Short Course

April 2025

High-Performance Composite Structures and Components

- Materials, Design and Manufacturing Techniques:



Location : at Client

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Aim and Overview

Mills Carbon Design

An Advised DESIGN PROCEDURE for Components using Structural Composites Al stages to provide an Effective and both Cost and Weight Efficient result Andrew Milks Matt Dawson, Krutarth Jani A case study is provided and each step of the Structural

 The three-day course provides an understanding of how to design and manufacture components and structures using polymer composite materials.

Design and Design for Manufacture process is explained

- It suits both inexperienced young engineers and experienced engineers seeking more detailed knowledge of design and manufacturing with polymer composite materials.
- Case studies from the aircraft, automotive, sports equipment and marine sectors are used throughout with practical demonstration of manufacturing processes if desired.
- The course is focused on concept and detail design, materials and manufacturing technology, but also includes the usage and application benefits of stress analysis tools.
- The course fee includes unlimited usage of both; an on-line design guide for lightweight structures and components, and an on-line materials and process selection tool which compares application weight and manufacturing cost using the range of selected materials and processes.
- The presenter, following experience in the 1980's with Airbus UK on carbon fibre structures development and a Tier 1 carbon fibre component supplier has been at Cranfield for 33 years running UK Gov and industrially funded research projects focused on improving design and manufacturing of light-weight structures using high-performance composites. Now independent, he is helping UK design and manufacturing companies.

Scope and Topics:

Mills Carbon Design =

- Benefits of using high performance composite materials using case studies
- Materials forms fibres, plastics and core materials
- Processing requirements and targets
- Materials and process technique selection through application requirements
- High-rate manufacturing techniques
- Manufacturing techniques for weight optimised high-performance structures
- Thermoplastic composites manufacturing
- Materials and process selection engineering tool demonstration with manufacturing cost and weight comparisons
- Joining and assembly best practice joint design and assembly techniques
- Mould tool design and materials
- The design process Explanation and demonstration of the stages of structural design from application concept to manufacturing instructions
- Case studies of best practice design and manufacturing from the automotive, motorsport, aerospace, marine, wind energy and sports equipment sectors
- Manufacturing process demonstrations if requested
 - Prepreg lay-up and vacuum infusion

Mills Carbon Design

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Design Guide

An Advised DESIGN PROCEDURE for Components using Structural Composites

21 stages to provide an Effective and both Cost and Weight Efficient result

Andrew Mills, Matt Dawson, Krutarth Jani

A case study is provided and each step of the Structural Design and Design for Manufacture process is explained

Stages - from Initial Concept to Serial Manu	Mills Carbon Design		
Design Conception	Slide Number		
1. Working out the requirements & loads – worst cases	38		
2. Define the shape – available space, styling CAD model	41		
3. Decide how to split it up and assemble it – how many parts	57		
4. Working out how the structure works and decide how to stiffen it	65		
 – simple skin, beams, stiffeners, sandwich panels 			
5. Define the deflection limits	89		
6. Decide how to mould it	94		
7. Decide what type of plastic	103		
8. Select the reinforcement type	105		
9. Work out what fibre directions are needed for the loadings – the lay up	113		
10. Work out initial laminate thicknesses	117		
11. Work out how it will be attached and assembled	136		
Design refinement			
12. Detailed strain analysis and lay up detailing	162		
13. Lay up definition for manufacturing – material drape consideration	167		
14. Add extra reinforcement for bolted points and edges	173		
Manufacturing			
15. Specify materials types with suppliers	175		
16. Mould tool design	176		
17. Manufacturing drawings	207		
18. Build and assess structural details & validate prototype with client	210		
19. Update design & manufacturing technique	213	3	
20. Manufacturing Process Flow Definition	214		
21. Set up manufacturing facility	215		



Materials and Process Selection Software Tool

https://www.prosel.co.uk/

PROSEL

 Selection of suitable composite M&Ps by interactively working through new applications design and manufacturing requirements

PROSEL provides:

- Capable materials and processes
- Component weight and manufacturing cost

comparison for each recommended M&P option

1st Stage Design Page

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			Meanlain Ref.	
STAGE 1: PART FUNCTION			Subaran Materian	
Part definition			 Chopped Carbon Size - automated preforming by wired New "parameter 20 Process, Peerls Transfer Mounting (RTM - InARTM) 	theat in
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Wills Carbon Design

A world-first interactive design tool developed within the UK Composites Industry Cluster CIC

Home Screen



PROSEL Output Page Example

Name		Process	Weight	TooName	Tool cost	Libeur	Material cest	Te5
Autoria and DD	ted UD Tape Lay Up 1 730	Preprez Compression Moulding	3.8	Type6 - Double sided steel press tool - Prepreg or Wet Pressing	-04	4.6	£ 189	£ 201
CFSNC AMC	High FoF plus filer Quantum	Modding compounds Press Moulding	5.9	Type11 - Harshened mutched earlace elect - CPEMC	£ 10	\$2.	£ 243	£. 256
Gott St	NH CB1200	Prepreg Compression Moulding	5	Typed - Double alded also press tool - Prepreg or Wal Pressing	2.0	6.0	£ 503	E 521
	shopped PP thickness Jmm	No.iding sompounds Press Moulding	6	Type11 - Hordered matched surface elect - CFSMC	£ 10	42	£ 153	£ 165
NCF		Compression RTM (asa (Eap RTM) with automated preforming	48	Type15 - Compression RTM or HP RTM - precision aligned and sealed tools	8.54	63	£ 99	£ 116
NCF		High Pressure RTM with Automated Preforming	4.8	Type13 - Compression RTM or HP RTM - precision aligned and sealed tools	£ 14	13	8 102	E 119
Signal NCF Hy	in (inconstituted) Onopped I UD and 50% 50%	Compression RTM (also Gep RTM) with automated preforming	5.6	Type15 - Compression RTM or HP RTM - precision aligned and availed tools	6.14	a	619	1.41
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Woven		Compression RTM (ake Gep RTM) with automated preforming	8.1	Type10 - Compression RTM or HP RTM - precision aligned and sealed tools	£14	6.4	E 128	E 144
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