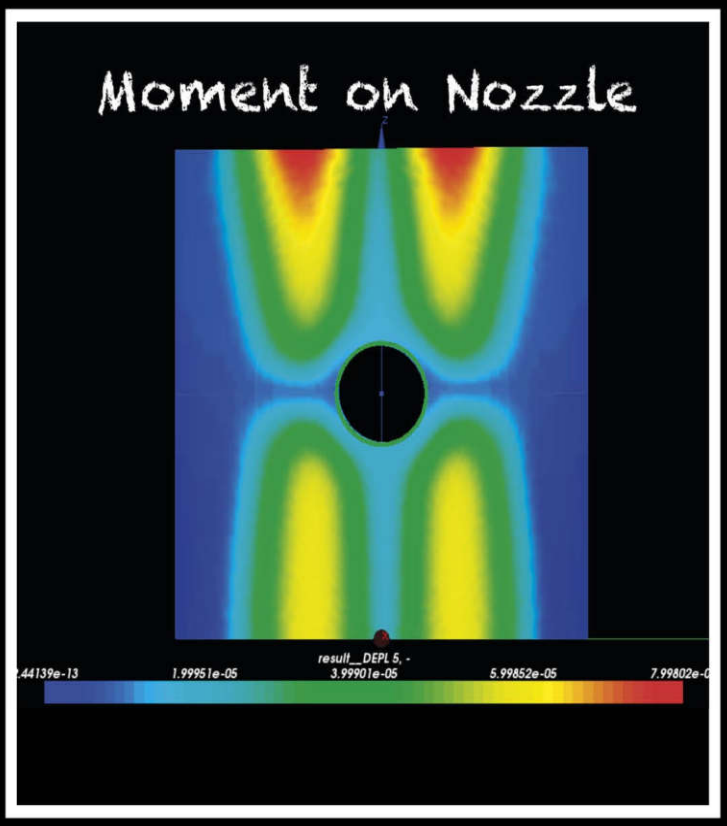
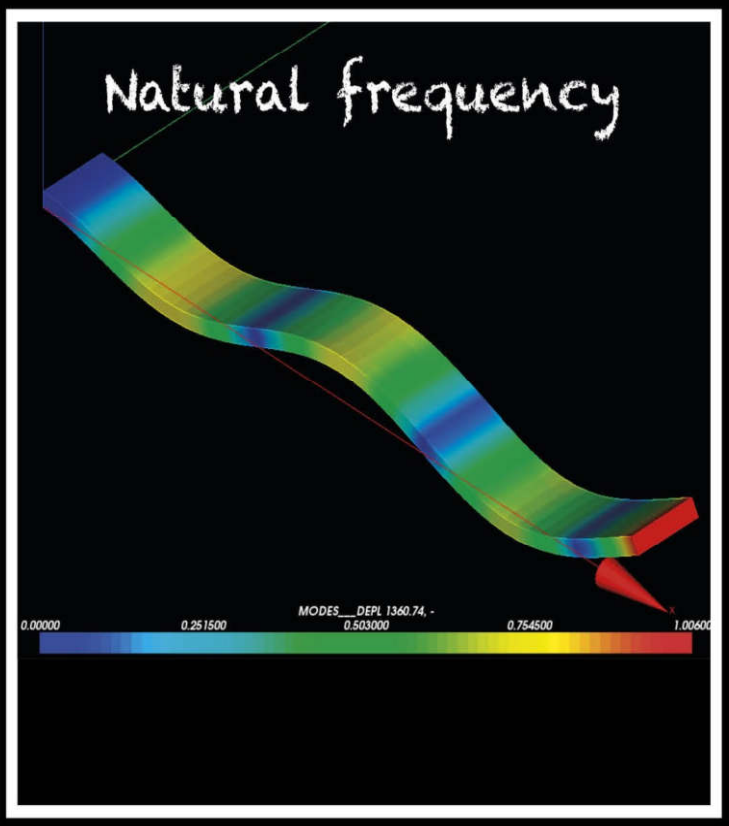
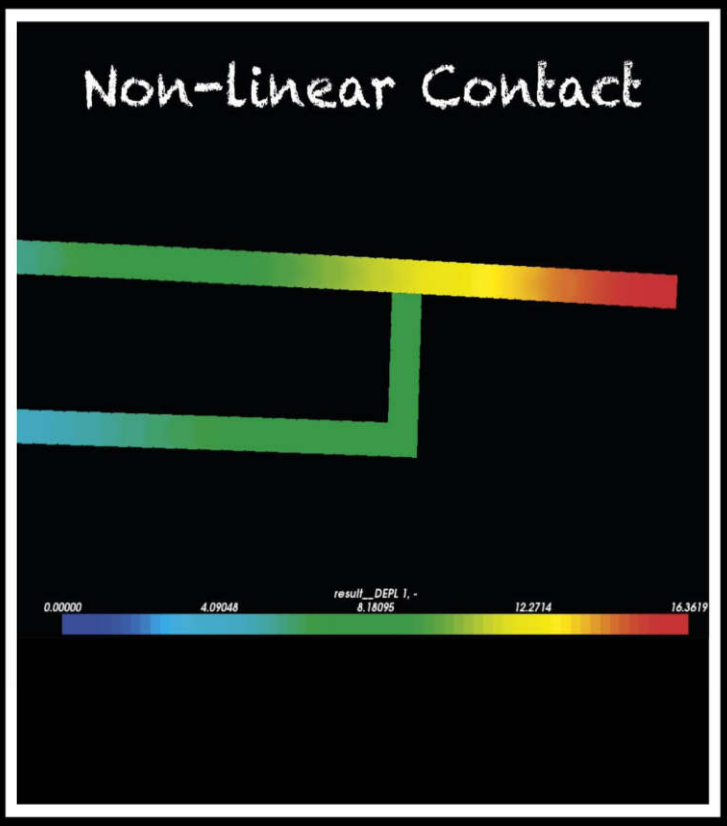
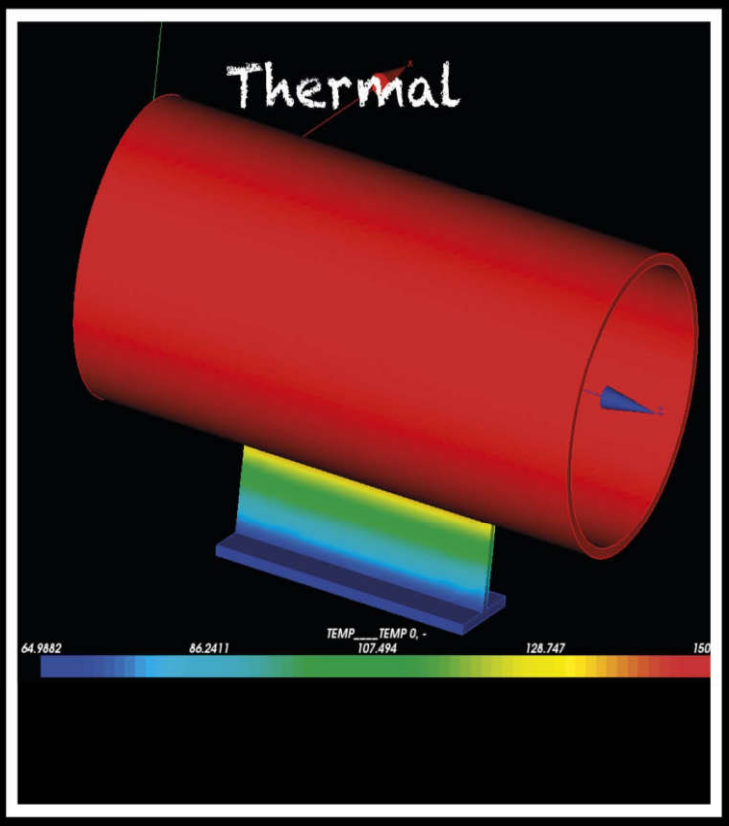
Intermediate

Finite Element Analysis using Open source Software









- by Dharmit A. Thakore

Finite Element Analysis using Open Source Software – Part 2

Second Windows Edition

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Edition 2W

To
My wife,
Our beloved sons
&
Open Source Software

About the Author

Dharmit Thakore practices as a Mechanical / Piping Engineer in Queensland. He received his Bachelor's degree from Birla Vishwakarma Mahavidhyalaya, Vallabh Vidhyanagar, Gujarat, India which was affiliated with Sardar Patel University. He started his engineering career as a young Graduate in Larsen & Toubro – Sargent & Lundy, Vadodara. He came to Australia for further studies and settled here. He received his Chartered Professional Engineer (CPEng) as a Mechanical / Piping Engineer.

Dharmit has broad interests, which include finite element analysis, design, optimization and Open Source software. He is a member of Engineers Australia and Board of Professional Engineers in Queensland.

Foreword

This book is written after nearly 5 years after I published Edition 1. It took me around 5 years to publish this Edition 2 and I am proud of publishing it. After I published Finite Element Analysis using Open Source Software in Windows 10, which become instant success overnight, I received many emails and the theme of them was the same, "When will you publish Intermediate Finite Element Analysis using Open Source Software?". I knew that users of Windows system is more and if an Open Source Software, that too which is powerful as Code_Aster, is available in Windows version, everyone with the right mindset will want to use it.

I havent changed the story line of the book from its previous Edition, and it still follows John and Esha as did my previous book. Do write to me and keep on emailing me on what you need to see in my future books.

Foreword to Edition 1

After the success I received by writing my first Book "Finite Element Analysis using Open Source Software – Part 1", I received many email communications congratulating me and telling me how easy it was to use my book. Readers had found an easy to use, easy to read and easy to follow documentation for Open Source Software that can be used for Finite Element analysis. Some said that they completed the entire book with the exercise within one single weekend and I doubt if they had taken any sleep in between.

The users of my book were fresh graduates from the university who knew the fundamentals and had been using proprietor software in their university and now as they were out of university, they wanted to use something that doesn't hurt their hip pocket. Others were seasoned professionals who knew other proprietary software but wanted to know how to perform FEA using Open Source Software.

This book starts with updated examples in version 13.x for Code_Aster from previous book. It then goes on and adds on advanced analysis.

This book is written for

Those who have a passion for learning Open Source software, particularly CAD and FEA software. This book is written for those who are new to software like Salome-Meca and Code_Aster.

If you are having trouble understanding where to start with Salome-Meca and Code_Aster, this book is written for you. If you are having troubles understanding the computer translated Code_Aster User Documents (which are rich in information), this book is written for you. If you want easy reference to 75% of FEA problems that are encountered by engineers in day to day life and want to do that by Open Source Software, this book is written for you.

This book is for those who don't want to waste their time in finding tutorials online and trying to make logical and sequential sense. This book starts with a very basic introduction of what to do to perform FE Analysis, and then, with each new Chapter, it introduces new concepts in an easy to understand format. If you want to learn how to do FE Analysis with Open Source software in a week's time, than this book is for you.

This book is not written for

If you are advanced user of Salome-Meca and Code_Aster and after reading the Table of Content you can say to yourself that "the information covered in this book is something that I already know", this book is not for you.
This book is also not written for someone who does not know what Finite Element Analysis is. FE Analysis, as a fundamental, should be known to the user of this book.

What software would you need to follow through

All examples in this book are done on a Windows 10 laptop.
Software used for this book are

- Salome-Meca Windows version 2018
- Efficient version 0.3.0

Please note that if you install a software that is of higher version than that mentioned above, the screenshots may differ, but the fundamental concepts remain the same.

Table of Contents

What will be covered in Part 2

After Esha learnt how to perform FEA using Open Source Software like Salome-Meca and Code_Aster, she started her professional career in the same firm that she did her internship. She was happy that John was her mentor all the way long. Esha started gaining more experience with Linear Static Finite Element Analysis, and with more experience she needed less reliance on John's guidance. Esha started doing her FE Analysis with more confidence.
After several months, John caught up with Esha to find out how she was feeling regarding the use of Open Source Software for Finite Element Analysis. Esha was very excited to tell John all about her experiences while they met for coffee. Then Esha told John that every now and then a different type of FE Analysis comes to her for which she is not ready yet. She has to pass them to her other colleagues as she is not feeling confident and she is feeling a bit lost. As usual John was listening to her words carefully and asked her if he could help. Esha was waiting for John to say that and she listed the analysis which she felt were a bit tough for her to do.

Parametric Modelling in Salome for Geometry and Mesh generation

Esha said that John had taught her how to "Dump the study" so that if she wants to recreate the geometry and mesh, it becomes easy for her. But what if she wants to change some of the parameters. What if Esha wants to generate geometry of the Pressure Vessel and Nozzle junction with different PV Diameter and Nozzle Diameter? What if she wants to change the mesh density in the PV Shell thickness or in the Nozzle thickness?

Combining element types in a single FE Analysis

Esha said that sometimes the models are too big and it would really help her if she could combine 3D elements with shell elements and Beam elements. This would make FE Analysis run faster without compromising her results. Was there a way to do this in Salome and Code_Aster?

Non Linear Material Analysis

Esha said that what John taught her in last book in Chapter 9 for checking against Allowable stress of the material was sufficient at that time, but she wanted to know if she could put the Graph of the Material Properties in Salome or Code-Aster and if the Analysis could take care of checking when the Allowable stress has been reached and stop the analysis?

Contact FE analysis

Esha said that she was happy to perform Assembly FE Analysis, but sometimes there is a requirement where she needs a gap between two parts and that load can only be translated once there is contact between surfaces. Was there a way to do it in Code_Aster?

Modal Analysis

Sometimes in her career, Esha had come across a FE problem where she needed to find the Natural frequencies of a given shape of the object. Esha asked John, if it was possible in Code Aster to find out the Natural frequencies of the object by performing Modal Analysis?

Thermal Analysis

Esha remembered that once she was asked if there was a way to perform Thermal analysis in Code_Aster. As Esha didn't know, she had to again pass it along to her colleague. Is there a way to conduct Thermal Analysis in Code_Aster?

These were some of the example problems that she had the opportunity to do but was not able to do them due to her limited knowledge. There were some more problems that she wanted to discuss with John but first she wanted to know if her existing problems can be solved.

John told Esha that both Salome-Meca and Code_Aster were capable of conducting the analysis she asked for and much more.