COURSE OVERVIEW ME0129
Static Equipment Design Using PV Elite Software

Course Title
Static Equipment Design Using PV Elite Software

Course Date/Venue
Session 1: July 07-11, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: December 14-18, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
ME0129

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Fracture mechanics is the field of mechanics concerned with the study of the propagation of cracks in materials. It uses methods of analytical solid mechanics to calculate the driving force on a crack and those of experimental solid mechanics to characterize the materials resistance to fracture.

The course is designed to provide participants with a detailed and up-to-date overview of Fracture Mechanics. It covers the strength of materials approach to design against fracture; the S-N curve approach to design against fatigue failure; the linear elastic fracture mechanics (LEFM); the elastic-plastic fracture mechanics and fatigue crack; using crack growth analysis to define inspection in tervals; the crack closure and linear damage model for variable amplitude loading; the retardation and load interaction; and the environmental cracking.

During this interactive course, participants will learn the linear elastic fracture mechanics; the weight function method for arbitrary stress gradients; the elastic-plastic applications; apply finite element analysis of components with cracks; the fracture mechanism in metals and alloys that includes ductile fracture; and the cleavage fracture, ductile-brittle transition region and intergranular fracture.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply a comprehensive knowledge on fracture mechanics using PV Elite software
- Differentiate fracture mechanics versus strength of materials approach to design against fracture as well as fracture mechanics versus S-N curve approach to design against fatigue failure
- Define linear elastic fracture mechanics (LEFM) covering the griffith model for cracks, energy release rate parameter, stress intensity factor (K), crack tip similitude, crack tip plasticity and K_{IC} testing
- Discuss elastic-plastic fracture mechanics including crack tip opening displacement (CTOD) parameter, J-integral parameter, J_{IC} and J resistance curve testing and the similitude under elastic-plastic conditions
- Recognize the fatigue crack covering similitude in fatigue, empirical crack growth equations, life prediction by numerical integration and using crack growth analysis to define inspection intervals
- Explain in detail the crack closure, linear damage model for variable amplitude loading, retardation and load interaction as well as the growth of small cracks
- Interpret environmental cracking including the basic principles and terminology in corrosion engineering, stress corrosion cracking (SCC), hydrogen embrittlement, corrosion fatigue and laboratory testing
- Implement the applications of linear elastic fracture mechanics and discuss the principles of superposition, computing stress intensity factor for polynomial stress gradients and the weight function method for arbitrary stress gradients
- Carryout elastic-plastic applications and apply finite element analysis of components with cracks
- Identify the fracture mechanism in metals and alloys that includes ductile fracture, cleavage fracture, the ductile-brittle transition region and intergranular fracture

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of fracture mechanics for those involved in the design, fabrication or testing of pressure vessels or those who want to know more or move to this very interesting engineering area. Further, the course is also beneficial for those involved in maintenance, repair and flaw evaluation of pressure vessels.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:-

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Maged Elhefnawey, PhD, MSc, BSc, ASNT-NDT, is a **Senior Mechanical & Maintenance Engineer** with **extensive years** of experience in **Insulation** Inspection & Quality Control, **Insulation** Standards & Regulations, **Thermal Insulation**, **Piping System Insulation**, **Pipeline & Piping Insulation**, **Insulation** & Corrosion Protection, **Insulation** Maintenance & Repair, **Heat Exchanger & Boiler Insulation**, **Insulation Installation** Techniques, **Insulation** Thickness Calculation, **Insulation** Retrofitting, **Insulation** Materials & Selection, **Insulation** Testing & Quality Assurance, **Tanks & Vessels Insulation**, **Heat Exchanger & Tank Farms**, **Pressure Relief Valve**, **Control Valves & Actuators**, **Compressor & Pumps** Troubleshooting & Repair, **Piping & Pipeline** Maintenance, **Boiler** Operation & Maintenance, **Flange Joint & Flange** Management, **Bolt Torquing**, **Vibration** Analysis, Gas Transmission & Piping Distribution System (**ASME B31.8**), **Material Selection** Codes & Standards, **Diesel Engine** Operation & Maintenance, **Pipe Stress** Analysis, **Rotating Equipment** Inspection & Troubleshooting, **Gas & Steam Turbine**, **Dry Gas Seal**, **Motors**, **Turbo-expanders**, **Gears**, **Blower & Fan**, Vapor Recovery Unit System, **Thermal Power Plant**, **Pressure Vessel** Design & Fabrication, **Hydraulic System** Operation & Maintenance, **Bearings & Lubrication**, **Roll Pass** Design & Mill Operation, **Furnace** Operation & Troubleshooting, **Fired Heater**, **Mechanical Equipment** Installation, **Piping & Pipe** Support Systems, **Welding** Inspection, **Coating** Inspection, **ASNT-NDT** Techniques, **Painting** & **Hydrotesting**, **Piping** Fabrication & Assembly and **Water Pipes** Inspection & Repair. He is also well-versed in **Maintenance Auditing & Benchmarking**, **Maintenance & Reliability** Management, **Equipment Failure Analysis**, **Rotating Equipment & Machinery**, **Material Cataloguing** & Storage, **Alignment & Balancing** Techniques, **Condition** Monitoring, **Machinery Failure** Analysis, Reliability Centered Maintenance (**RCM**), Root Cause Analysis (**RCA**), **Maintenance Planning & Scheduling**, **Physical Asset** Management, **Maintenance Cost Control**, **Prevention & Predictive** Maintenance, **Lubricant & Oil** Analysis and **Refinery Equipment** Maintenance.

During his career life, Dr. Maged has gained his expertise and thorough practical experience through several positions and dedication as the Acting **Department Head**, **Thermal Insulation Engineer**, **Section Head Projects Engineer**, **Mechanical Engineer**, **Maintenance Engineer**, **Mechanical Supervisor**, **Lecturer**, **Instructor/Trainer**, **Assistant Professor** and **Senior Thermal Insulation Technician** for various international companies and institutions such as the Gulf of Suez Petroleum Co. (GUPCO), British Petroleum (BP), BETROBEL, KNPC, SAIPEM Engineering, Natural Gas Pipeline, TRACTEBEL Engineering, Suez and TransGas Company to name a few. He also worked as **Mechanical/NDT Supervisor** wherein he was responsible for executing the scheduled inspections for welding, coating, pipeline, painting, hydrotest of pipeline & piping and fabrication and assembly.

Dr. Maged has a **PhD** and **Master's** degree in a **Certified API 580** Risk Based Inspection, a **Certified API 570** Piping Inspector, a **Certified API 510** Pressure Vessel Inspector, a **Certified API 653** Aboveground Storage Tank Inspector, **Mechanical Production Engineering** and a **Bachelor's** degree in **Mechanical Power Engineering**. Further, he is a **Certified ASNT Level II** (RT-PT-MT & UT), **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and further published numerous academic papers and delivered various trainings, courses, workshops, seminars and conferences worldwide.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Design Against Fracture*** *Fracture Mechanics Versus Strength-of-Materials Approach to Design Against Fracture*
0930 – 0945	*Break*
0945 – 1100	***Design Against Fracture Failure*** *Fracture Mechanics Versus S-N Curve Approach to Design Against Fatigue Failure*
1100 – 1215	***Linear Elastic Fracture Mechanics (LEFM)*** *The Griffith Model for Cracks • The Energy Release Rate Parameter • The Stress Intensity Factor (K)*
1215 – 1230	*Break*
1230 – 1420	***Linear Elastic Fracture Mechanics (LEFM) (cont'd)*** *Crack Tip Similitude • Crack Tip Plasticity • K_{IC} Testing*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Elastic-Plastic Fracture Mechanics*** *Crack Tip Opening Displacement (CTOD) Parameter • J-Integral Parameters*
0930 – 0945	*Break*
0945 – 1100	***Elastic-Plastic Fracture Mechanics (cont'd)*** *J_{IC} & J Resistance Curve Testing • Similitude Under Elastic-Plastic Conditions*
1100 – 1215	***Fatigue Crack*** *Similitude in Fatigue • Empirical Crack Growth Equations*
1215 – 1230	*Break*
1230 – 1420	***Fatigue Crack (cont'd)*** *Life Prediction by Numerical Integration • Using Crack Growth Analysis to Define Inspection Intervals*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Fatigue Crack (cont'd)*** *Crack Closure • Linear Damage Model for Variable-Amplitude Loading*
0930 – 0945	*Break*
0945 – 1100	***Fatigue Crack (cont'd)*** *Retardation & Load Interaction • Growth of Small Cracks*
1100 – 1215	***Environmental Cracking*** *Basic Principles & Terminology in Corrosion Engineering • Stress Corrosion Cracking (SCC)*
1215 – 1230	*Break*
1230 – 1420	***Environmental Cracking (cont'd)*** *Hydrogen Embrittlement • Corrosion Fatigue • Laboratory Testing*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

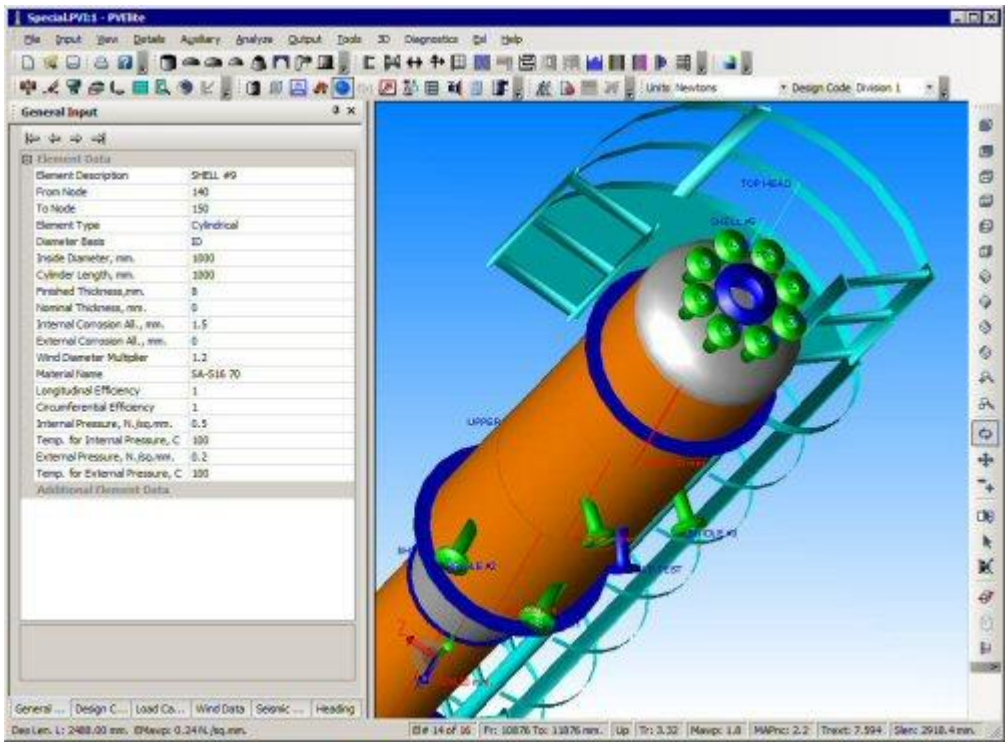
0730 – 0930	***LEFM Applications*** *The Principle of Superposition • Computing Stress Intensity Factor for Polynomial Stress Gradients*
0930 – 0945	*Break*
0945 – 1100	***LEFM Applications (cont'd)*** *The Weight Function Method for Arbitrary Stress Gradients*
1100 – 1215	***Elastic-Plastic Applications*** *The EPRI J Estimation Handbook • Ductile Instability • The Failure Assessment Diagram (FAD) Method*
1215 – 1230	*Break*
1230 – 1420	***Elastic-Plastic Applications (cont'd)*** *Incorporating Weld Residual Stresses into the FAD Method • Monte Carlo Probabilistic Analysis*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Finite Element Analysis of Components with Cracks*** *Incorporating a Crack into a Finite Element Mesh*
0930 – 0945	*Break*
0945 – 1100	***Finite Element Analysis of Components with Cracks (cont'd)*** *Comparison of Methods to Compute KI • Modeling Crack Growth with Finite Element Analysis*
1100 – 1215	***Fracture Mechanisms in Metal & Alloys*** *Ductile Fracture (Micro Void Coalescence) • Cleavage Fracture*
1215 – 1230	*Break*
1230 – 1345	***Fracture Mechanisms in Metal & Alloys*** *The Ductile-Brittle Transition Region • Intergranular Fracture*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the “PV-Elite” software.



PV-Elite Software

Course Coordinator

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