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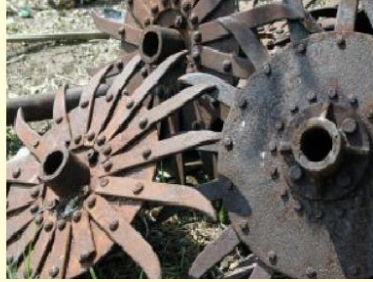

Welcome to UTMIS autumn course
Volvo Cars, Gothenburg
15-16 October, 2019

Fatigue, Damage and Failure of Composite Materials

Mechanisms, fatigue life diagrams, and life prediction

Prof. Ramesh Talreja, Texas A&M University

UTMIS Autumn Course
15-16 October, 2019

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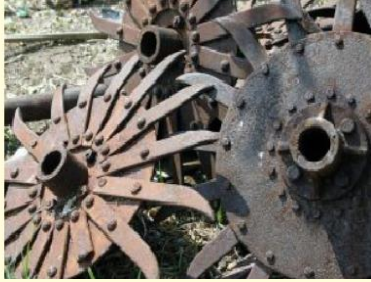

Agenda	
Day 1 – 2019-10-15	
09:00-09:30	Registration and coffee
09:30-10:00	Presentation of Volvo Car Corporation
10:00-11:30	Introduction: “Big picture” of cost-effective design of composite structures. Role of manufacturing defects in composite failure. Failure modes in tension, compression and shear. Modeling strategies: phenomenological vs. mechanisms-based.
11:30-12:30	Lunch
12:30-14:00	Fatigue life diagrams (FLDs) as a means of conceptual interpretation of fatigue in unidirectional composite materials. Roles of fibers, matrix and interfaces.
14:00-14:30	Coffee
14:30-16:00	FLDs for composite laminates. Cross ply laminates, angle ply laminates, quasi-isotropic and general laminates.
16:00-17:00	Activity organized by Volvo Cars
19:00-	Dinner at Hotel Post in Gothenburg

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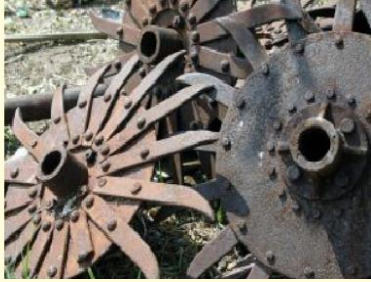

Agenda	
Day 2 – 2019-10-16	
08:30-10:00	Fatigue life prediction. Assessment of phenomenological models and commercial codes. Mechanisms-based modeling. Damage evolution. Critical damage states. Failure criteria.
10:00-10:30	Coffee
10:30-12:00	Damage mechanics. Multi-scale models. Reliability and statistical considerations.
12:00-13:00	Lunch
13:00-14:30	Damage tolerance. Structural health monitoring. Cost-effective design. Sustainability.
14:30-15:00	Coffee
15:00-16:00	Closure
16:00	End of course

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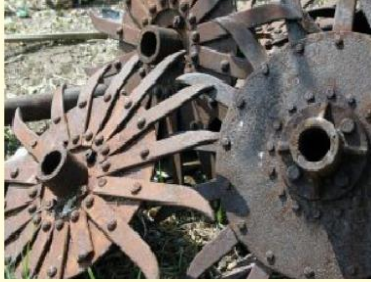

UTMIS program för 2020:

Års- och nätverksmöte:
Tid och plats: 4-5 februari hos Epiroc, Örebro.
Tema: Doktorandprojekt

Vårmöte:
Tid och plats: 5-6 maj hos Gränges, Finspång.
Tema: Termomekanisk utmattning

Höstkurs:
Tid och plats: 21-22 oktober hos LiU, Linköping.
Tema: "Advanced Fatigue design: why local is better"
Talare: Filippo Berto, NTNU

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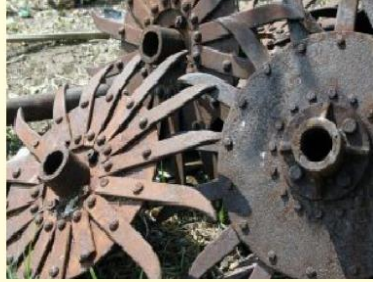

Hotel recommendations

- Clarion Hotel Post, 60 rooms are pre-booked, 1450 SEK per room and night incl. breakfast. Booking number 2099GR029532, credit card guarantee needed, reserved rooms are available until 15 September.
- The hotel is close to the railway station and buses to Volvo Cars.
- The conference dinner will be at Clarion Hotel Post. Rooms are available 14 to 16 October.

Conference location

The course will be held in the PVD building at Volvo Cars, Volvo Jakobs väg 17 in Göteborg. Entrance to the PVD reception is at the south side of the building.
The closest bus stop is Volvo Torslanda PV. Please visit www.vasttrafik.se for more information about buses. Note that tickets cannot be bought on board the buses.
There are a few guest parking lots outside the building, register in the reception. Parking in the parking houses is free.

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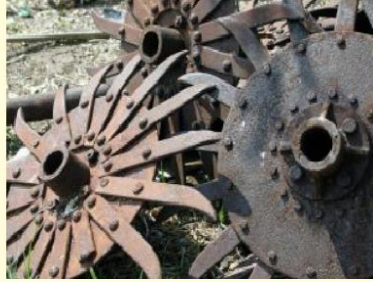


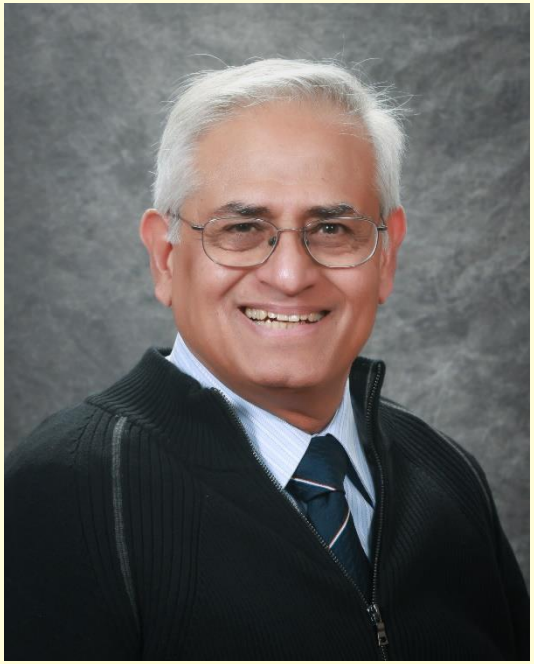
Short Course for UTMIS (The Swedish Fatigue Network):

Fatigue, Damage and Failure of Composite Materials

Mechanisms, fatigue life diagrams, and life prediction

Prof. Ramesh Talreja, Texas A&M University

Short bio:
Dr. Ramesh Talreja is currently Tenneco Endowed Professor in the Department of Aerospace Engineering and in the Department of Materials Science and Engineering at Texas A&M University. Prior to that, 1991-2001, he was a professor of aerospace engineering at Georgia Institute of Technology. His career in composite materials began at the Technical University of Denmark where he earned his PhD in Solid Mechanics in 1974 and was endowed with a Doctor of Technical Sciences degree in 1985 on his collected contributions to fatigue and damage mechanics of composites. Dr. Talreja has published extensively in the composite materials field. He has written the first-ever monograph on fatigue of composites in 1987 and since then 35 books and book chapters, given over 240 invited presentations at conferences, universities and industry R&D organizations, taught over 20 short courses, and is or has been on Editorial Boards of 18 international journals as well as has served as Editor-in-Chief of International Journal of Aerospace Engineering and as Associate Editor of Mechanics of Materials journal. He is the recipient of the 2013 ICCM Scala Award and World Fellow and Life Member of ICCM. The American Society for Composites selected him for the 2017 Outstanding Researcher Award. His current interests are in cost-effective and sustainable design of composite structures.



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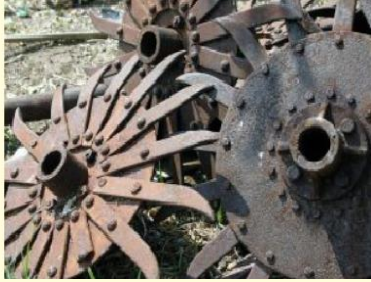

Fatigue, Damage and Failure of Composite Materials

Mechanisms, fatigue life diagrams, and life prediction

Composite materials continue to expand in applications from aerospace structures to automotive and wind energy sectors. At the same time, the manufacturing techniques have broadened from prepreg based tape laying to a variety of resin infusion methods such as resin transfer molding (RTM) and its vacuum assisted version (VARTM). Contrary to metals, the role of manufacturing induced defects in failure of composites is vital. This two-day course will emphasize the understanding of mechanisms underlying the failure of composite materials, in particular under fatigue loading. A critical assessment of phenomenological failure theories will be made and a mechanisms-based approach will instead by advanced. Fatigue life diagrams, introduced by Talreja as a means of interpreting the roles of fibers, matrix and interfaces in composites will be discussed and advanced concepts of damage mechanics will be described to predict fatigue life. Damage tolerance, structural health monitoring and cost-effective design will also be discussed at the end of the course.

Lectures:

1. Introduction: “Big picture” of cost-effective design of composite structures. Role of manufacturing defects in composite failure. Failure modes in tension, compression and shear. Modeling strategies: phenomenological vs. mechanisms-based.
2. Fatigue life diagrams (FLDs) as a means of conceptual interpretation of fatigue in unidirectional composite materials. Roles of fibers, matrix and interfaces.
3. FLDs for composite laminates. Cross ply laminates, angle ply laminates, quasi-isotropic and general laminates.
4. Fatigue life prediction. Assessment of phenomenological models and commercial codes. Mechanisms-based modeling. Damage evolution. Critical damage states. Failure criteria.
5. Damage mechanics. Multi-scale models. Reliability and statistical considerations.
6. Damage tolerance. Structural health monitoring. Cost-effective design. Sustainability.

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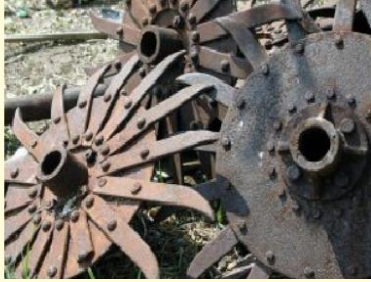

Additional information

- The course is given in English

Lecturers at the UTMIS autumn courses

- **2001: Prof. K J Miller**, UK, *Fracture mechanics and crack propagation*
- **2002: Prof. R Pippan**, Austria, *Material science for fatigue and fatigue life prediction*
- **2003: Prof. G. Cailletaud**, France, *Stress calculation for fatigue*
- **2004: Prof. Y Murakami**, Japan, *Metal fatigue – fundamentals and applications*
- **2005: Prof. M W Brown**, UK, *Multiaxial Fatigue*
- **2006: Prof. Tim Davis**, UK, and Prof Bo Bergman, Chalmers, *Failure mode avoidance*
- **2007: Prof. Darrell Socie**, USA, *Fatigue made easy*
- **2008: Prof. Grzegorz Glinka**, USA, *Fatigue Design of Welded Structures*
- **2009: Prof. Michael Vormwald**, Germany, *A short crack growth approach to fatigue assessment*
- **2010: Prof. Dr. Cetin Morris Sonsino**, Germany, *New Local Concepts for the Design of Welded Joints-Industrial Applications*
- **2011: Prof. David Nowell,** UK, *Contact Fatigue – Initiation and growth of short cracks in complex stress fields*
- **2012: André Bignonnet,** France, *Fatigue Load Analysis course*
- **2013: Prof. Jim Newman**, USA, *Fatigue and Fracture Workshop*
- **2014: Prof. Gunnar Härkegård,** Norway, *Fatigue analysis of notches, defects and cracks*
- **2015: Prof. Ulrich Krupp,** Germany, *Very high cycle fatigue and the fatigue limit: significance of microstructurally short fatigue cracks*
- **2016: Prof. Ali Fatemi,** USA, *Fatigue of materials and applications to design*
- **2017: Dr. Thomas Svensson,** Sweden, *Statistical aspects on fatigue testing, modelling and design*
- **2018: Hans Ansell,** Sweden, *Structural Integrity and Service Life Assessment of Airplanes*
- **2019: Prof. Ramesh Talreja,** USA, *Fatigue, Damage and Failure of Composite Materials-Mechanisms, fatigue life diagrams, and life prediction*