

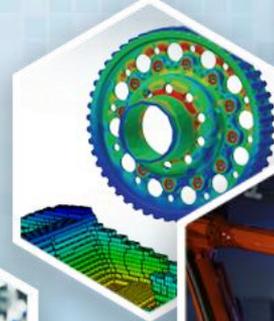
Welcome to the Digital Twin IACMI Working Group

Johnathan Goodsell

Purdue University

October 8, 2020

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composites software for
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Working Group Meeting Rules/Guidelines



- ◆ **Format includes an introduction and opening presentation from the meeting leader(s)**
- ◆ **All participants will be muted once the presentation starts**
 - ◆ Remain on mute unless you wish to speak. You will need to unmute yourselves to speak. Please re-mute yourself after speaking.
 - ◆ If you are on the meeting via phone, use *6 to unmute and re-mute
- ◆ **The platform allows for live polls**
 - ◆ One poll may be for meeting frequency
 - ◆ Other polls may be created by the leaders or in live time based on input

Consortium Working Groups



- ◆ **Mission** – Increasing computing power is changing the world of design and simulation. It is becoming possible to model materials at multiple scales and associated manufacturing processes to aid in decision making. The ability to create "digital twins" of physical reality points toward integrating such tools into future manufacturing lines using Industry 4.0 technologies and Machine Learning. What demonstrations can help validate this shift? Where can IACMI and industry work together to accelerate this transformation?
- ◆ **Formation**
 - ◆ Participants interested in composites design modeling and simulation
 - ◆ Participants include industry, academia, government
 - ◆ Elect chair, meet more often than yearly
 - ◆ Opportunity to align with external entities (NAFEMS, AIAA, Conferences)

◆ Principal Activities

- ◆ Identify key technical and cost challenges in simulation
- ◆ Conduct needs assessment specific to composites simulation software
- ◆ Conduct evaluations of commercial software tools available
- ◆ Propose round robin software tool comparisons
- ◆ Report activities and successes at IACMI member meetings and other forums, including trade press and conferences
- ◆ Engage funding agencies and industries to support R&D needs

What is the Digital Twin Working Group?



◆ Scope of the Digital Twin working group

- Evaluation and development of simulation of composites manufacturing and performance
- Develop virtual design allowables
- Make simulation accessible to the composites supply chain

◆ Digital Twin working group objectives

- Integrating digital twin technology into future manufacturing using Industry 4.0 technologies and Machine Learning.

- ◆ **What is model based engineering? – Don Farr, Boeing**
- ◆ **What is the digital twin?- R. Byron Pipes, Purdue**
- ◆ **What is integrated computational materials engineering? – Josh Dustin, Boeing**

The Digital Twin in Composites Manufacturing



- ◆ High rate manufacturing processes:
 - ◆ Additive manufacturing with extrusion deposition
 - ◆ Compression molding of hybrid SMC and prepreg platelet systems
 - ◆ Compression sheet forming
 - ◆ Resin transfer molding
 - ◆ Hybrid molding
 - ◆ Pultrusion
 - ◆ Filament winding
 - ◆ Prepreg autoclave molding

Meeting Frequency



◆ Should this group meet virtually and if so, how often.

◆ Quarterly (4x per year)

- ◆ IACMI virtual member meeting - week of February 15, 2021
- ◆ May 24-27, 2021
- ◆ IACMI (virtual?) meeting Detroit – week of July 19, 2021
- ◆ October 18-21, 2021

◆ Bi-monthly (6x per year)

- ◆ Four meetings above plus two additional meetings

◆ Monthly (12x per year, or 11x if December skipped)

- ◆ Four meetings above plus virtual in other months



CVF Material

This takes a multiscale, building-block approach to developing material models from microscale constituents, mesoscale continuous and discontinuous structures, to homogenized global response.

CVF-Material is part of the Composites Virtual Factory™, developed at Purdue University in the [Composites Manufacturing & Simulation Center](#) with funding from the US Department of Energy as part of the Institute for Advanced composites Manufacturing Innovation.

For more information on design, modeling, and simulation of composites, visit the Composites Design and Manufacturing HUB at cdmhub.org.

Tutorial

Use the Materials page to create basic materials. Basic materials could be fibers, polymers, fillers, etc...

Use the Continuous page to create continuous fiber material definitions. This consists of a fiber material, matrix material, and fiber volume (or weight) fraction. Swipe right to view computed effective properties!

Use the SFRP page to create short fiber reinforced plastics-like material definitions. This consists of a fiber material, matrix material, optional filler material, and fiber volume (or weight) fraction. Additionally, the fiber orientation state in terms of the orientation tensor diagonal components must be given. Aligned = (1, 0, 0), Planar Random = (0.5, 0.5, 0), 3D Random = (0.33, 0.33, 0.33). Swipe right to view computed effective properties!

Use the Laminate page to define simple laminates based on a Continuous material definition. Swipe right to view computed effective properties!

Test on Apple Devices! Get TestFlight by Apple



<https://apps.apple.com/us/app/testflight/id899247664>

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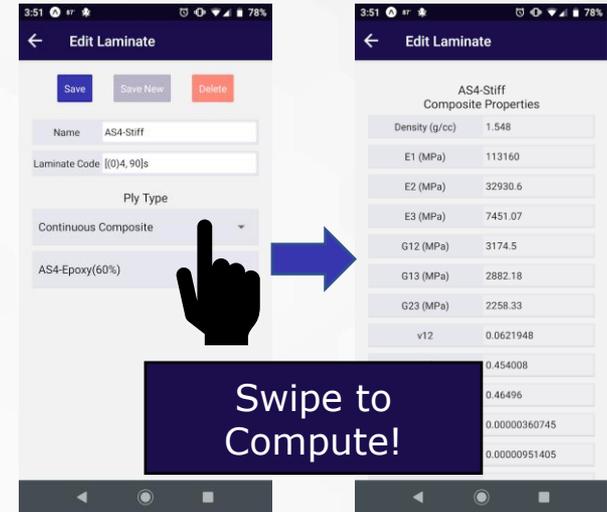
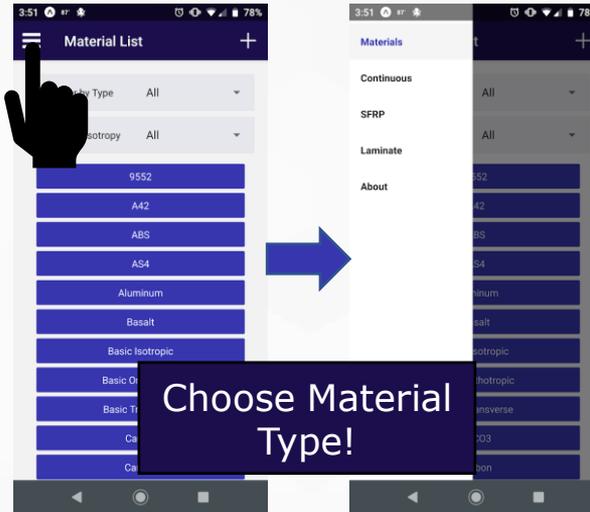


<https://testflight.apple.com/join/UbCfcFcd>

Test on Android from Play Store!



<https://play.google.com/store/apps/details?id=com.cvf.material>





**Thank you for
attending!!**