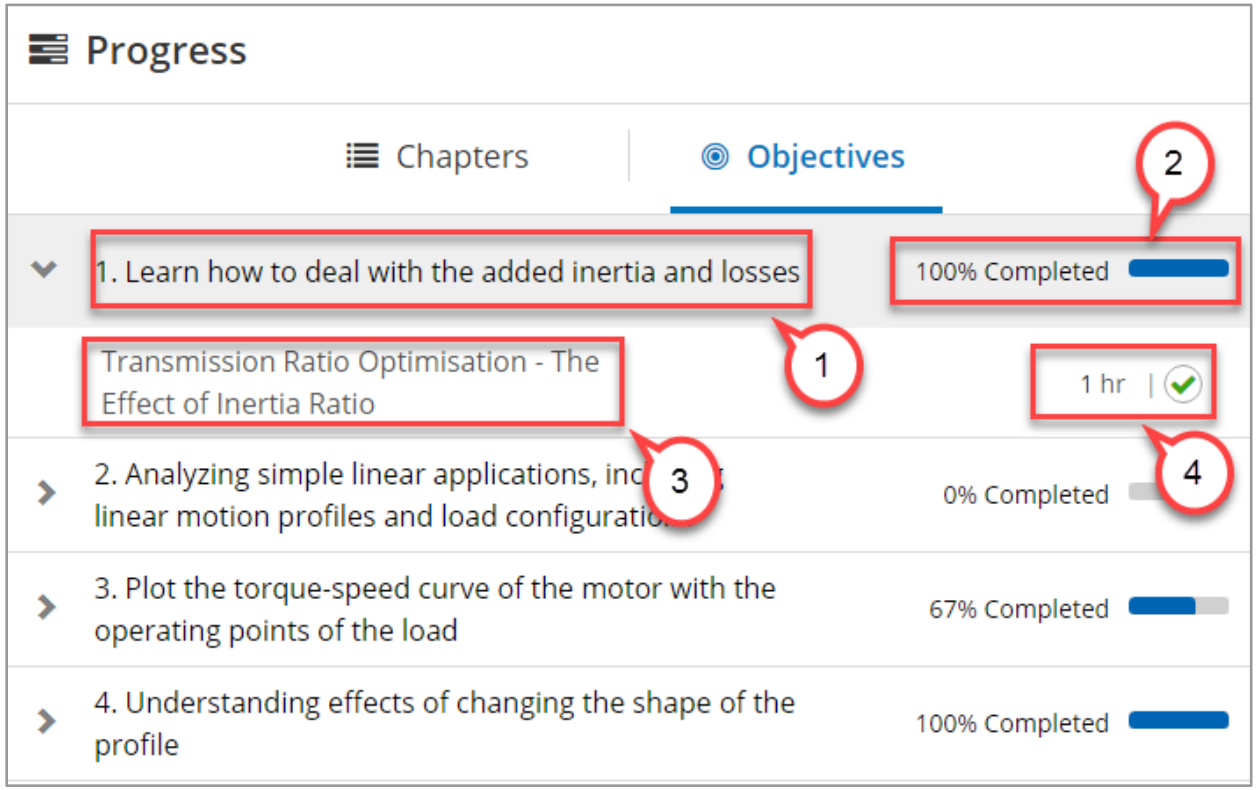
Here:

- Label 1 represents a topic within a chapter
- Label 2 represents total time spent by you on this topic
- Label 3 represents current status of this topic. For more informations on status refer section Track Status of Each Topics of this document.

b. Learning Objectives Progress

The COSMATT course comprises a set of Learning Objectives (LOs). Each topic is intend to contribute to the progress of one or more LOs. Completing a topic increases the associated LO progress.

Click the “Objectives” tab to see your LO wise progress.



Here:

- Label 1 represents a Learning Objective (LO)
- Label 2 represents LO progress
- Label 3 represents the course topic to which the LO is mapped
- Label 4 represents time spent and status of the course topic

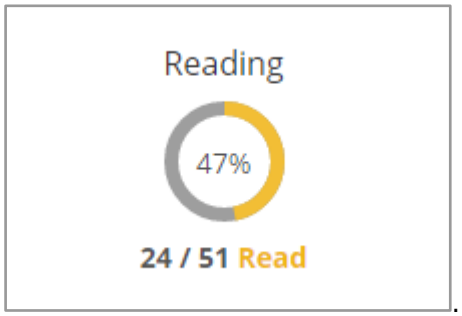
.

3. Engagement

This part of the page indicates your engagement with the course.

a. Reading

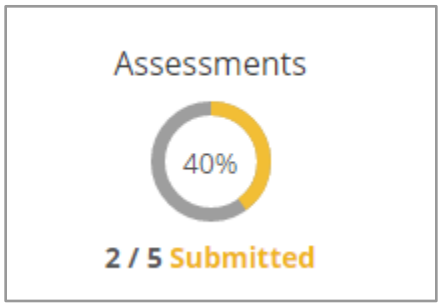
This comprises of the progress of “Reading” sections in the course. When you complete a topic by clicking “Mark as Complete” button, the progress of “Reading” increases by one.



In the figure above, **24 / 51** represents that the 24 out of total 51 course topics are completed, accounting to a progress of 47%.

b. Assessment

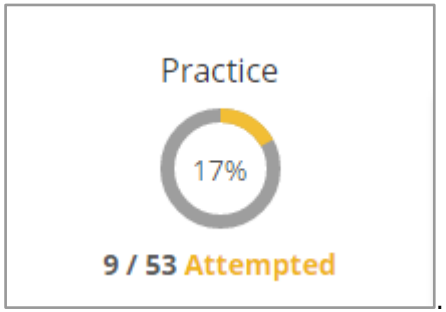
This comprises of the “End of Chapter” assessments in the course. When you Submit an assessment, the progress of “Assessments” increase by one.



In figure above, **2 / 5** represents that the 2 out of 5 assessments are submitted accounting to a progress of 40%.

c. Practice

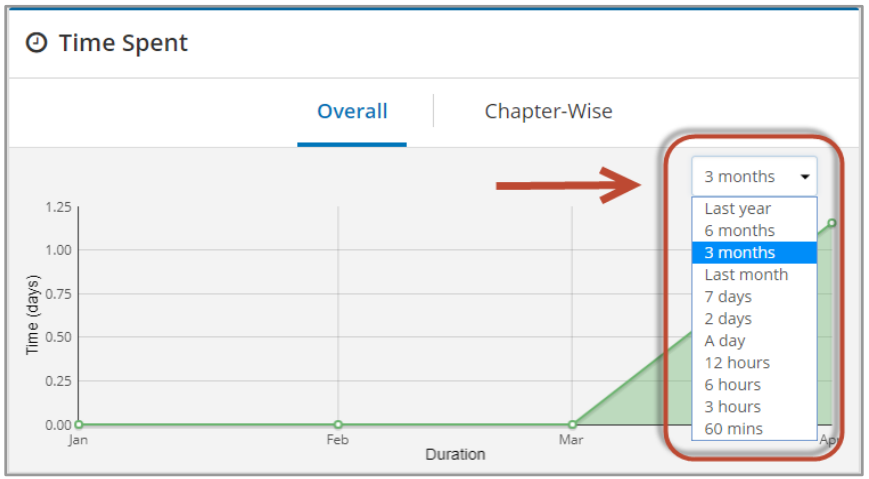
This comprises the practice questions under “Test Your Understanding” heading within the course. When you perform a practice question correctly, the progress of “Practice” increases by one.



In figure above, **9 / 53** represents that the 9 out of 53 practice questions are performed correctly, accounting to a progress of 17%.

4. Time Spent

A detailed analysis of the time spent is shown here. You can switch between Overall and Chapter-Wise time spent report by clicking the desired button at the top of the widget. Use the Duration Drop-down to select a time-spent duration period.



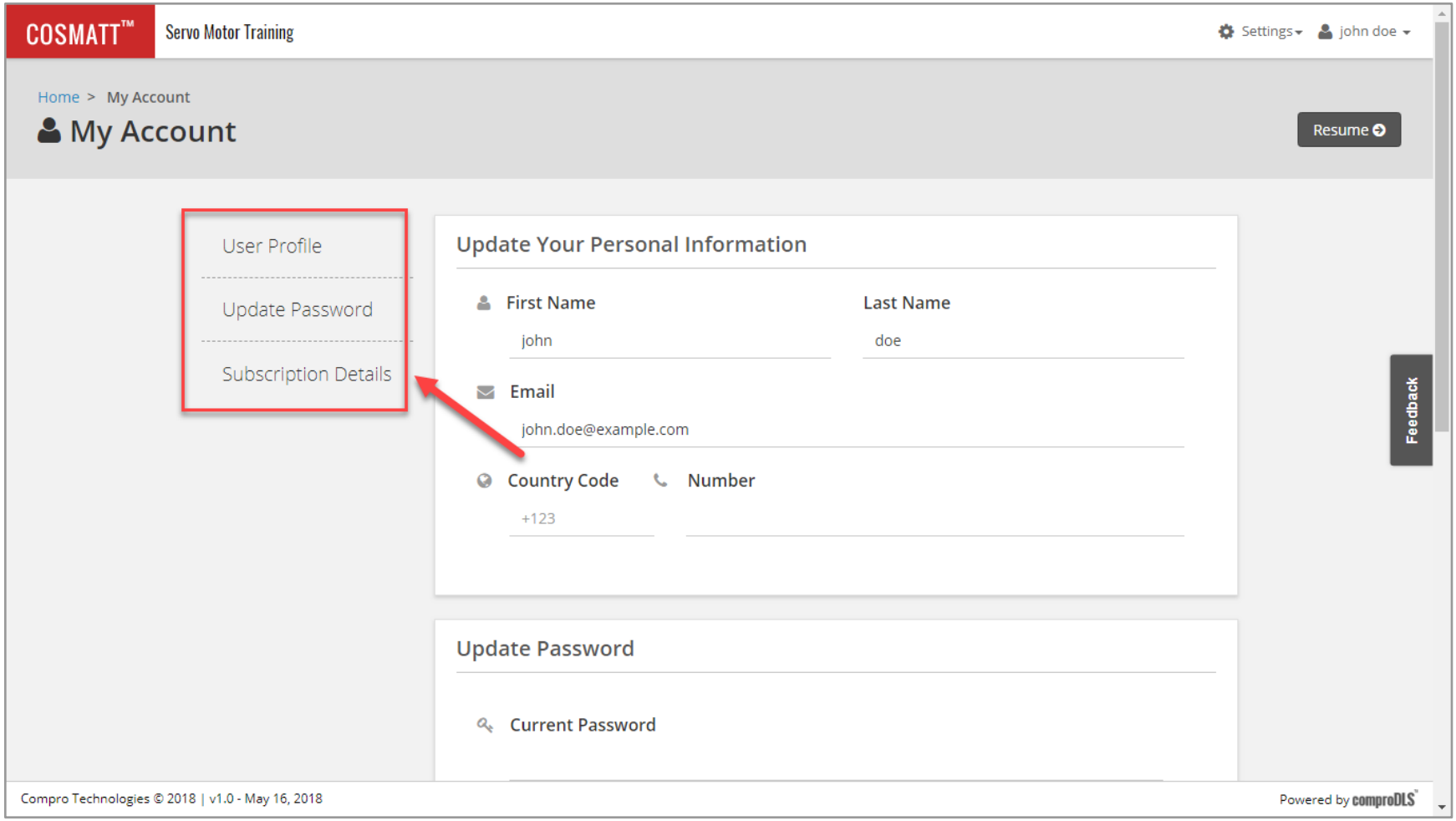
View your account information

You can see your your account information by clicking the “My Account” link which is available inside the “User Information” dropdown displayed at the top-right corner of the application

Here you can:

1. View your Profile and Contact Information
2. Change your Account Password
3. View Subscription Details

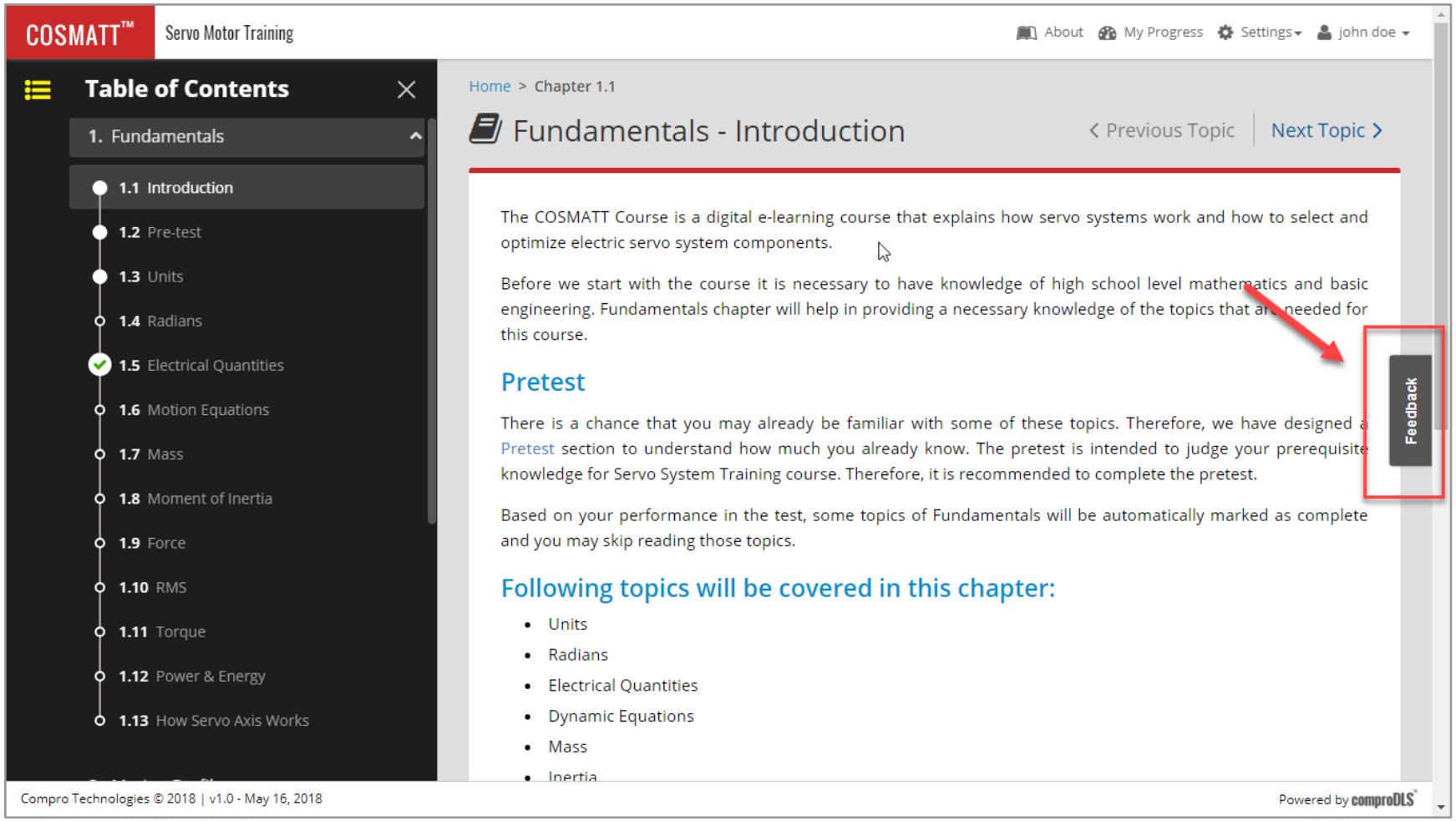
Use relevant links on the left or scroll through the page to visit various sections of the page:



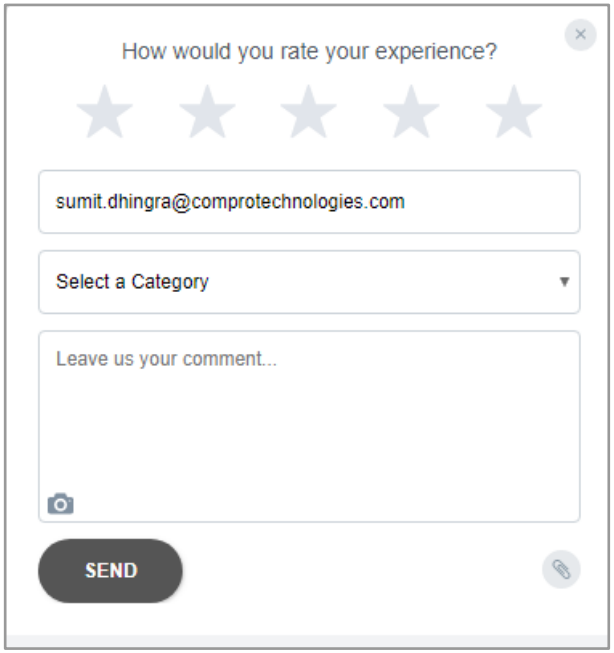
You can click on Resume button to continue reading from where you left off.

Feedback

You can easily share your valuable feedback with us using the feedback component. Feedback component can be activated by clicking the “Feedback” tab/button anchored to the center right of the application.



“Feedback” component allows to you to rate your experience and provide comments.



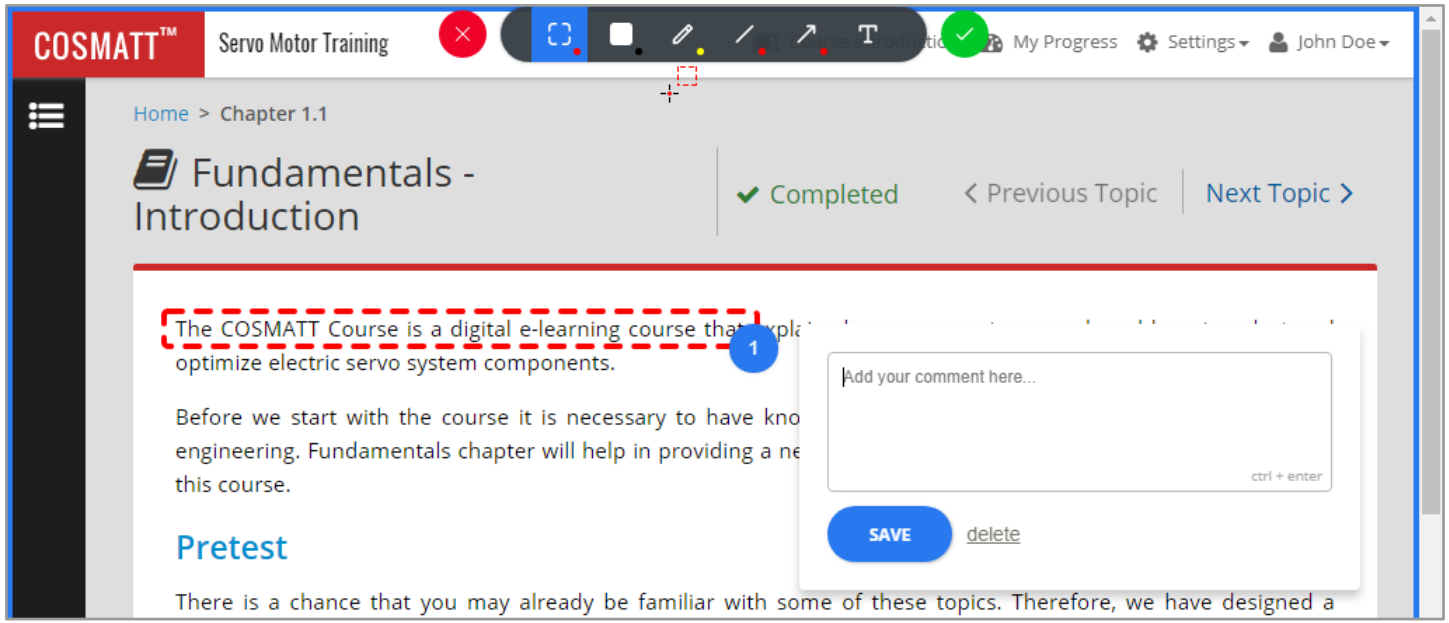
Clicking button will post your feedback.

How to add an Attachment of your Feedback?

Use the icon to add an attachment with your feedback. Clicking this icon will activate “Select File” dialog box where you can select a file which you want to attach and share with us.

How to Attach a Screenshot of your Feedback?

Use the icon to take a snapshot of your screen for sharing with us. It also activates the drawing tool so that you can draw on the screen to highlight the content or features that need to be fixed.



Use SAVE button to save the comment added on highlighted area. Use icon to save the screenshot or icon to reject the screenshot and return to “Feedback” component.

Contact Us

For additional support or account renewal information, please email us at: cosmatt@comprotechnologies.com