

NAFEMS Non-Linear Finite Element Analysis

Singapore: 1st to 2nd March 2018

An opportunity to ensure that your organization gets maximum benefit using FEA

Register now to secure your early bird registration fee

Motivation.

Many problems facing designers and engineers are nonlinear in nature. The response of a structure cannot be simply assessed using linear assumptions.

Nonlinear behaviour can take many forms and can be bewildering to the newcomer. All physical systems in the real world are inherently nonlinear in nature.

One of the most difficult tasks facing an engineer is to decide whether a nonlinear analysis is really needed and if so what degree of nonlinearity should be applied.

Looking at a bolt heavily loaded in an attachment fitting, it may be that the change in stiffness and load distribution path are critical in evaluating peak stress levels. Perhaps the assembly is in an overload condition and we need to check that plastic growth is stable and there is no ultimate failure – bent but not broken!

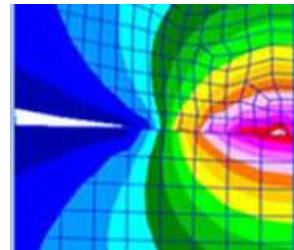
A flange on a connector arm may be under compressive load, but also sees heavy bending. We need to assess the resistance to buckling with deflection dependent loading paths and possible plastic behaviour.

Whatever the nature of the challenge, the objective of this course is to break down the nonlinear problem into clearly defined steps, give an overview of the physics involved and show how to successfully implement practical solutions using Finite Element Analysis.

Course Details

The course is completely code independent. No software is required.

Each topic in the class is treated as a building block and is presented using an overview of the physics and theory involved. The math is kept simple and the emphasis is on practical examples from real life to illustrate the topic. The mapping to Finite Element analysis techniques is shown with numerous workshops. The tutor will be running analysis interactively and involving the students in the process via Q and A periods during each session, follow up emails and a course bulletin board



Students are shown the various approximation methods and how to judge which are acceptable and appropriate for solving a wide range of practical problems. Practical considerations of types of nonlinearity, solutions available, elements to use and structural details are shown by numerous examples.

Of equal importance is the assessment and interpretation of results. This starts with ensuring a building block linear solution is feasible and accurate. Once this stage is completed then the degree of nonlinear complexity is gradually increased until an effective simulation of the real world event is developed. A range of hints and tips are shown for a wide range of different nonlinear analysis types.

Interaction is encouraged throughout the course. Students are welcome to send in problems from industry and these will be discussed as time permits.

A full set of printed and bound notes will be issued to every attendee.

Who Should Attend?

This course is aimed at practicing engineers who wish to learn more about how to apply finite element techniques to nonlinear analysis in the most effective manner. Ideally a student should have some experience of FEA analysis, but this is not essential. The material that is presented is independent of any particular software package, making it ideally suited to current and potential users of all commercial finite element software systems. This course is a must for all engineers aiming to use FEA as a reliable predictive tool for nonlinear analysis.

The course is open to both members and non-members of NAFEMS.

Course Programme

Day 1

- Introductions
- Background to Non-linear
- Linear versus Non-linear
- Types of non-linearity
- Introduction to:
 - Geometric non-linearity
 - Material Non-linearity
 - Contact non-linearity
- Example - oil tank
- Nonlinear Strategy:
 - Convergence
 - Loading
 - Boundary conditions
 - Scope of the Analysis
- In Depth: Geometric Nonlinearity
 - Shallow roof example
 - Linear Buckling Rod Example
 - Further Nonlinear Buckling

Day 2

- In Depth: Contact Nonlinearity
 - Contact surface methods
 - Contact example
- In Depth: Nonlinear Material
 - Yield Criteria
 - Flow Rules
 - Beyond Ultimate
 - Viscoelasticity
 - Hyperelastic material
 - Nonlinear Material Examples
- Mesh Adaptivity and Element Erosion
- Nonlinear Transient Analysis
 - Implicit versus Explicit FE Analysis methods
 - Explicit Background
 - Explicit Rod Example

Registration will be held on Thursday morning between 8.30am and 9:00am, with the course starting immediately afterwards. The tutor will aim to commence the course at 9.00am on both days and finish by 5pm each evening. Each day there will be short morning, lunchtime and afternoon breaks.

Course Tutor



Tony Abbey has created and taught a wealth of FEA training material over the past 20 years. Thousands of engineers across the world have benefited from his live and e-learning based classes. He has developed a reputation for providing the student with an experience that is full of insight gained from his extensive experience, but which also challenges and motivates. Tony has been working with FEA for nearly 40 years, both in Industry and for leading FEA software providers in the UK and the US.

His informal and interactive presentation style allows the key concepts to be taught in a manner which involves participants fully in the course material. Tony presents papers at NAFEMS and other conferences on a regular basis and has been involved with NAFEMS since its formation. He has written a series of very popular articles on FEA for Desktop Engineering magazine.

Venue

Grand Copthorne Waterfront Hotel
392 Havelock Road
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Web: [Website](#)



Situated just 22 kilometres (12 miles) away from Changi International Airport, the 30-story Grand Copthorne Waterfront Hotel is located along the Singapore waterfront near Boat Quay, Clarke Quay and Robertson Quay. Easily accessible by taxi to various business and entertainment districts, such as Raffles Place, the Marina Bay Financial Centre, Orchard Road, Chinatown, Sentosa and Universal Studios, the hotel presents itself as the ideal place to stay and explore Singapore.

Accommodation

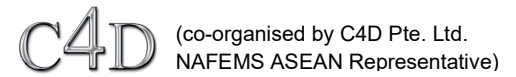
We have negotiated a small number of rooms at the Grand Copthorne Waterfront Hotel. The NAFEMS Training course accommodation rate is SGD 230++ inclusive of one complimentary daily breakfast. The rate is available up to 1 month before the course, subject to availability. To book please quote "NAFEMS Training" and email: rsvns.gcw@millenniumhotels.com.

About NAFEMS

NAFEMS is the International Association for the Engineering Modelling, Analysis and Simulation Community. We focus on the practical application of numerical engineering simulation techniques such as the Finite Element Method for Structural Analysis, Computational Fluid Dynamics, and Multibody Simulation, website: www.nafems.org

About C4D Pte. Ltd.

C4D is the ASEAN Region representative for NAFEMS and works to grow NAFEMS membership within the region. C4D has engaged with many leading organisations to help bring the benefits of NAFEMS membership and Professional Simulation Engineer (PSE) certification.



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