5 KOKKUVÕTE

Käesoleva lõputöö ülesandeks oli projekteerida ning valmistada FS Team Tallinna 2017/2018 aasta hooaja võistlussõiduki FEST18 süsinik monokokk-kere.

Enne kere projekteerimist uuriti varasemaid meeskonna monokokk-kere lahendusi ja tutvuti konkurentide lahendustega. Kogutud teadmiste ja võimalike lahendustega asuti kere projekteerimise juurde. Projekteerimisel lähtuti tudengivormeli sarjas kehtivate FSG reeglite piirangutest, sõitjate vajadustest ning veermiku, elektroonika ja aerodünaamika koostude paiknemisest. Samuti peeti silmas, et projekteeritav monokokk-kere peab omama kaubanduslikku välimust.

Kere projekteerimise esimese etapina pandi paika sõitja istumisasend, mis suuresti lähtus eelmisel hooajal kasutatud asendist. Muudatused toimusid rooli asendis ja võistlussõiduki sõiduvalmidus protsessi ja seadistamise jaoks tarvilike nuppude paigutuses. Samuti sai muudetud kere, et tagada parem nähtavus sõitjatele vajalikesse kohtadesse.

Peale sõitja asendi paikapanemist paigutati keresse kaks suuremat elektroonikakomponenti: mootorite kontroller ja akukast. Võrreldes eelmiste hooaegadega valiti esmakordselt läbi kokpiti avause ja vaheseina akukasti keresse sisestamise ja välja tõstmise meetod. Akukast ise paigutati kere põhja, juhi selja taha. Komponentide suurusest tingituna projekteeriti ka monokokk-kere antud sektsioonides nendest lähtuvalt.

Veermikust tulenevad suuremad muutused viidi sisse monokokk-kere eesmises osas. Nimelt viidi esiamortide kinnitus maapinnaga paralleelsele pinnale, ning esmakordselt meeskonna monokokk-kerede ajaloos mõeldi välja lahendus eesmiste amortide katmiseks. Amortide katmisega muutus ka senine FS Team Tallinna monokokk-keredele omane kandiline välimus sujuvamaks ja aerodünaamilisemaks.

Esmakordselt meeskonna monokokk-kerede ajaloos mõjutasid aerodünaamilised detailid kere projekteerimist. Aerodünaamilistest elementidest mõjutas kere projekteerimist enim difuusori kasutuselevõtt. Difuusori ja jahutuselementide paigutusest tingituna võeti vastu ka eelpool mainitud akukasti keresse läbi kokpiti avause sisestamise ja välja võtmise meetod. Esitiiva parameetrite tõttu paigutati, aga pedaalid sõidusuunas tõusva kalde all olevale pinnale, millest tingituna tõusis ka vormeli nina kõrgemale.

Kuna valituks osutus antud hooajal monokokk-kere ühes tükkis lamineerimine, siis õnnestus keresse sisse lamineerida ka eesmine turvakaar. Antud turvakaare materjal jäi siiski töö autori pingutustest hoolimata samaks eelmisel kahel hooajal kasutatud 25CrMo4 terastoruga.

Peaturvakaar projekteeriti vastavalt FSG reeglitega nõutule ja projekteeritava monokokk-kere omapäradele.

Materjalide poole pealt mindi üle eelimmutatud kanga ja polümetakrülamiidist vahu kasutamisele, mis võimaldasid toota parema kvaliteedi ja jäikusega monokokk-kere. Uutest materjalidest ja monokokk-kere ühes tükis lamineerimisest tingituna õnnestus võrreldes eelmise hooajaga vähendada kere massi ~2,5 kilogrammi jagu. Uuest tootmistehnoloogiast ja materjalidest tingituna valmistati esmakordselt ka süsinikkiud kangast vormid.

Kokkuvõttes võib öelda, et valminud FEST18 süsinik monokokk-kere täitis püstitatud eesmärgid. Projekteerimisel saavutati kere võimalikult optimaalne kuju, vastavalt vajalikele komponentidele, ning uue tootmistehnoloogiaga valminud kere mass vähenes võrreldes eelnevate hooaegadega, resulteerudes meeskonna ajaloo kõige kergema monokokk-kerega.

6 SUMMARY

The aim of this bachelor thesis was to design and manufacture a carbon fiber monocoque for FS Team Tallinn 2017/2018 year season formula car FEST18.

Before designing the body, previous monocoque chassis solutions used by the team and also competitors designs were studied. With obtained information and possible solutions in mind the monocoque design process begun. During the monocoque design process limiting factors of FSG rules, drivers demands and furthermore chassis, electronics components and aerodynamic devices positioning were taken into consideration. It was also kept in mind that the finished product must have commercial appearance.

As the first phase of the monocoque designing driver seating position was put in place, which mostly proceeded from previous years seating position. Changes were made to the positioning of steering wheel and the buttons required for setting the vehicle driving ready and for changing the vehicle setup. Monocoque was also modified to allow better vision to necessary places for drivers.

After locking in driver seating position two biggest electronics components (motors controller and accumulator container) were positioned inside the monocoque. For the first time, compared to previous seasons, the method of lifting the accumulator inside and out of monocoque through the cockpit opening (and firewall) was chosen for the first time. The accumulator container itself was positioned on the monocoque floor behind the driver. Due to the size of the components monocoque chassis in the mentioned sections was designed on the basis of the components geometry.

The changes resulted from the suspension system were mainly made to the front part of the monocoque chassis. Namely the front shock absorbers attachment was placed on a surface parallel to the ground and for the first time in teams monocoque frame history a solution to cover the front shock absorbers was invented. By covering the front shock absorbers the faceted shape peculiar to FS Team Tallinns previous monocoques was changed to a more smoother and aerodynamic shape.

For the first time in teams monocoque chassis history aerodynamic devices influenced the designing of the monocoque. Of the aerodynamic devices the biggest impact to the design was resulted from the use of diffuser. Due to the positioning of the diffuser and cooling system elements the previously mentioned method of removing the accumulator container through the cockpit opening was endorsed. Due to the parameters of front wing the pedal box was placed on an upward inclining surface which resulted in the raising of the formula cars nose.

Because the choice of laminating the monocoque chassis in one piece was made, it was possible to laminate the front hoop into the monocoque laminate. Despite the thesis authors' efforts the front hoop material stayed the same (25CrMo4 steel pipe) as for the previous two seasons. Main hoop was designed according to the FSG rules and the nature of the monocoque.

On the materials side the use of prepreg carbon fiber and polymethacrylamide core were introduced, which made it possible to produce a monocoque with better quality and stiffness. The introduction of new materials and the production of the monocoque in one piece resulted in weight loss by around 2.5 kilograms compared to the previous season. New production method and materials also caused the need to produce carbon fiber moulds for the first time.

In conclusion, it is safe to say that the manufactured FEST18 carbon fiber monocoque chassis fulfilled the goals set. During the design process the most optimal monocoque shape considering all necessary components was modeled. The final product manufactured with the use of new technology weighed less than previous of it's kind resulting in being the lightest monocoque in teams history.