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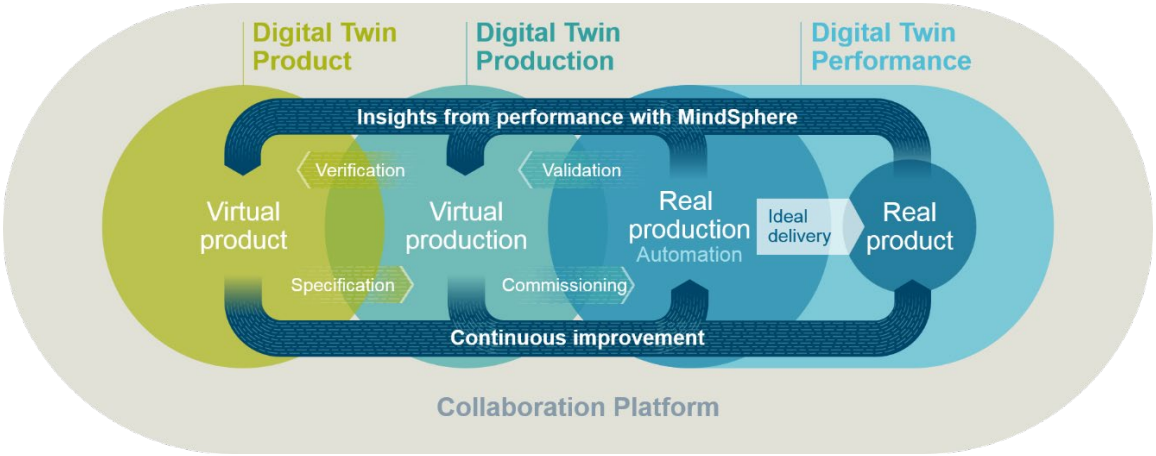
FSAE 2020 Siemens *Digital Twin Engineering Excellence Award*

For the newly 'Virtualized' FSAE competition, Siemens Digital Industries Software is sponsoring the "**Digital Twin Engineering Excellence Award**", a $6,500-total award to recognize three Formula Electric teams which have used professional, innovative and thoughtful 'Digital Twin' engineering practices. Formerly given at Formula Student Germany, we're bringing this prestigious award to N. America for the 1st time!
(See the Siemens *Video Success Story Award* notice as well, open to Combustion or Electric teams.)

'Digital Twin' is the concept of a digital, simulation-oriented representation of the targeted product from the earliest stages of the design cycle - to detailed design and on to fabrication, testing, competition and maintenance. It involves both feed-*forward* and feed-*back* between your comprehensive virtual model and your fabricated racecar (at least in normal times!)

$2,300 1st Place
$2,000 2nd Place
$1,600 3rd Place

We'd like to see that your team has relied on digital design and simulation models to guide the full product lifecycle to meet your goals and requirements. In addition, product data management, ongoing and efficient change/problem management processes, and your process for educating new team members are valuable to show.



General Conditions

- Teams can apply for the award by submitting an application (max. 6 pages) by **midnight of Monday June 15th, 2020**. You may include appendices, drawings etc. in PDF format for additional supportive information. We may also read your FSAE Static Design document if available.

Please email your application (or questions) to head judge leigh.anderson@siemens.com.

- Be sure to address as many of the 8 rating categories listed below as best you can. Even if you don't apply, these are important success guidelines that all the top 10 teams in the world follow.
- Depending on how close the judging is among the finalists, the judge panel may arrange a Q&A webconference if needed.
- Use of Siemens brand & Siemens' Mentor brand software tools is highly encouraged but not required.

Eligibility

- The award is open to **Formula Electric** teams registered for FSAE 2020. We are looking forward to understanding your insightful Digital Twin!

Resources

- For no-cost grants of Siemens software & training courses apply at: https://tinyurl.com/ycotdmq2
- Learn how Siemens software helps FSAE design challenges, at https://tinyurl.com/y9dzz8ty and a list of software packages relevant for FSAE challenges at https://tinyurl.com/y9wlhnm4
- Explore the useful templates, tutorials, even free cloud CFD computing at Siemens' Formula Student/SAE forum at https://tinyurl.com/u3zx7bp

Appendix A:

The 8 categories that are judged are listed below. Also you can use this checklist to plan improvements to your team's methodology:

1. **Electrical** Design & Simulation plus its connections to other disciplines and product/data management. Level of simulation automation. Use of software for design and simulation of electrical system design, electrical schematics, and wire-harness. Also **Embedded Software** sophistication and integration of in-vehicle software into electro-mechanical simulations.
2. **Mechanical** Design & Simulation plus its connections to other disciplines and product/data management. Level of simulation-automation. Integration of mechanical with electrical and other disciplines. Test-benches validating digital models. Use of 3D CFD simulation to guide aero downforce and cooling design.
3. **Product/Data management** systems and software in place and used deeply and broadly. Use of a central, unified 'backbone' PDM software..
4. **Professional** level of Digital Twin process and the Digital Twin application, as well as the Design Report and the professional conduct, presentation materials of the Meeting with judges if selected as a finalist.
5. **Innovation** in Digital Twin Process/methods, and/or innovation of the car/parts/performance derived from using Digital Twin processes.
6. Depth and breadth of **Feed-forward and Feedback**/continuous-maintenance of the simulations/models.
7. **Knowledge and personnel management/**training/infrastructure - to keep Digital Twin engineering process going and improving despite annual turnover.
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8. **Digital Twin improvement** – note which items are major improvements either over last year for a more mature team, or since inception for a new team or progress in Digital Twin methods.

Appendix B:

Digital Twin Thinking, Examples, Questions

- Below are examples to help you recognize the type of engineering thoughtfulness and process we're looking to reward. The more compelling the better.
- Explain the overall strategy/architecture process starting with the first concept of your car and simulations, other digital models or calculations that guided the architecture and key attributes of your car.
- Show the maturity and completeness of your "Digital Twin" virtual design across all domains: such as mechanical, electrical, software, documentation for judges and team collaboration, fabrication, and racecar operations.
- Explain how multi-physics simulations (including but not limited to CFD, FEM, MBS, Electrical, System simulation) were used to influence the design of your aero package, chassis, cooling system or other aspects of the car. Did it drive trade-offs or innovations in other parts of your 'virtual car'?
- Did your CFD simulations influence other disciplines such as electrical system, sensors, telemetry, actuators, or the drivetrain? Did you come up with some innovations using CFD simulations? Or what major insights did you discover when analysing cooling your engine or accumulator?
- Explain the digital design of your car's electrical system and wire-harness design. Did you innovate to modify/augment the car's performance and/or endurance via electronics and wiring, especially relating to light-weighting, or innovative use of sensors and/or actuators? Did you virtually integrate your 3D-CAD chassis model with wire-harness layout to calculate correct 3D wiring lengths? We are looking for well-developed electrical system & wiring harness designs including use of schematics, design-checking, electrical simulation, 3D CAD virtual integration, and a formal parts library. Did you use a professional software tool meant for wiring harness- or just Excel and Visio for your harness design, plus some string in the chassis?
- Show your team's ability to accurately predict your race car's performance from simulation models, such as vehicle dynamics or lap-times. Did you use special sensors for measuring the car during race or testing conditions? How did the digital models and physical measurements evolve as you learned? Sensors? Telemetry? Feed-forward examples? Feed-back examples?
- Explain how your car's electro-mechanical design includes thorough and accurate digital models and simulation, including embedded software if used.
- Have you made parts using 3D-printing/additive manufacturing (AM), or CAM to drive CNC machines, or other digitally-driven production such as composites part design (such as using carbon composite design software to drive a CNC ply-cutter?
- Have you discovered performance or other problems that showed up in the physical car or physical parts, that you diagnosed the root-cause and solved back in the digital model of the car or parts, then validated the fix in the physical car? Or updated the digital model from physical data, (feed-back), that then guided improvement in the physical car (feed-forward)?
- How did you keep track of your requirements and the data created along your design process? Did you use a product data management system (PDM), and/or requirements management software? What effort did you take to make sure every team member works on the most current status of any available data/models/documents? PDM software helps you manage product data and process-related information in a unified database system. This information includes design data, models, parts information, manufacturing instructions, requirements, notes and documents. A PDM system provides solutions for secure data management, process enablement, and configuration/version management.
- For each engineering or fabrication discipline, how have your improved over last year?