STEERING LIMITATIONS FOR IN-SITU AUTOMATED FIBRE PLACEMENT MANUFACTURED STRUCTURES

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Lukas Raps – **"Steering Limitations for in-situ Automated Fibre Placement manufactured Structures"** Date, Time, Room



Dr. Ashley Chadwick – "Cryogenic Hydrogen Storage in thermoplastic Composite Vessels" Date, Time, Room

Fynn Atzler – **"Rapid Production of Complex Composites: Combining Fused Granular Fabrication and AFP"** Date, Time, Room

Simon Hümbert – **"title"** Date, Time, Room

Thermoplastic Composites for Complex Geometries







- Out-of-autoclave manufacturing
- Dustfree assembly \rightarrow welding
- Repairability
- Impact toughness
- Advantageous permeability properties







Cylindrical section \rightarrow single curved

1. Straight 45 ° ply



Name des Vortragenden, Institut, Datum







Complex section \rightarrow double curved

2. Theoretical steered ply



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4. Optimised layup strategy



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In-situ AFP





Nip-point temperature*	470 °C
Consolidation force	500 N
Roller hardness	Shore A 60
Tool temperature	20 °C
Layup speed	125 mm/s



* System process parameter measured using a thermocamera and an emissivity coefficient of ϵ = 1

Lukas Raps, Institute of Structures and Design, 01.08.2023

Study scope

- Steering radii 4000 mm 200 mm
- Suprem CF/LM-PAEK ¹/₂ " prepreg tape
- Substrate
 - In-situ AFP laminate
 - Pressed laminate
- Analysis Methods
 - Flexible ruler and Caliper measurements
 - GOM
 - Profilometer



Preliminary experiments



- Layup on in-situ AFP substrate
- Steering radii 2000 mm 200 mm
- Flexible ruler and Caliper measurements
- Profilometer scans





Course of Steering Tracks

1. Pile up at inner radius

 Piled-up tape rolled over, wrinkles form





Critical arc length





Steering on pressed substrates

- Layup on pressed laminates
- Steering radii 4000 mm 500 mm
- GOM scans and analysis





Critical arc length





Consolidated Tape width





Tape boundaries and center curve





Tape boundaries and center curve





Conclusion



- Defects occur at any steering radius
 → no critical steering radius defineable
- Critical arc length can be quantified
- Further investigation
 - tape width changes during steering
 - 1/4 inch tape
 - Mechanical properties



Thank you for your attention

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Impressum



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