

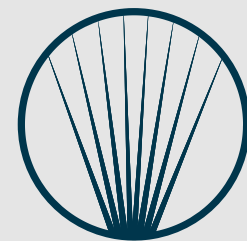
FORMULA STUDENT

QUIZZES PERFORMANCE



ARISTURTLE

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With several hundred teams registered around the world, the competition for slots at Formula Student events is hard!

The Quiz does not really do the process justice. Yes, we served between 10 and 15 questions, but they are not your general trivia questions from the pub. They can contain anything that falls under the title "Rules and General Engineering Knowledge". This includes, but is not limited to: Electronic circuits, material science, score calculations, Formula Student rules and vehicle dynamics.

Each competition has a slightly different format to the quiz-scoring, but the overall concept results in the teams with the fewest wrong answers in the shortest amount of time are getting a competition slot. To ensure that we have the best possible chance to participate in all competitions during the summer. Practice a lot!

Race car development has to continue, even though there are quizzes. During January, there are daily quiz – practice sessions. Every morning, we all work together to become experts in the rules and all other fields we can be tested in. Answering questions from our own database, reading the rules, solving quizzes from earlier years etc. It is very similar to our exam period actually!

During an official registration quiz, the questions appear on the blackboard. Therefore, communication and teamwork are the keys to ensure that all questions are solved correctly and fast. This requires practice, and development of some routines. This season, the 5th of February was the big quiz day! This day is filled with quizzes, the first starting at 10.00 a.m., and the last starting at 20.00 p.m.. On this day, the smallest mistake can mean we do not have a competition to attend during the summer. The evening before, will be one of very few where the office is quiet. Everyone has to be fit for fight, ready to achieve the goal: Qualify for all the competition slots we want for the summer!

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Here you can find some of the questions we could encounter during the quizzes.

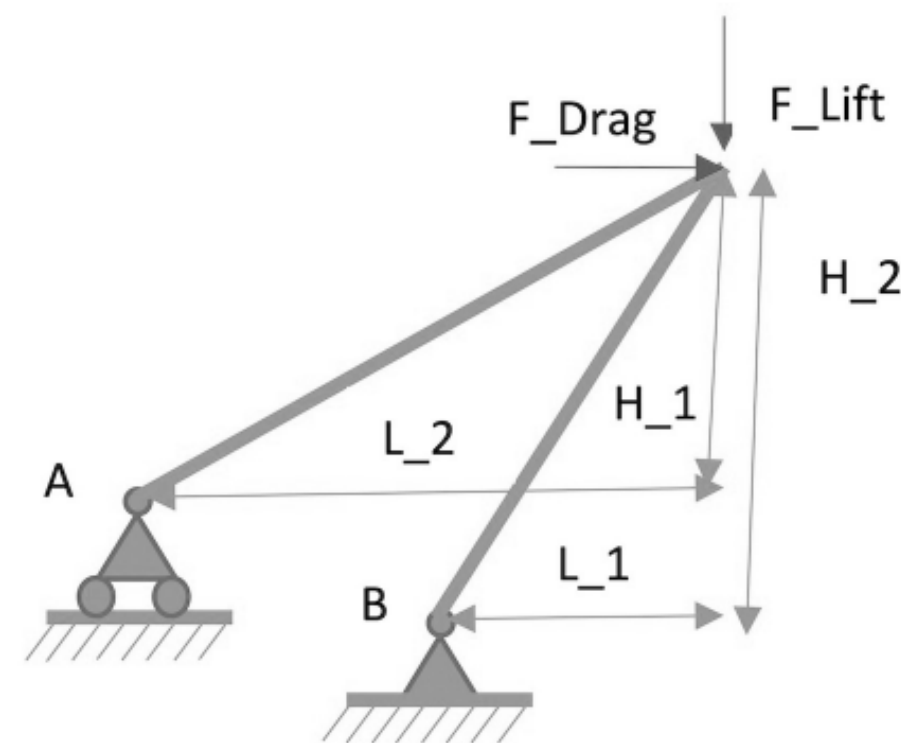
Q8

During last years acceleration a top speed of 100 km/h was reached. Due to big improvement in the new drivetrain, the new vehicle reaches a top speed of 120 km/h. The aerodynamics chief has some worries about the stability of the rear wing bracing due of the highr aerodynamics load. Given the geometry below, by how much % does the bearing force in point A change in comparison to last year (The aerodynamic package did not change and therefore some values can be assumed for both vehicles).

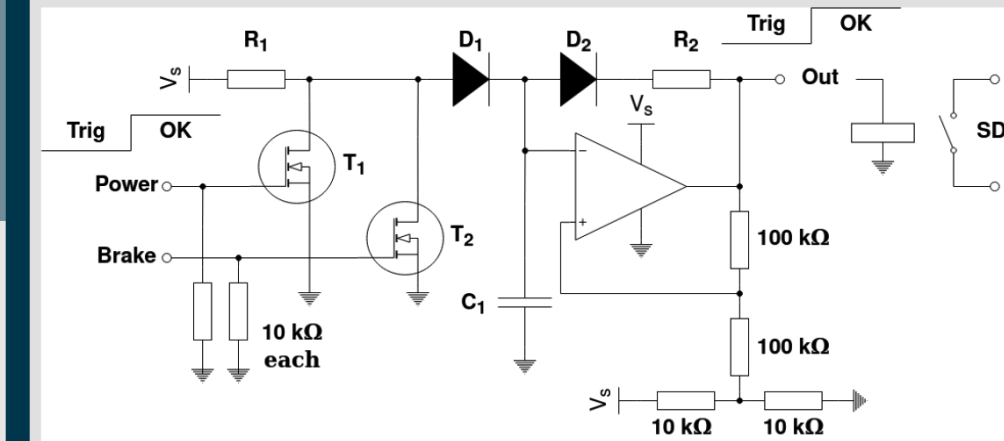
All the useful parameters are given below:

$c_L = 3.8$ $c_D = 1.2$ $A = 1 \text{ m}^2$ $\rho = 1.1 \text{ kg/m}^3$ $L_1 = 50 \text{ mm}$ $L_2 = 100 \text{ mm}$

$H_1 = 125 \text{ mm}$ $H_2 = 165 \text{ mm}$



The given circuit shows an implementation of a BSPD latch.



(click image to enlarge)

Evaluate the

- time to trigger: transition of both inputs from Vs to 0V. State the results in milliseconds. Round to one decimal place.
- time to reset: transition of both inputs from 0V to Vs. State the results in seconds. Round to one decimal place.

The following conditions are assumed:

- $V_s = 5\text{V}$
- $R_1 = 150\text{k}\Omega$
- $R_2 = 5.6\text{M}\Omega$
- $C_1 = 1.5\mu\text{F}$
- ideal Diodes with constant $V_f = 0.7\text{V}$ and $I_r = 0\text{A}$
- FETs as ideal "switches" with V_{th} somewhere between 1V and 4V, $R_{ds_on} = 0\Omega$ and $I_{ces} = 0\text{A}$
- ideal operational amplifier
- at least on trigger and reset cycle already occurred before
- the circuit has reached steady state before the input transition
- there is an input conditioning circuit evaluating hard braking and respective power delivery or throttle position with digital outputs which is not shown in the schematic
- both digital inputs have always exactly the same logical state which is either 0V, trigger condition, or Vs, idle

Give your answer in the following format: time to trigger, time to reset. Example: if the time to trigger is 1234,5ms and the time to reset is 12,3s then use 1234.5, 12.3 as answer value.

Answer:

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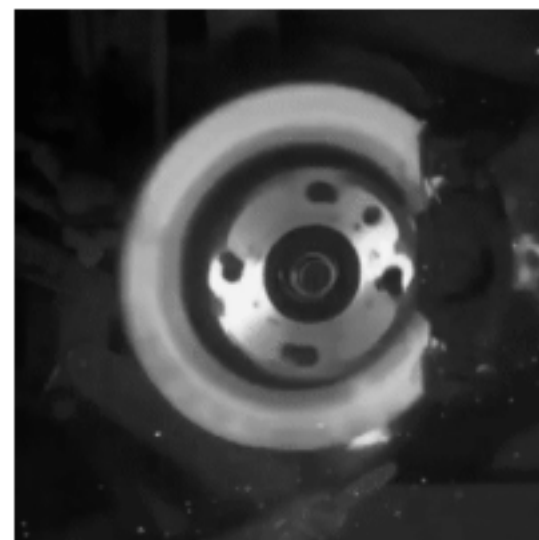


9) Your team use a LiFePO4 TS battery with 120S1P layout. The minimal, nominal and maximal cell voltage is 2.8, 3.3 and 3.65V, the cell capacity is 7.2Ah. Only the rear wheels are driven by independent motors and inverters. The custom-designed inverters have 900uF capacitance each. For the discharge circuitry, only a relay and a resistor are used. What is the minimum possible average power of the resistor during the discharge process?

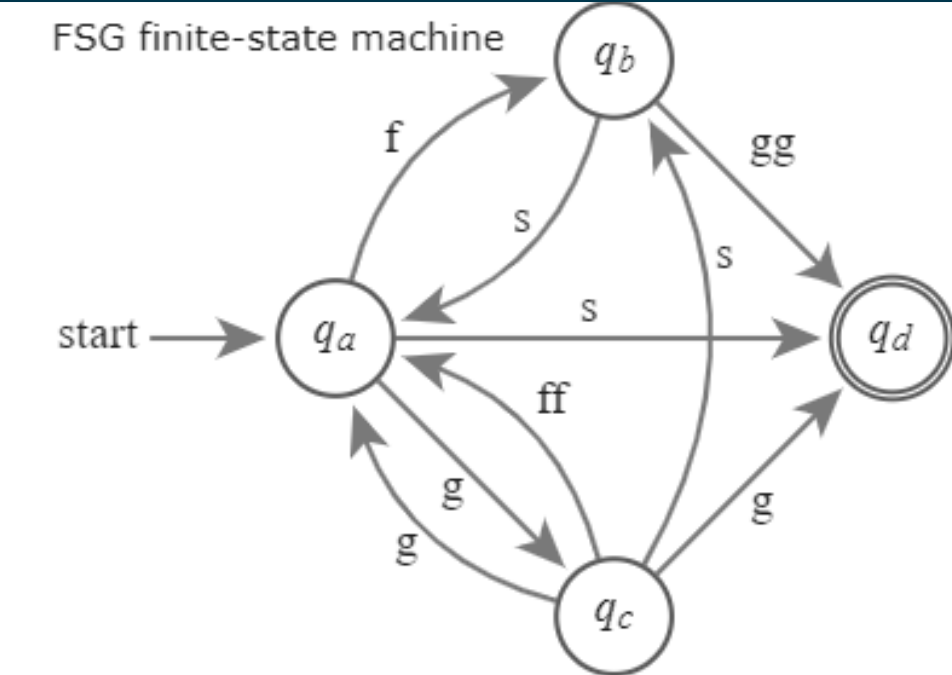
- ☐ A) 25.7 W
- ☐ B) 34.5 W
- ☐ C) 27.6 W
- ☐ D) 34.2 W
- ☐ E) 33.9 W
- ☐ F) 16.9 W

Brake Lines

The maximum pressure in your hydraulic brake lines is estimated to be 85 bar. How thick does the shielding of those lines need to be?



- ☐ no shielding is required if the pressure is below 95 bar (9.5 MPa)
- ☐ no shielding is required because brake lines require no shielding
- ☐ min. 1 mm aluminum or steel
- ☐ min. 1 mm steel or 2 mm aluminum



[click to enlarge](#)

The shown finite state machine is used to check if an input data stream matches with some regular expression.

The data matches the regular expression if the final state q_d is reached at the end of the input stream.

What regular expression(s) will be checked by the state machine?

- ☐ $^{(gffgss|ffsf)^*(fgg|gsgg|s|gg)}\$$
- ☐ $^{([fs|g]+(fs|gss|fs))^*(fgg|s|gs[gg|s]^*)\$}$
- ☐ $^{((g(ss|ff|g))|fs)^*(s(((f|gs)?gg)))\$}$
- ☐ $^{((g?(ss|g))|fs)+(s|gsgg|gg)}\$$

You may select one or more answers.

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ARISTURTLE'S

RANKINGS

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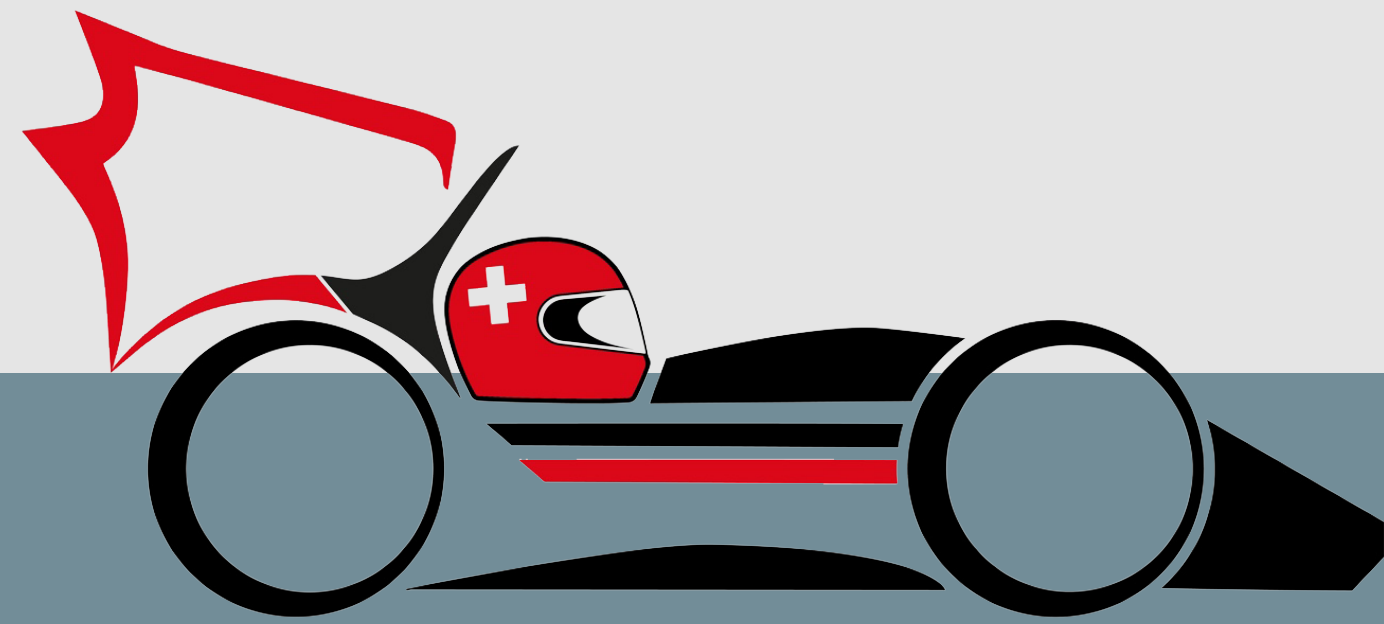


TOP EV Teams
2nd place



**EV category
6th place**

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FORMULA STUDENT
SWITZERLAND

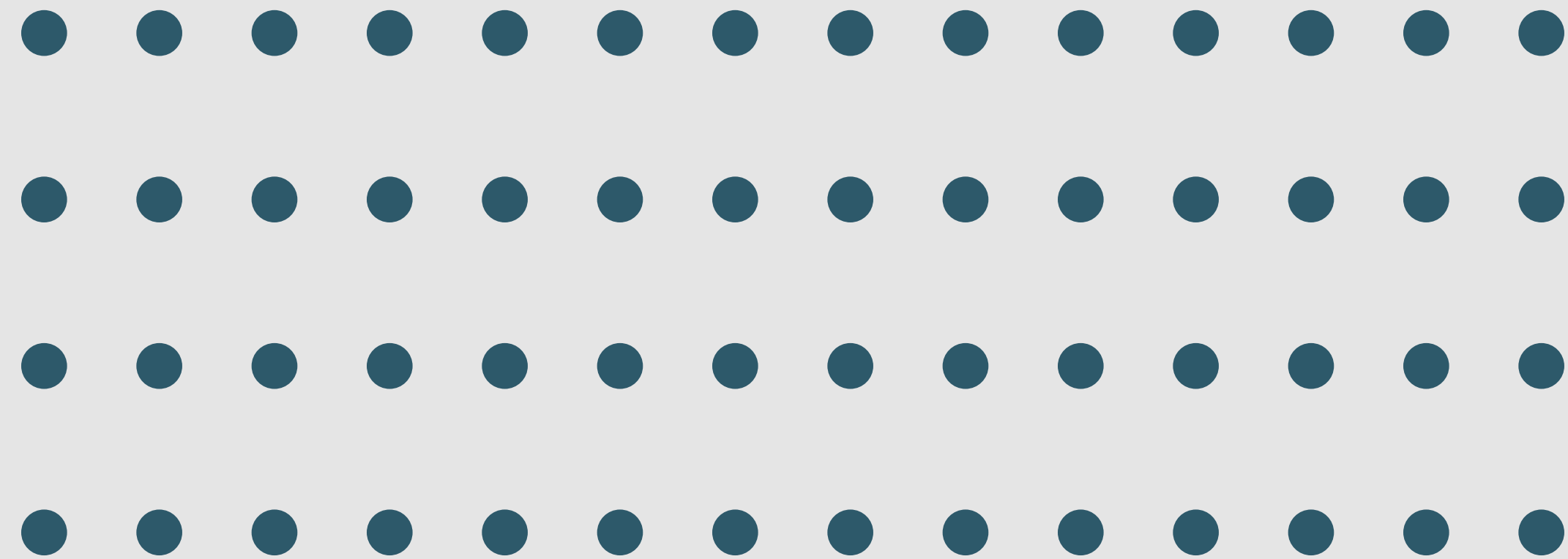
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EV category
17th place
Waiting List



**EV category
5th place**

**DV category
1st place
on list D'**



FORMULA **EAST**
STUDENT

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EV category
2nd place
Waiting List

DV category
14th place
Waiting List

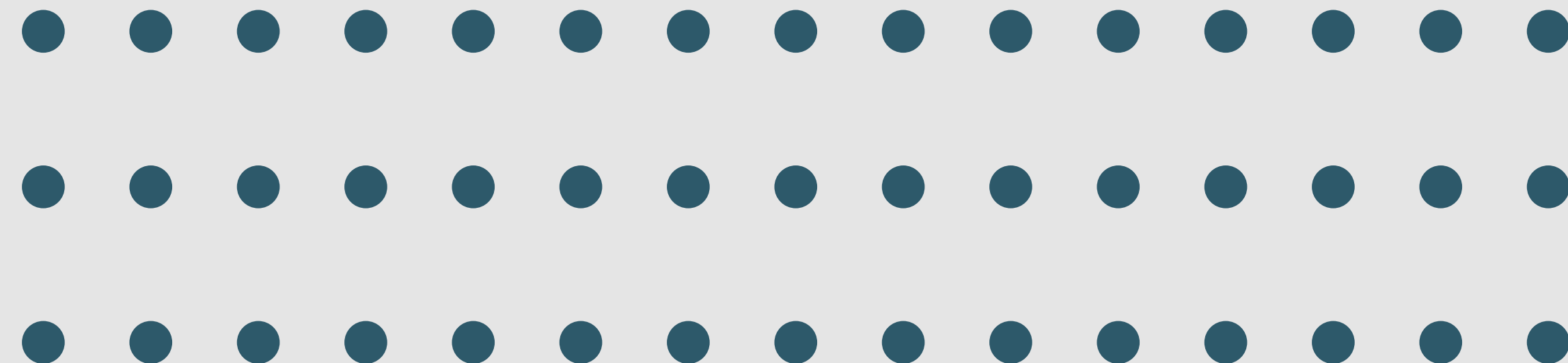


EV category
1st place
Waiting List

DV category
5th place
Waiting List



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At the end of the registration quizzes, Aristurtle managed to achieve its goal. That is, to qualify for the most demanding Formula Student competitions with the best possible performance. It is noteworthy that Aristurtle is the only Greek team that managed to take first places among top Formula Student teams. Typical examples are the second place in the category of electric vehicles (TOP EV teams) in Formula Student Netherlands and the sixth place in Formula Student Austria where the competition takes place on the official track of Formula 1, on the Red Bull Ring.

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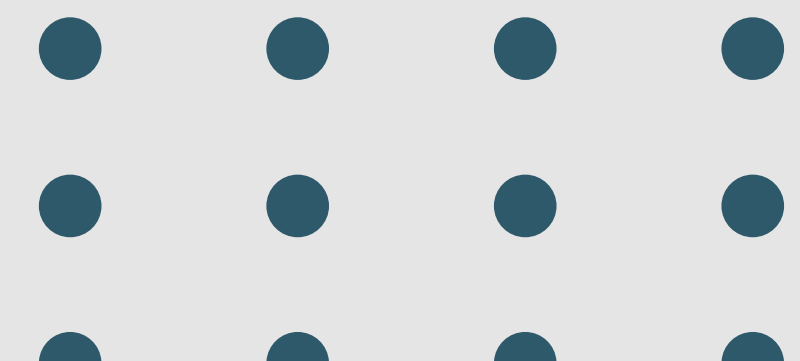
Aristurtle is pleased to announce its participation in two international Formula Student competitions, Formula Student Austria and Formula Student East for the 2021 racing season.



The Formula Student East will take place from 3rd of August to the 8th of August at the Zala Zone Automotive Proving Ground.

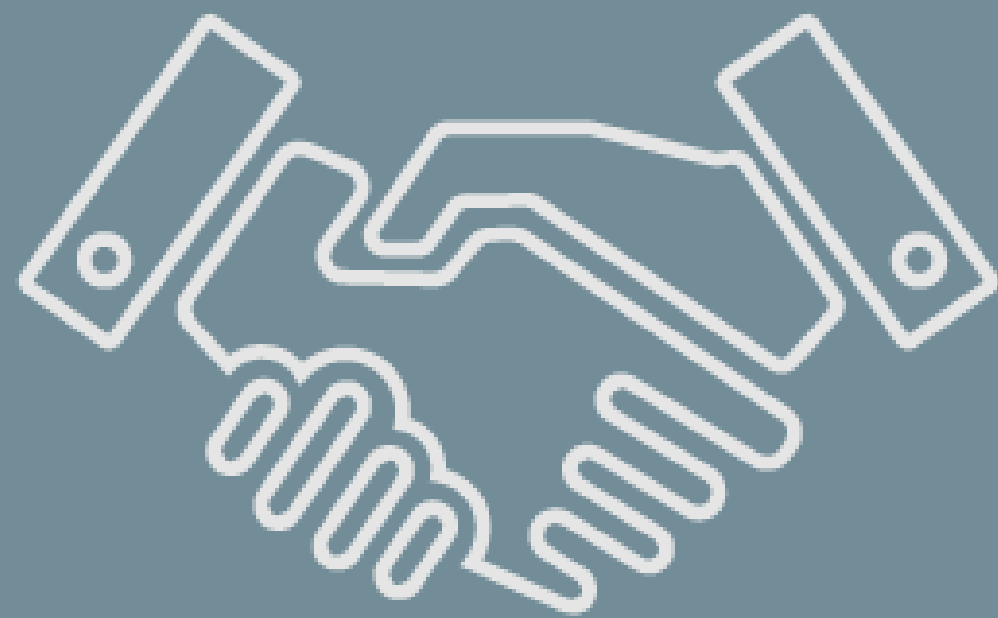


The Formula Student Austria will take place from 25th of July to the 29th of July at the Red Bull Ring Race Track.





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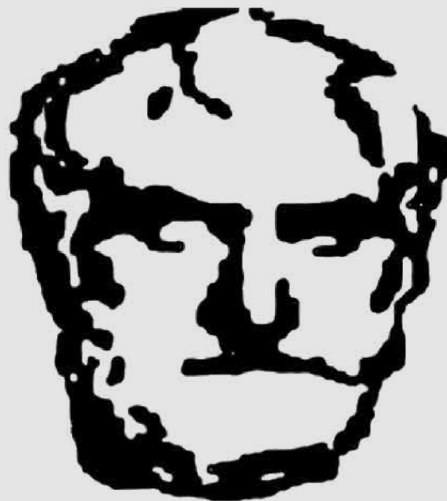
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Aristotle University of Thessaloniki



RESEARCH COMMITTEE
ARISTOTLE UNIVERSITY OF THESSALONIKI



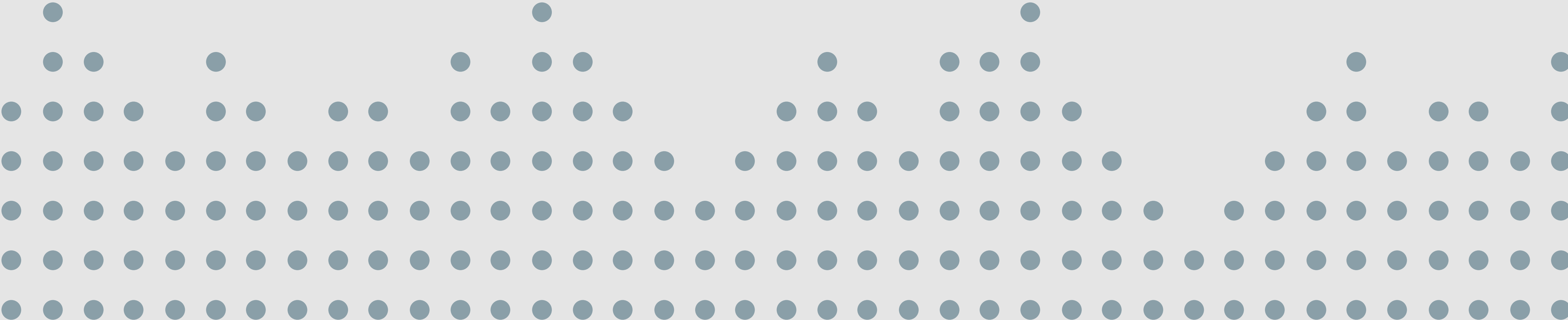
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EMLab





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The future of energy



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BETA^B
SIMULATION SOLUTIONS

dSPACE



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ΑΝΤΑΛΛΑΚΤΙΚΑ ΑΥΤΟΚΙΝΗΤΩΝ – ΕΞΟΠΛΙΣΜΟΣ ΣΥΝΕΡΓΕΙΩΝ

JAMSport
SUSPENSION SYSTEMS



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BOSCH



TOYOTA



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CARBON
FIBER
TECHNOLOGIES



INTERAMERICAN



EJET



Painting & Conveling Systems



DIMOULAS S.A.
SPECIAL CABLES



SBG SYSTEMS



See the possibilities



Περιφέρεια
Δυτικής
Μακεδονίας



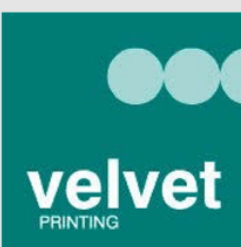
πλαισιο



SUNLIGHT
Reliable Battery Solutions



GALILEO
GALILEI



Power
PartsAG



KOUROUZIDIS
CNC WORKSHOP



GATS



ΤΕΧΝΟΜΕΤΑΝ Α.Ε.Β.Ε.
ΑΝΟΞΕΙΑΣΤΟΙ ΧΑΛΥΒΕΣ



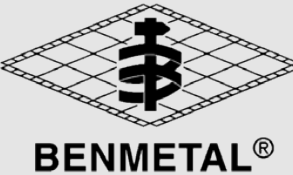
ΦΡΑΝΤΖΗΣ
ΜΗΧΑΝΟΥΡΓΙΚΗ ΒΙΟΜΗΧΑΝΙΑ

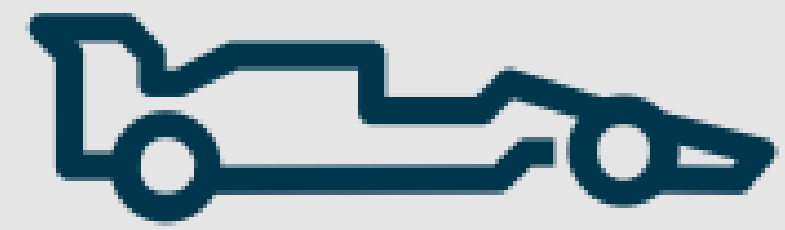


Altium



SYSPROGS





Till

the

next

race

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