Composites Design and Manufacturing Workshop

"Future vision of opportunities in Composites Design and Manufacturing"

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THEMATIC DISCUSSIONS REPORT

Responsible:

Fellipe Sabat
Project Portfolio & Partnerships Coordinator
CISB – Swedish-Brazilian Research & Innovation Centre
Phone: +55 11 4314 9466

Summary

Group 1: Multi-functional composites

Challenge: 1) Controlling the dispersion and interactions in nanostructured composites;
2) Self-healing composites

Participants:

Name	Institution	Contact
Danilo Carastan (Leader)	UFABC	danilo.carastan@ufabc.edu.br
Marcello Menezes Eifler	Brazilian Army	agich@dct.eb.mil.br
Pontus Nordin	Saab Group	pontus.nordin@saabgroup.com
Rosario Castro	Lindholmen Science Park	rosario.castro@lindholmen.se

Ideas	• Intelligent coating materials (I.e. electrical conducting, IR), such as functional paints and pre-manufactured coatings based on thermoplastics and nanoparticles; • Damage tolerant composites; • Nano-engineered carbon fiber reinforced polymers for tough mechanical applications.
Applications	• Aircraft Industry; • Army (To increase durability in vehicles, armor and other devices).

Project Structure	• Stakeholders;
	  ○ Academia: UFABC, Military Engineering institute (IME), Army's Department of Science and Technology (DCT);
	  ○ Industry: Saab, Composite Manufacturing Industry
	• Next Steps.
	  ○ Follow-up meetings

Group 2: Manufacturing process modelling

Challenge: Predict manufacturing induced defects as a function of the manufacturing parameters and experimentally characterize their effect on strength

Participants:

Name	Institution	Contact
Clovis Eca Ferreira	Embraer -	eca@embraer.com.br
Fábio Musetti de Souza	Brazilian Army	agiadj4@dct.eb.mil.br
Maria Weiland (Leader)	Saab Group	maria.weiland@saabgroup.com;maria.weiland@saab.se
Nicolino Foschini	ESI GROUP	nfo@esi-group.com
Plínio Stocco Muniz	Inbra Aerospace	plinio.stocco@inbraaerospace.com.br
Ragnar Larsson	Chalmers	ragnar.larsson@chalmers.se
Renato Leão De Lello	UNIFEI	renato.lello@unifei.edu.br
Stefan Jakobsson	FCC	stefan.jakobsson@fcc.chalmers.se
Thomas Lundholm	KTH	thomas.lundholm@kth.se

Ideas	• Certification of the Surface manufactured; • New simulation tools.
Applications	• People very Experienced with the process that do not know computer Modelling; • Software to calculate the porosity that grows during the cure of resin.

Project Structure	• Partnership Between Universities and Companies for modelling prepeg Lay-up;
	  ○ Simulating issues (controlling the process with on-line measurements)
	  ○ Simulation tool development
	  ○ Model of technology challenges: overlaps and gaps
	• Stakeholders.
	  ○ Industry: Saab, Embraer and Inbra
	  ○ Universities: To be determinated

Group 3: Design and design optimization

Challenge: Optimize the stacking sequence for a laminate subjected to stiffness and strength requirements. The current design guidelines (10% rule, use of 0, 90, 45 and -45 degrees orientation only, number of repeated plies, etc) should be further evaluated.

Name	Institution	Contact
Alexander Westerhagen	Saab Group	alexander.westerhagen@saabgroup.com
Dan Zenkert (Leader)	KTH	danz@kth.se
Felipe Franzoni	Embraer	felipe.franzoni@embraer.com.br
Fredrik Winberg	Biteam AB	f.winberg@biteam.com
James Rojas Waterhouse	USP - EESC	waterhouse@uol.com.br; james@sc.usp.br
José Everardo Baldo Junior	Institute for Technological Research	josebaldo@ipt.br

Ideas	• Multi-disciplinary optimization;
	  ○ Performance
	  ○ Material selection
	  ○ Manufacturing
	  ○ Cost
	• Manufacturing process development;
	• 3D Weaving;
	  ○ Pultrusion
	  ○ High toughness matrix systems
	• Technology transfer between different application areas.

Applications	• Prefebly wide;
	  ○ Aerospace
	  ○ Automobile
	  ○ …
	• Solutions for high stress areas.

Project Structure	• To Be further Discussed.

Group 4: Fatigue

Challenge: review the current design practices to design components prone to fatigue.

Participants:

Name	Institution	Contact
Amauri Gavazzi	Embraer	
Anders Johansson	Saab Group	Anders.a.Johansson@saabgroup.com
Gustavo Miranda Guimarães	Embraer	gustavo.guimaraes@embraer.com.br
Luiz Cláudio Meniconi	Petrobras/Cenpes	meniconi@petrobras.com.br
Tonny Nyman (Leader)	Saab Group	tonny.nyman@saabgroup.com
Walter Jesus Paucar Casas	UFRGS	walter.paucar.casas@ufrgs.br

Ideas	• Simplified models for dimensioning and analysis to increase the allowables loads; • Reliable monitoring systems; • Damage assessment and corrective actions.
Applications	• Aerospace; • Underwater systems (oil and gas included); • Land vehicles; • Ships.
Project Structure	• To Be further Discussed.

Group 5: Design and Manufacturing

Challenge: include manufacturing aspects (process limitations, ply drop offs, draping, manufacturing induced defects, etc) to the design procedure.

Participants:

Name	Institution	Contact
Evandro Benedetti Sant'Ana	Inbra Aerospace	evandro.benedetti@inbraaerospace.com.br
Felicia Lai Jakobsson	Saab Group	felicia.lai.jakobsson@saabgroup.com
Fernando C. Ferraz	Akaer	fernando.ferraz@akaer.com.br
Kerstin Johansen	Linköping University	kerstin.johansen@liu.se
Lars Sjostrom (Leader)	Saab Group	Lars.Sjostrom@saabgroup.com
Pontus de Laval	Saab Group	pontus.delaval@saabgroup.com
Sérgio Frascino de Almeida	ITA	frascino@ita.br/sergio.frascino@gmail.com

Ideas	• Bridge the gap between design and manufacturing;
	• Enable designers to use the potential of composites, not only change the material;
	• Revise the design criteria and philosophy in order to achieve more suitable solutions for composite processes;
	• Composites development from 2D to 3D structures;
	• Improve use of 3d arrangement in order to mitigate parts & function.
	Project Ideas:
	1. Off the shelf solution for automated composite manufacturing
	  • Ongoing project, LiU can send PhD to Brazil
	  • Interested so far: Inbra, LiU, Saab
	2. Collaborative multidisciplinary design optimization in preliminary design
	  • Ongoing project, LiU can send PhD to Brazil
	  • Interested so far: ITA, LiU, Saab, Akaer
	3. Composite materials and flexibility design for manufacturing and assembly
	  • Research environment exist in at LiU, Possible accommodation of Brazilian researcher into this group
	  • Interested so far: ITA, LiU, Saab
	4. Widen mindset of engineers to integrate design and manufacturing
	  • How to: share data, communicate and integrating requirements.
	  • A more educational project
	  • Interested so far: ITA, LiU, Akaer

Applications	
Project Structure	• To Be further Discussed