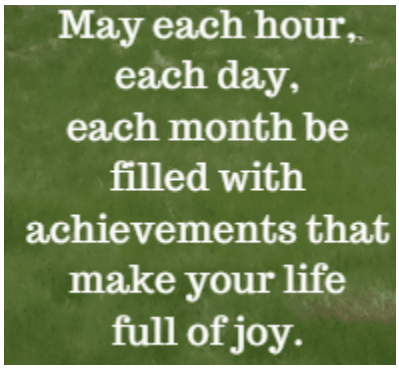
Issue 20 May 2019

SFA Newsletter

Seasons Greetings!



Welcome you all to join as members of SFA! Please find the membership form inside; kindly fill in and contact Secretary of SFA through email.

Experts and experiences:

- Dr. P. Raghothama Rao, Former Scientist, CEMILAC, DRDO Presently Faculty in SJCIT, Chikkaballapur, 562101

Message from our President

Dear readers,

Warm season's greetings! The New Year 2019 started off very well with cherishing moments of the successful launch of ISRO's PSLV-C43 rocket and the first locomotive-less Train-18 crossing 180 kmph speed limit. It is a very happy moment that we are rolling out the 20th issue of our News Letter!

Our Society successfully organised the Second in the Quadrennial Series of the International Conference ICONS during Dec 14-17, 2018 at IIT Madras. It is heartening to note that there were a decent number of technical sessions on Failure Analysis in ICONS-2018. Implementing the decision taken at the recent Council meeting, we designed and issued membership cards to all our Life Members. Our Chapters are gearing up for activities - with Kanpur Chapter making a beginning. A few more Chapters have expressed their intentions to conduct several technical events soon. I sincerely congratulate all those for their contributions and news on various events that are being reported in this issue.

Dr. B P C Rao
President, SFA

Working hard and keeping time are two important attributes for a successful endeavour. Keeping our eyes on stars with foot firm on the ground, Chapters are required to pursue activities towards meeting the aims & objective of our Society.

Best wishes to all the readers!

B P C Rao

Edited by: Dr. P. Parameswaran, Metallurgy & Materials Group, IGCAR, Kalpakkam & Dr. Swati Biswas, Materials Group, GTRE, Bangalore

From the Desk of Editors

Dear readers:

You are browsing through the 20th issue of the Newsletter of Society for Failure Analysis (SFA).

We solicited articles for the current issue from failure analysis experts of our country who had worked on many case histories.

We thank the author Dr P. Raghothama Rao, formerly of CEMILAC, Bengaluru who made a brief but interesting contribution.

As far as events are considered, we have two events to report this time- one from Chennai and another from Kanpur.

It is gratifying to see SFA Chennai doing a yeoman service by spending a useful day on conducting a seminar on the subject: Engineering Failure Analysis exclusively for students and faculties of engineering college at Vel Tech, Avadi, Chennai.

The event conducted by SFA, Kanpur was spearheaded by Dr Eswara Prasad and his team from DMSRDE, Kanpur alongwith IIT, Kanpur. Commemorating Prof. T.R. Anantharaman, the event was organised in a grand manner by the Chapter.

An event BRIC-NDT in memory of Dr.Baldev Raj has been initiated by SFA, Chennai alongwith ISNT Chapter which is annually conducted to introduce NDT and failure analysis to engineering UG & PG students.

We take this opportunity to appeal to the Indian industry to use SFA as a forum to share their experiences on trouble shooting. A great way to add content to this newsletter is to include a calendar of upcoming events. The details of important forthcoming international and national events are included; so also the books recently published on the topics of the subject.

We value your comments, which really boost our enthusiasm to perform better. Therefore, as always, your views and comments, mailed to swati@gtre.drdo.in or param@igcar.gov.in are welcome. We wish you all free from failures and a joyful life!

You may visit our web site for your comments/suggestions or any queries : www.sfaindia.org

(P .Parameswaran
& Swati Biswas)
Editors

Editors of Newsletter:
Dr.P.Parameswaran, IGCAR
Dr.Swati Biswas, GTRE

Aims and Objectives of Society for Failure Analysis

The aims and objectives of the Society shall be:

To serve as National Society to promote, encourage and develop the growth of "Art and Science of Failure Analysis" and to stimulate interest in compilation of a database, for effective identification of root causes of failures and their prevention thereof.

To serve as a common forum for individuals, institutions, organizations and Industries interested in the above.

To disseminate information concerning developments both in India and abroad in the related fields.

To organize lectures, discussions, conferences, seminars, colloquia, courses related to failure analysis and to provide a valuable feed back on failure analysis covering design, materials, maintenance and manufacturing deficiencies / limitations.

To train personnel in investigation on failures of engineering components and their mitigation.

To identify and recommend areas for research and development work in the Country relating to failure analysis.

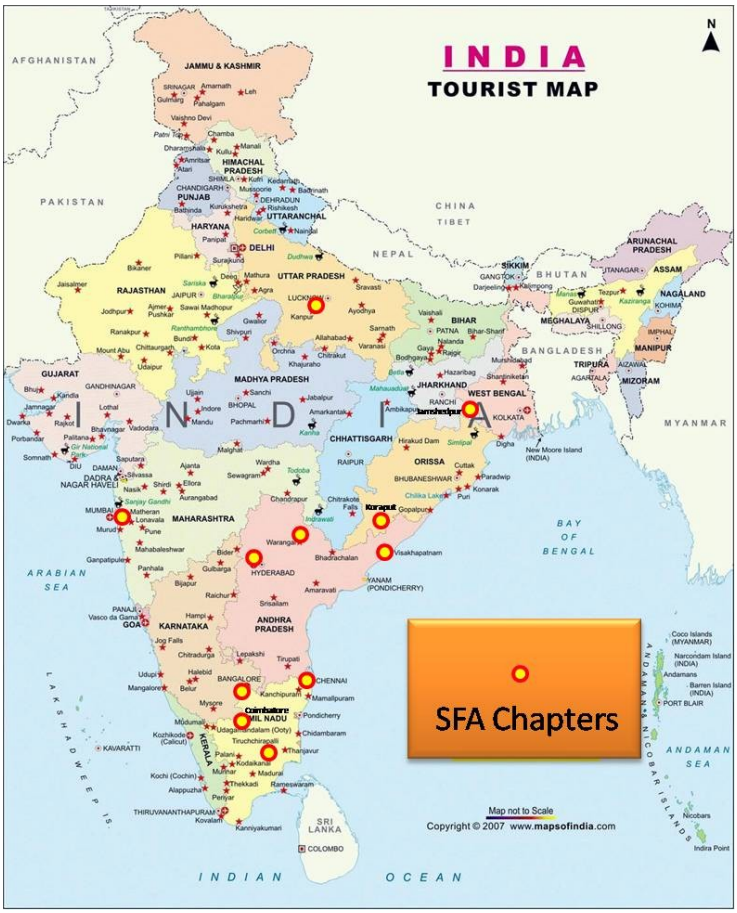
To establish liaison with Government, individuals, institutions and commercial bodies on failure analysis, methodologies and to advise on request.

To cooperate with other professional bodies having similar objectives.

To affiliate itself to appropriate international organization(s), for the promotion of common objectives and to represent them in India.

To organize regional chapters in different parts of the country as and when the need arises.

To do all such other acts as the Society may think necessary, incidental or conducive to the attainment of the aims and objectives of the Society.



Failure Analysis of a Certified Product - an Oxymoron?!

P. Raghothama Rao, Former Scientist, CEMILAC, DRDO
presently, Faculty in SJCIT, Chikkaballapur, 562101
e mail: p.raghotham@gmail.com

Failure is an unholy event perhaps repugnant in human kind, be it in life or in any engineering equipment. Least of all it sets in sickly feeling and is demoralising too. But in practice and philosophy of life perhaps there is none who has not experienced failure or part of the failure. There may not be anybody who had success all along the life and there is not certainly a machine produced in series and numbers without encountering failure in its performance during its service life as predicted. Failure is thus an integral part of the life and its analysis has always been a vista for learning to avoid recurrence and achieve consistency and improved performance. Failure as an event, necessarily calls for a pause in progressive activity for a review and renders better understanding of the performance needs. It is well known that failure is comprehended as the unfulfilled gap between the predicted and the actual performance. In other words, it is a hiccup in sustained performance. In the service sector, it is the gap in Expectation less the Satisfaction in the service rendered although it is largely abstract but disappointment is regarded as failure.

With the advances in technology, engineering products are becoming increasingly precise and multidisciplinary in functioning to perform the various intended tasks. Especially with the advent of software-driven systems, the performance is presumed and expected to be immaculate. Complexity in the system and comfort level being accorded as an outcome of performance, are galloping. When one evaluates a system for guaranteed performance one looks into all aspects such as weak links and possible defects likely to arise as part of manufacturing, testing and in-service environment conditions and the like. All the defects in its nature and extent vis-a-vis performance are thoroughly understood. Sufficient safety factor is accorded. Operating profile and domain are defined to have safe and consistent performance. When it comes to hi-technology engineering products, yet another important aspect which has been always addressed with utmost concern and even mandatorily is safety. This leads to understanding that hi-tech products call for ensuring safety of the operator as well as the innocent and passive society around.

Among the machines the mankind has built to date, aircraft is perhaps the most fascinating. The desire to conquer distance and time is perennial and the sustained effort going on is unmatched. This flying machine called aeroplane as most modern useful engineering system, poses ultimate and extended challenges on safety, consistency and reliability whenever it is airborne and throughout its service life. Safety of the occupants and the safety of civilian society on the mother earth can never be

WHEN I WAS YOUNG, I OBSERVED THAT NINE OUT OF 10 THINGS I DID WERE FAILURES. SO I DID 10 TIMES MORE WORK.

- GEORGE BERNARD SHAW

compromised and failure could prove extremely devastating. This is perhaps an apt example for hi-tech engineering product or system.

No small passenger aircraft will have less than fifty thousand parts and a single seat small range combat aircraft will have less than twenty five thousand parts made from a wide variety of materials and processes. Some subsystems operate only once in the life time of the aircraft, like the ejection seat system where the reliability has to be close to 100 percent and a consumable like tyre with defined life with a few hundred landings and call for periodic replacement may give surprises like tyre burst. Despite meticulous adherence to procedures and practices as per the stipulations of regulatory agency, occurrence of failure teaches one to hasten but slowly, towards perfection in performance.

To conclude while every endeavour in certification is to eliminate failure; it is to be noted that

"To err is human, to admit the ownership of error is more human"

"To correct an error and prevent the recurrence is Failure Analysis"

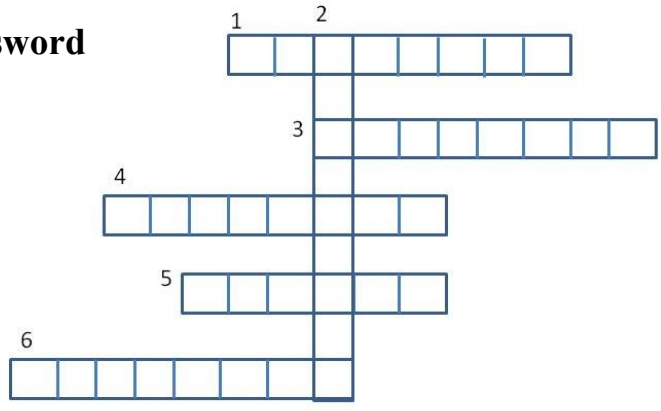
"Learning from failure is Real Progressive Life with a price tag"

The horizon of learning being unlimited in dimension, making perfection remains a moving goal post but human endeavour in pursuit of professionalism is a continuum.

To quote Dr. APJ Abdul Kalam, "Do not take rest after your first victory because if you fail in second, more lips are waiting to say your first victory was just luck"

In essence the failure analysis is to be taken as an ingredient in life to improve performance and to stay in business. Failure analysis allays the fear of non-performance while Certification assures performance of engineering systems.

Solve the following crossword



Across

1 form of error
3 material causing rough surface
4 process to provide rough surface in components
5 to achieve good surface finish
6 machining to produce hole

Down

2 poisonous heat treatment

Answers: turn over to p15

One Day National Seminar On ENGINEERING FAILURE ANALYSIS 23rd February 2019 Organized by SFA, Chennai Chapter alongwith Vel Tech High Tech Dr Rangarajan Dr Sakunthala Engineering College Avadi, Chennai

On 23rd Feb, 2019, SFA, Chennai Organised one day seminar on "Engineer Failure Analysis" alongwith Department of mechanical engineering, Vel Tech High Tech Dr Rangarajan Dr Sakuntala Engineering College, Avadi.

The engineers in designing a component along a certain specifications which provides a given function without any immature failure consider involving in discussion with production and service engineers. Since everything must eventually fail (in some way) during the course of function with a sought after level of performance, the engineers must design in such a way as to avoid failure which is catastrophic in nature as it would result in loss of property, damage to the environment, and possibly injury or loss of life. As it is well known that the engineering components are designed with factors of safety to avoid any premature failure, failures are unavoidable due to complex interaction of factors like materials' choice, the manufacturing stage problems or service related unexpected loading or environmental effects. Therefore carrying out a systematic engineering failure analysis is a useful feedback to the engineers and scientists as it can provide useful information as to why a component or structure failed and this is appropriately addressed in future

designs.

With the above consideration, one day seminar on the subject discussed the modes of failures to give an insight into how a component was loaded and what form of loading or stress state led to failure and the degradation effects of service environments, prevention methods with case studies. This one –day seminar discussed following topics with experts giving lectures on:

- Fatigue & Fracture
- Materials' aspects of Engineering failures
- Failure Analysis of Automotive components.

The seminar was well- attended by more than 100 scholars in active manner. All the participants were provided with a certificate of participation.

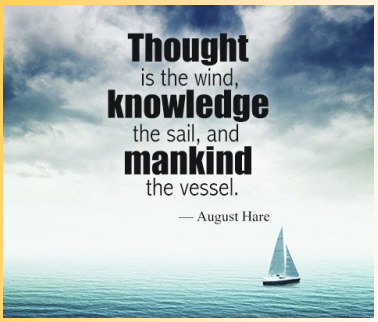
Prof. Raghuprakash, IIT Madras delivering lecture during the one day seminar

Sri. Fannish Tewari, M/s. Cater Pillar, Chennai delivering lecture during the one day seminar

National Seminar on "Advanced Materials & Materials Technologies for Prototypes and Systems" (AMMTPS-2019), 3rd – 6th April at DMSRDE, Kanpur Organized by TR Anantharaman Research Foundation & DMSRDE, Kanpur in association with SFA, Kanpur Chapter

TR Anantharaman Education and Research Foundation (TRAERF), Hyderabad and Defence Materials and Stores R&D Establishment of DRDO, Kanpur jointly organized a four-day National Seminar on Advanced Materials and Materials Technologies for Prototypes and Systems (AMMTPS-2019). Thus commenced the Decennial Celebrations of TRAERF during April 03 – 06, 2019 at DMSRDE, DRDO, Kanpur in association with JATC of IIT, New Delhi and SFA Kanpur Chapter, Kanpur with active participation of a total of 160 engineers from industry (OFs, HAL, PSUs, MSMEs, UP Corridor Industries), scientists from DRDO and other organisations (ATVP, DMSRDE, ADRDE, CEMILAC, DMRL, DRDL, ASL, SSPL, NSTL, NPOL, NMRL, TBRL, CVRDE, DEBEL, IRDE, ADE, ADA, DLJ, CSIR-CGCRI, NML, NIIST, ISRO Units) and faculty members from various academic institutions (IIT-BHU, IIT-Kanpur, IIT-Delhi, JATC/IIT-D, NIT-Nagpur, NIT-Jamshedpur, AU-Visakhapatnam, PSG College-Coimbatore, UPTTI-Kanpur). Apart from these participants, 75 meritorious students and research scholars of various laboratories and engineering colleges of Kanpur have also been supported to attend this national seminar. A technical exhibition, entitled ADVANCED DEFENCE PRODUCTS EXHIBITION was also organized in which 12 large industrial pavilions have showcased their recent products and software capabilities directed towards defence production. As many as 2000 students and learned citizens of Kanpur have visited this technical exhibition and the same was extensively covered in the local media.

The principal aims of AMMTPS-2019 were two-fold: (i) To evolve roadmaps for the development and deployment of advanced materials; and (ii) To develop materials technologies and materials systems, capable of addressing the requirements of futuristic Indian national prototypes and systems, in general and in



particular, those for Indian Defence in the areas of Missile, Aero and Naval applications. A keynote lecture on Materials for Future Defence Systems, by Dr. SV Kamat, DS & DG (NSM), DRDO and 12 invited lectures by leading Systems / Programme / Laboratory directors of DRDO, 5 detailed technical interaction sessions and a special brainstorming session on RE-ESTABLISHING INNOVATIVE RESEARCH IN DRDO, Chaired by Professor Shrikant Lele, Former Director, IIT-BHU & Chairman, LRC, DMSRDE were the key components of the Seminar, which were well appreciated by all the participants, including 12 service officers and Radm. R Viswanathan, VSM, PDSC, ATVP. Professor P Rama Rao, President, TRAERF, Dr. G Malakondiah, Treasurer, TRAERF, Dr. K Bhanu Sankara Rao, Trustee, TRAERF, Professors D Banerjee, LM Manocha, V Ramaswamy, Vakil Singh, RK Mandal, NK Mukhopadhyay, P Venkitnarayanan, Anish Upadhyay, Drs. V Bhujanga Rao, KU Bhasker Rao, MZ Siddique, Vikas Kumar, N Eswara Prasad, AK Ghosh, Manoranjan Patri, Air Comdr. DB Murali, VSM, chaired the various technical sessions. A special report prepared based on the proceedings of AMMTPS-2019 will be submitted to NITI Aayog and DRDO with recommended roadmaps and the salient pointers for future initiatives for advanced materials and materials technologies for Indian Defence.

Dr. Baldev Raj Memorial Bridge Course on Nondestructive Evaluation and Quality Assurance (BRM-BCNQ)

May 20 – 24, 2019, IGCAR, Kalpakkam

Jointy organised by
Indian Society for Non-destructive Testing (ISNT), Kalpakkam Chapter,
Society for Failure Analysis (SFA), Chennai Chapter &
Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam

Scope

Indian Society for Non-destructive Testing (ISNT) Kalpakkam Chapter, Society for Failure Analysis (SFA) Chennai Chapter and Indira Gandhi Centre for Atomic Research (IGCAR) are jointly organising 'Dr. Baldev Raj Memorial Bridge Course on Non-destructive Evaluation and Quality Assurance' (BRM-BCNQ) during May 20-24, 2019 at IGCAR for the benefit of students entering the final year of their B. E./B.Tech/ M.E./M.Tech. The objective of this course is to introduce advanced NDE technologies and more importantly, providing practical hands-on experience in the state-of-the–art NDE equipments available at IGCAR. This bridge course is a step towards capacity building so that the participating students will be able to plan towards a successful career in professions involving NDE and QA. Participation in this bridge course will enable the students to gain all necessary knowledge in the area of advanced NDE, to be able to take up any NDE assignment effectively, be it in research or industry or academics. The course will cover:

Fracture mechanics & Structural integrity
NDE during manufacture & Quality assurance
NDE for in-service inspection
Ultrasonic phased arrays and TOFD
Digital radiography and tomography
Eddy current arrays and imaging
Advances in infrared thermography
Acoustic emission testing
Weld NDE and residual stresses measurement
Corrosion monitoring NDE
Structural health monitoring/ condition monitoring
Signal and image processing & AI
Codes & Standards and reference blocks
Metallurgical failure analysis
Writing reports, procedures & papers
Effective communication and time management

About the Organisers

Indian Society for NDT (ISNT), Kalpakkam Chapter has been in the forefront of the training and certification activities for the past few decades. It has organised courses in almost all major NDT methods. This chapter enjoys all the obvious advantages of being located in Kalpakkam with active members from the Kalpakkam complex that houses IGCAR, Madras Atomic Power Station (MAPS), Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI), BARC facilities and Safety Research Institute (SRI).

Society for Failure Analysis (SFA) was founded to promote, encourage and develop the growth of "Art and Science of Failure Analysis" and to stimulate interest in compilation of a database for effective identification of root causes of failures and their prevention. It organises lectures, discussions, conferences and courses related to failure analysis and provides feedback on failure analysis covering design, materials, manufacturing deficiencies/limitations and maintenance.

Indira Gandhi Centre for Atomic Research (IGCAR), established in 1971, is engaged in broad based multidisciplinary programme of scientific research and advanced engineering directed towards the development of Fast Breeder Reactor (FBR) technology. Various equipment and facilities for NDE of FBR components are established under a single roof in the Kalpakkam complex. IGCAR is a constituent institution of Homi Bhabha National Institute (HBNI, an aided institution of the Dept. of Atomic Energy and a deemed to be University) and has an active academic program.

Who can attend?

This course is open only to students entering the final year of their B.E./ B.Tech or M.E / M.Tech (Mechanical/ Metallurgy/ Materials Science/ Industrial/ Manufacturing/ / Production/ NDT/ Welding Technology) in June/July 2019 in India and learnt/attended basic NDT. *Students completing B.E/B.Tech or M.E / M.Tech in 2019 need not apply*.

Support and arrangements

The expenses to attend the bridge course will be covered by the organisers. The students will be provided suitable accommodation and daily local transport during the course period. The students will also be provided second class train/bus fare to Kalpakkam & back, upon submission of tickets. All participants will be given participation certificates.

Selection procedure

Selection is based on pure merit and proven academic track record. Due consideration will be given to motivated students (see point 8 in Application Form). *Last date for submission of duly filled Application forms is April 15, 2019*.

For details Contact (e-mail preferred)

Dr. C. K. Mukhopadhyay
Convener, BRM-BCNQ
Head, Non-Destructive Evaluation Division
Metallurgy and Materials Group (MMG)
Indira Gandhi Centre for Atomic Research
Kalpakkam, TN- 603 102
Email: ndecourses@gmail.com
Phone: 044 27480500 Extension 23601/ 23602

Dr. BPC Rao
Chairman, BRM-BCNQ
Associate Director, Fast Reactor Fuel Cycle Facility (FRFCF)
Indira Gandhi Centre for Atomic Research
Kalpakkam, TN – 603 102
Email: bpcrao@igcar.gov.in
Phone: 044 27480500 Extension 37063

Dr. Baldev Raj
(1947-2018)

Padma Shri Dr. Baldev Raj (1947-2018), was the former Director of Indira Gandhi Center for Atomic Research (IGCAR), Kalapakkam and the Former Director, National Institute of Advanced Studies (NIAS), Bengaluru. He was an eminent nuclear scientist, material technologist, academician and a mentor to thousands of scientists and students. He had built a high level of expertise, individuals and facilities in domain of fast reactor sciences & technology and associated fuel cycle facilities in India in synergy within the Department of Atomic Energy, Universities, Research Centres, Industries, etc. He provided the umbrella under which scientific work in many areas including non-destructive evaluation (NDE), nuclear materials development, physical and mechanical metallurgy, welding science & technology, corrosion science & engineering, separation science & technology, liquid sodium science & technology, mechanics, safety research, electronics & instrumentation, materials science, sensors, nanoscience & technology, robotics & automation flourished at IGCAR.

Dr Baldev Raj initiated and nurtured NDE and QA capabilities at IGCAR. He provided innovative solutions to challenging NDE problems not only for the nuclear industry but also other core and strategic industries. He ignited the minds of his colleagues and motivated the professionals to collaborate for the development of a variety of path breaking methodologies and technologies for health care and heritage objects and structures. He was a fellow of the four Academies of Science, and Engineering in India, German Academy of Sciences, Third World Academy of Sciences, International Medical Sciences, ASM International and The Indian Institute of Metals. He led several professional bodies including Indian Society for NDT. He won several recognitions and awards and guided several PhDs. Dr. Baldev Raj was a visionary leader in science and technology and more importantly, a human being par excellence. In his fond memory, Dr. Baldev Raj Memorial Bridge Course on NDE and QA is conducted every year at IGCAR.

Application Form for Life Membership

Society for Failure Analysis

Society for Failure Analysis
C/O Regional Centre for Military
Airworthiness(Materials), CEMILAC
Kanchanbagh, Hyderabad - 500058

Phone: 040-24006604 / 24340750
Fax: 040-24341827
E-mail: sfaindia2015@gmail.com
Website: www.sfaindia.org

Affix Recent Good quality Passport Size Photo

Please √ applicable ☐ **Life Member**

1. **Title: Dr/Shri/Ms/Mrs.**
2. **Name in Block Letters:**
   First Middle Last
3. **Name as you would like it on the Membership card:**
   (max. 25 letters including spaces)
4. **Date of Birth:**
5. **Present Occupation /Designation and Correspondence Address:** Phone: Mobile: Fax: Email:
6. **Academic & Professional Qualification:**
7. **Professional Experience:**
8. **Endorsement by SFA Member:**

Name	Membership No.	Signature

9. **Primary Field of Interest** (please mark 1, 2, 3 in the in order of preference):

Strategic ☐	Power ☐	Foundry ☐	Welding ☐	Heavy Industry ☐	Transport ☐
Design & Failures ☐	Quality control ☐	Petrochemical ☐	Consultancy/ Services ☐	Materials & Manufacturing ☐	Education ☐

10. **Name of the Chapter you intend to be attached:**

Bengaluru ☐	Chennai ☐	Coimbatore ☐	Hyderabad ☐	Jamshedpur ☐	Kanpur ☐
Koraput ☐	Mumbai ☐	Trichy ☐	Vizag ☐	Warangal ☐	

11. **Subscription Fees:** Rs. 2000/- (Two thousand Rupees only) - One Time
    - Payment made by DD shall be in favour of "**Society for Failure Analysis**", **payable at Hyderabad** **OR**
    - Details for online payment: **Account No. 20495800082, IFSC Code: ALLA0211473**
      Bank Name: Allahabad Bank (Branch Name: Hyderabad Santosh Nagar), PAN: AAGAS3562G

    11.1 **If Payment made by DD give details:**
    D.D. No. and Date
    Bank Name Branch
    11.2 **If Payment made by Online:**
    - Transaction No. & Date:
    - Copy of the Transaction Receipt Enclosed: Yes / No

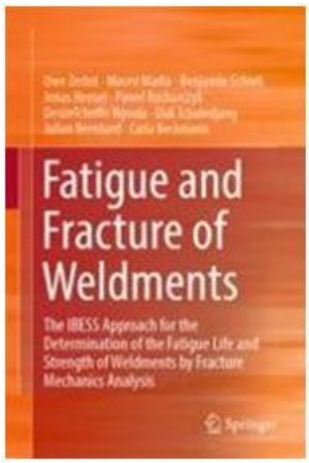
12. **Declaration by the Applicant**
    If elected, I agree to accept and abide by the Rules & Regulations/ Terms &Conditions of Society for Failure Analysis and to promote its aims and objects.

Signature of the Applicant

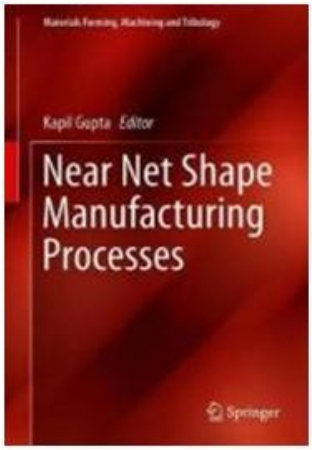
13.

Office Use Only					
Membership No.		Date of Enrolment		Chapter	
Amount Paid(Rs.)		Receipt No. /Date			

Books



Uwe Zerbst, Mauro Madia, Benjamin Schork, Jonas Hensel, Pawel Kucharczyk, DesireTchoffo Ngoula, Didi Tchuindjang, Julian Bernhard, Carla Beckmann
Publisher: Springer International Publishing
This book provides a comprehensive and thorough guide to those readers who are lost in the often-confusing context of weld fatigue. It presents straightforward information on the fracture mechanics and material background of weld fatigue, starting with fatigue crack initiation and short cracks, before moving on to long cracks, crack closure, crack growth and threshold, residual stress, stress concentration, the stress intensity factor, J-integral, multiple cracks, weld geometries and defects, microstructural parameters including HAZ, and cyclic stress-strain behavior. The book treats all of these essential and mutually interacting parameters using a unique form of analysis



Near Net Shape Manufacturing Processes: Editors: Gupta, Kapil (Ed.) This book covers the mechanism, salient features, and important aspects of various subtractive, additive, forming and hybrid techniques to manufacture near net-shaped products. The latest research in this area as well as possible future research are also highlighted

Current Trends in Boriding Techniques
Authors: Kulka, Michal
This book presents the most important thermochemical and physical techniques of boriding. The formation and characterization of different boride layers or boride coatings are compared in this book. The author analyzes the technological aspects of boriding processes, presenting the advantages and disadvantages of each method. The effect of the boriding techniques on the microstructure of borided materials is also indicated. The mechanism of formation of active boron atoms or ions and the phenomena during re-melting of alloying material together with the substrate are described. Special attention is devoted to powder-pack boriding, electrochemical boriding in borax, gas boriding, plasma gas or paste boriding and laser or plasma surface alloying with boron, acknowledged as the most important current methods in boriding. The thermodynamics of gas boriding is also analyzed.

Events in the pipeline

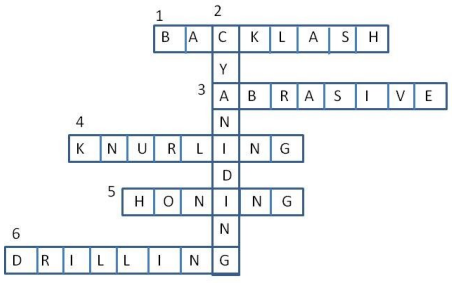
ICEFA 2019 : International Conference on Engineering Failure Analysis, France, October 29 - 30, 2019

The third International Conference on Structural Integrity ICSI2019 will take place in Madeira, Portugal, 2-5 September 2019.The event will take place at Hotel Casino Park.Symposia list availability was updated as follows:

A. Fatigue Crack Growth – experimental, theoretical and numerical approach organized by Grzegorz Lesiuk;
B. High Strain Rate Testing of Engineering Materials and Structures organized by José Xavier, Giuseppe Catalanotti, Hannes Koerber and Fabrice Pierron
C. Structural Health Monitoring organized by Hernani M. R. Lopes, José V. Araújo dos Santos, Pablo Moreno-García
D. International Symposium on Structural Integrity of iron&steel Bridges (ISSI-Bridges 2019) organized by Stéphane SIRE, Grzegorz LESIUK, José A.F.O. CORREIA
E. NDE methods and techniques serving structural integrity assessment organized by Peter Trampus, Paulo Tavares
F. Degradation Mechanisms in the Operation of Metal Structures organized by Vladimír Chmelko, Miloslav Kepka

For more details, check **www.icsi.pt**

Answers to cross word:



Across
1 form of error
3 material causing rough surface
4 process to provide rough surface in components
5 to achieve good surface finish
6 machining to produce hole

Down
2 poisonous heat treatment

Events by SFA

1) Understanding failures in Engineering materials @ Tyagarajar college of Engg., Madurai, July, 2019
2) National conference on Failure Analysis (NCFA 2019): 18-19, Oct. 2019; venue to be announced.
3) Engineering Failures- Characterisation & Prevention" @ IIT Kharagpur, Date and venue to be announced.

We are on the Web now!
Please visit www.sfaindia.org

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To

From
Society for Failure Analysis (SFA)
C/O Centre for Military Airworthiness & Certification, RCMA,
Kanchanbagh
Hyderabad-550058