

24. 3D-Konstrukteurstag in Bayreuth am 13.09.2023

Konstruktionseffizienz mit CATIA-V5

Eine Initiative der CAIQ
FCM-UserGroup

CAIQ – Computer Aided Creativity
public



Konstruktionseffizienz mit CATIA-V5

1 why

2 who

3 how

4 what

5 outlook

6 join



Increasing project challenges

but slow development of CATIA V5 enhancements

Situation

CATIA V5

- supported until 2030
- mainly developing 3DX and CATIA V6
- few CAA experts available

Demand

Product Enhancements

- faster operations
- streamlined one/few-click solutions
- scalability and extendibility
- rapid development responsiveness

Approach

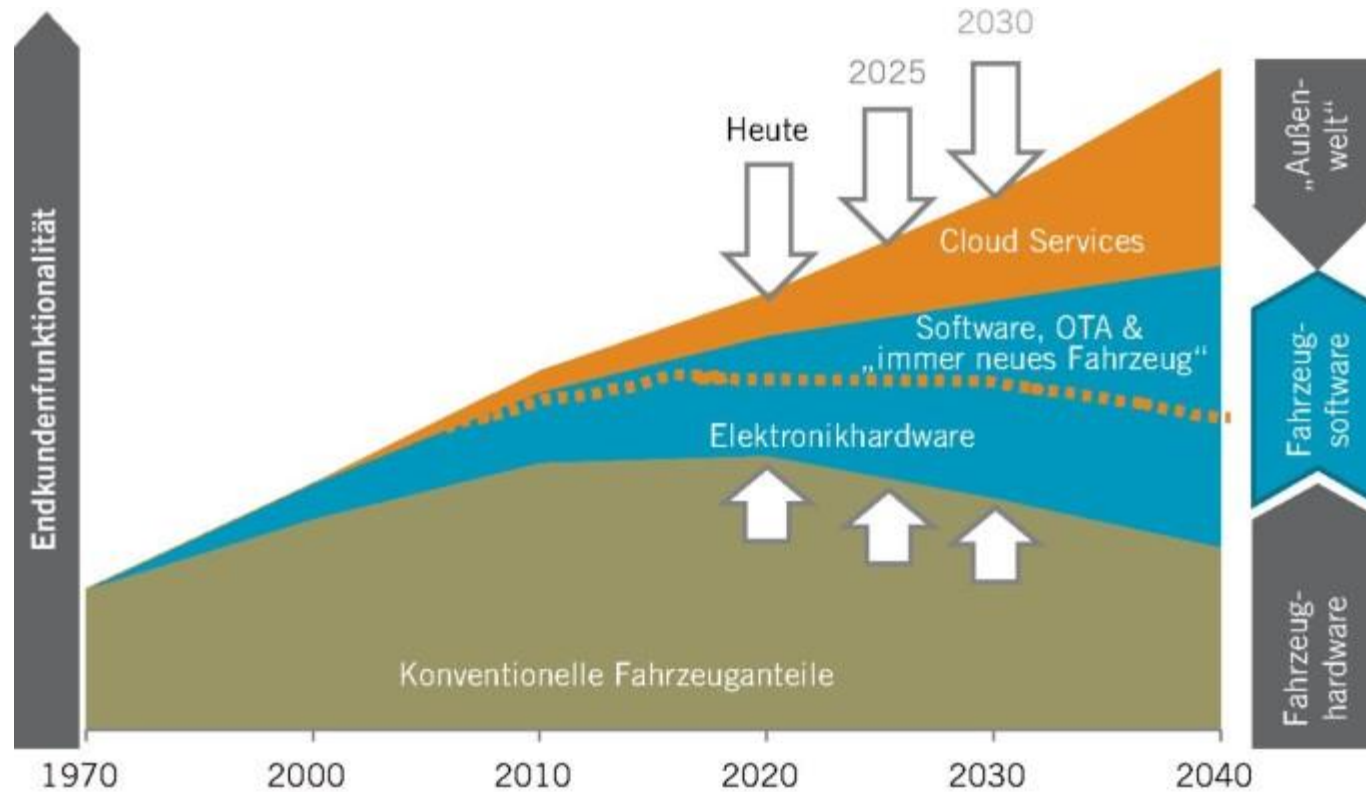
CATIA V5 User Collaboration

- self-organized user community
- specify requests
- aid in solutions
- test and endorse
- mutual assistance



Worsening conditions for hardware development

due to more focus on E/E and Software



Goppelt, G. Weniger Komplexität durch Elektrifizierung?. ATZ Elektron 15, 8–13 (2020). <https://doi.org/10.1007/s35658-020-0242-y>

Challenge

better functionality but

- less time
- less focus
- fewer experts
- lower prices
- less revenue

Worsening conditions for hardware development

Hardware is necessary, but ...

Situation

Increasing pressure

- on time & costs
- higher requirements & integration level
- shortage of experts
- “dynamic” styling
- low awareness

Demand

Optimize efficiency

- faster elaboration
- early and qualified information
- functional readiness
- high reactivity
- marketing

Approach

Ease the designer's work

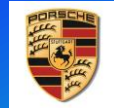
- reduce clicks (10→1)
- provide new functions
- support organization
- provide add. checks
- ease visualization



Initiator

...

- Simulation Management
- CATIA V5 Empowerment
- CAE Process Consulting
- Engineering Services



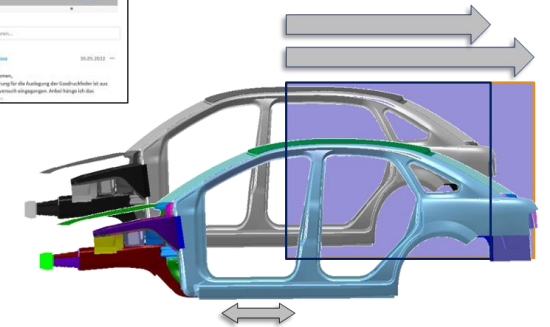
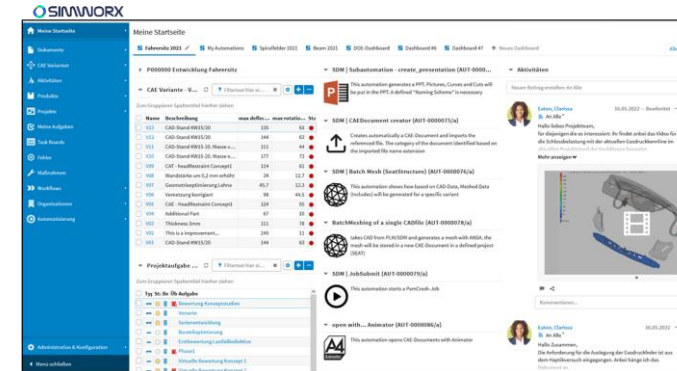
...



Why

Who

How



Courtesy Audi



UserGroup

the start constellation

Common goal:
define a set of functionalities in a CATIA Enhancement which brings immediate benefit and pays off in a very short time!

CAIQ

- high expertise in CATIA V5 development and programming
- >30 years expertise in CAE, Design, Usability

Partners

- high CATIA V5 application expertise mainly for Automotive Industry
- >30 years CAD expertise
- broad range of application areas

CONTACT

- >30 years PDM/PLM expertise



Partners



FCM - one basic technology, two directions of usage

CAD-oriented and CAE-oriented

FCM CAT.Assistant

to ease the daily work
of CATIA designers

native CATIA V5

FCM CAT.CAE-Bridge

to get functional designs
„first-time-right“

FCM Technology & native CATIA

CAIQ is CAA Adopter Partner to CATIA V5

UserGroup

the start

Several projects in diverse constellations

- Bachelor and Master theses
- customers like Porsche, BMW
- in context FCM CAT.CAE-Bridge (optimization)

first workshop November 11th at CSI in Munich

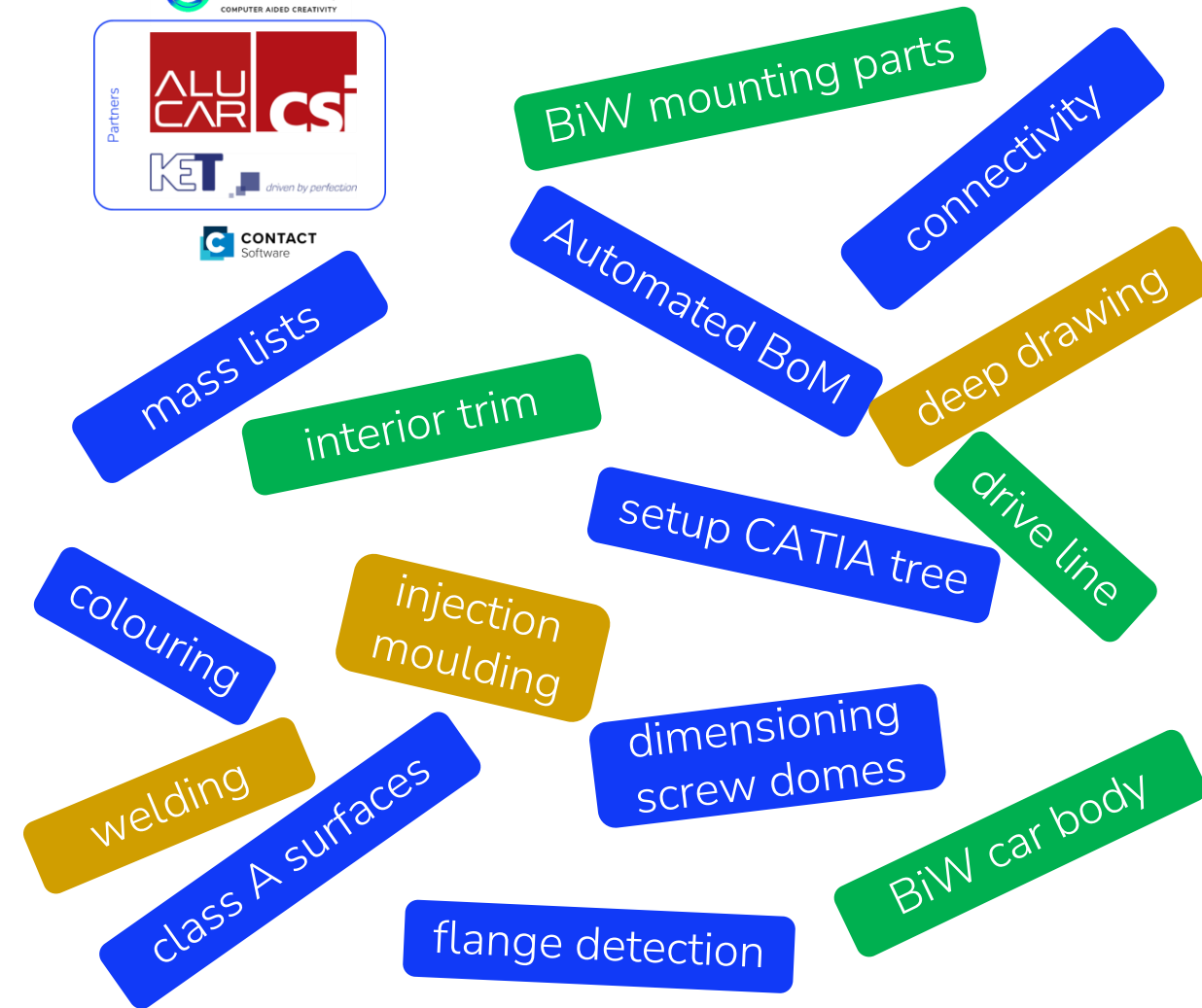
- get in personal contact
- report about basic time wasters in daily CATIA usage
- propose first issues to be dealt with

Follow-up

- several MS-Teams meetings
- 2nd workshop in presence May 17th at CAIQ
- first definition of key features for an MVP

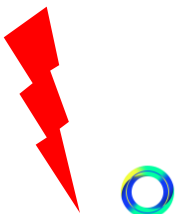
Internal work

- define and develop an MVP
- adopt license structure
- first marketing activities



Common goal:

define a set of functionalities in a CATIA Enhancement which brings immediate benefit and pays off in a very short time!



Who

How

What

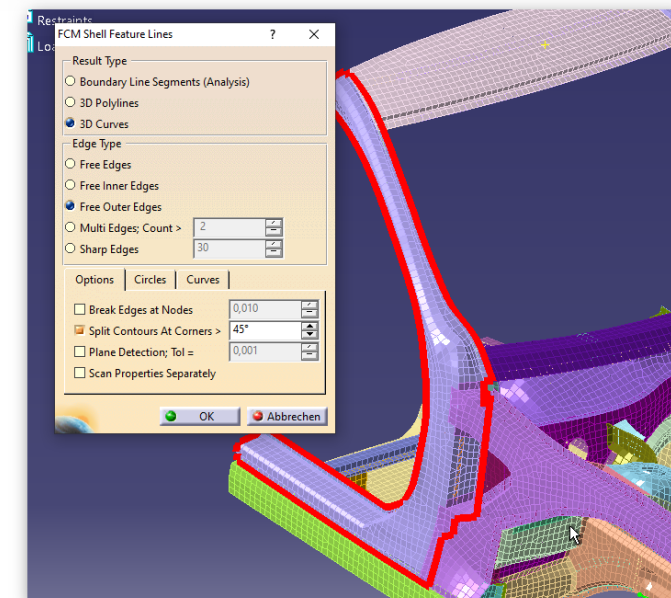
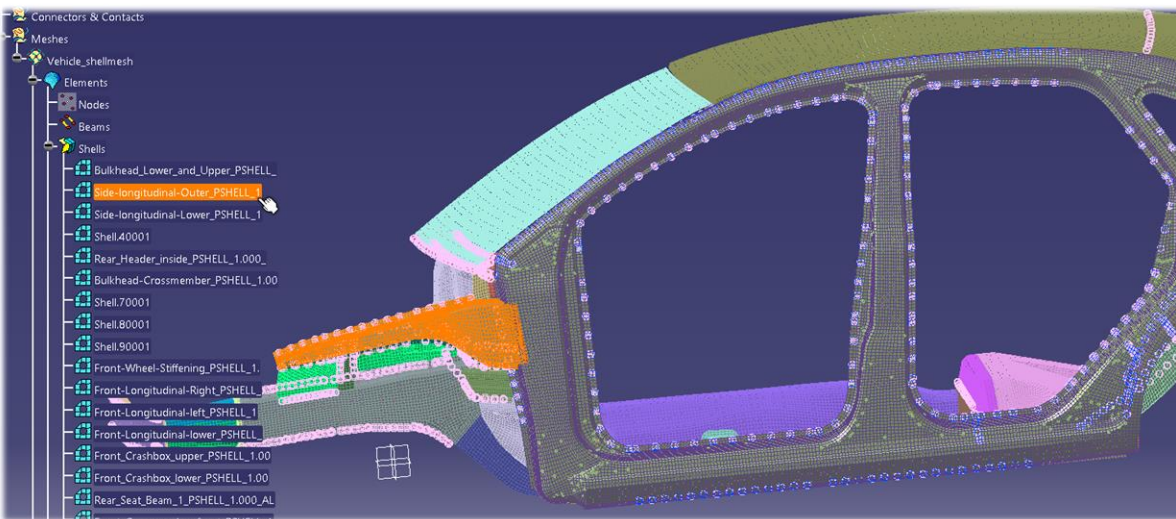
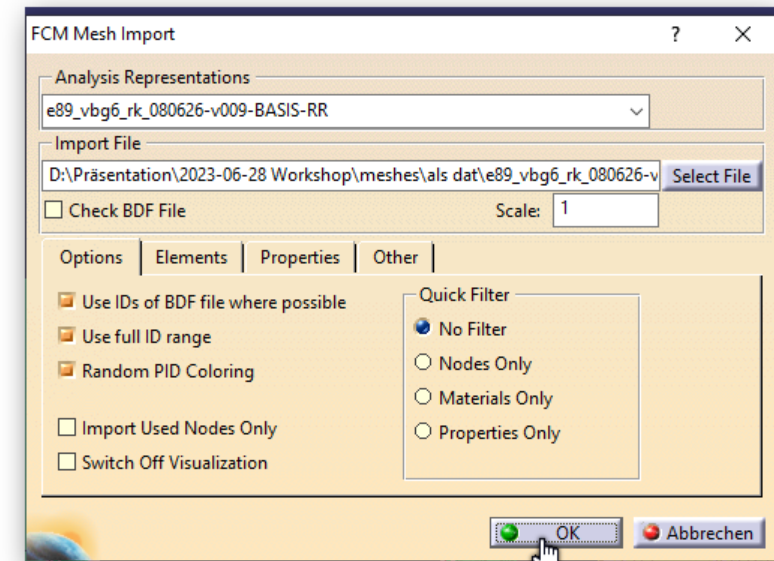
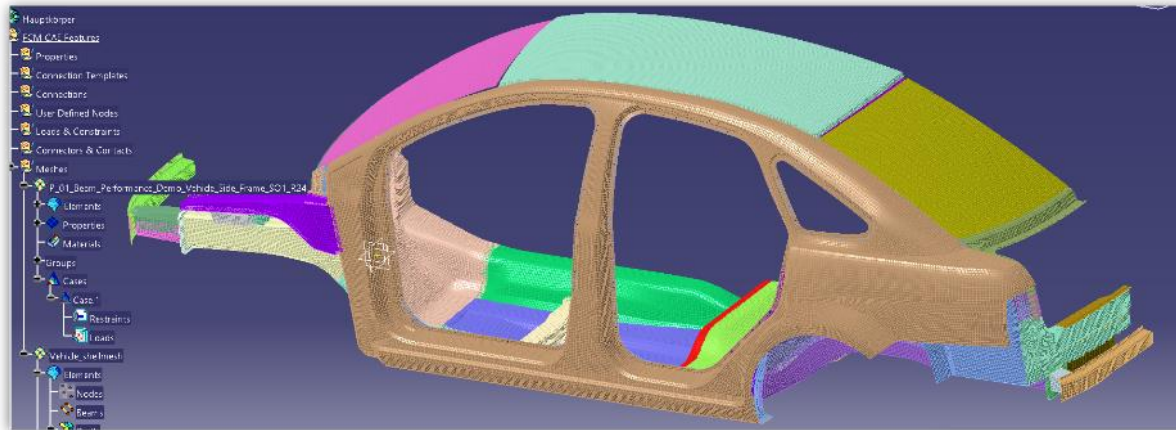
FCM CAT.Assistant

Overview

| Key topic | Category | Benefit |
|---------------|-------------------------------------|--|
| Data | Structured Import (FE-mesh, STL) | When reading data not structured for CAD (e. g. FE-meshes) the CATPart is automatically enhanced by information from FE like PID, Material, Colour, Connectivity Thus, the user easily can detect and operate the single structures |
| | Section Master | The user is provided with additional and simplified operational functions |
| Productivity | Geometry Operation | The user is provided with additional and simplified operational functions |
| | Parameter Toolkit | User is supported by additional technologies to operate and test parameters |
| | Model Management | Features to automatedly (re)organize a CATPart or select specific items "en block" |
| Visualization | Rendering | Easily create marketing material from CAT data |

FCM CAT.Assistant

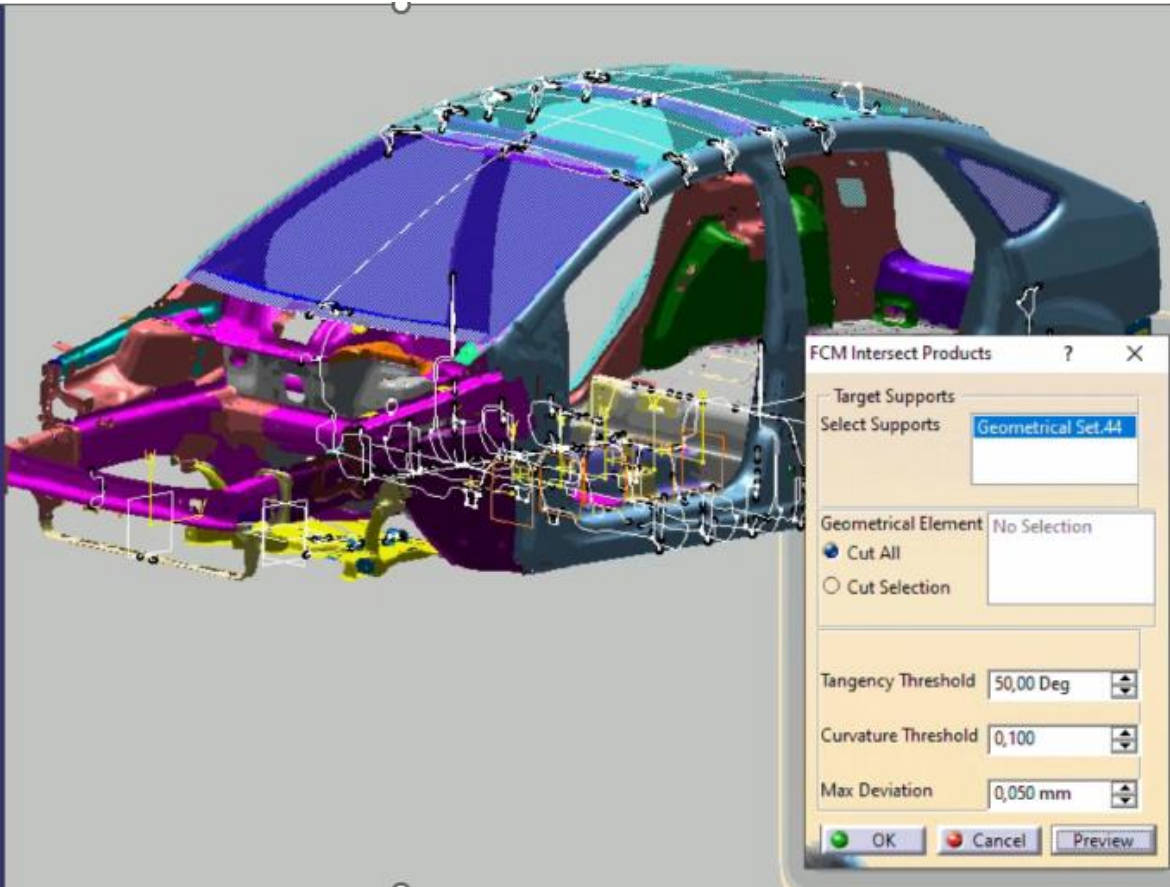
Structured data import (FE-meshes, STL-data)



FCM CAT.Assistant

Data Availability

Intersection



Section Master

intersect >>100

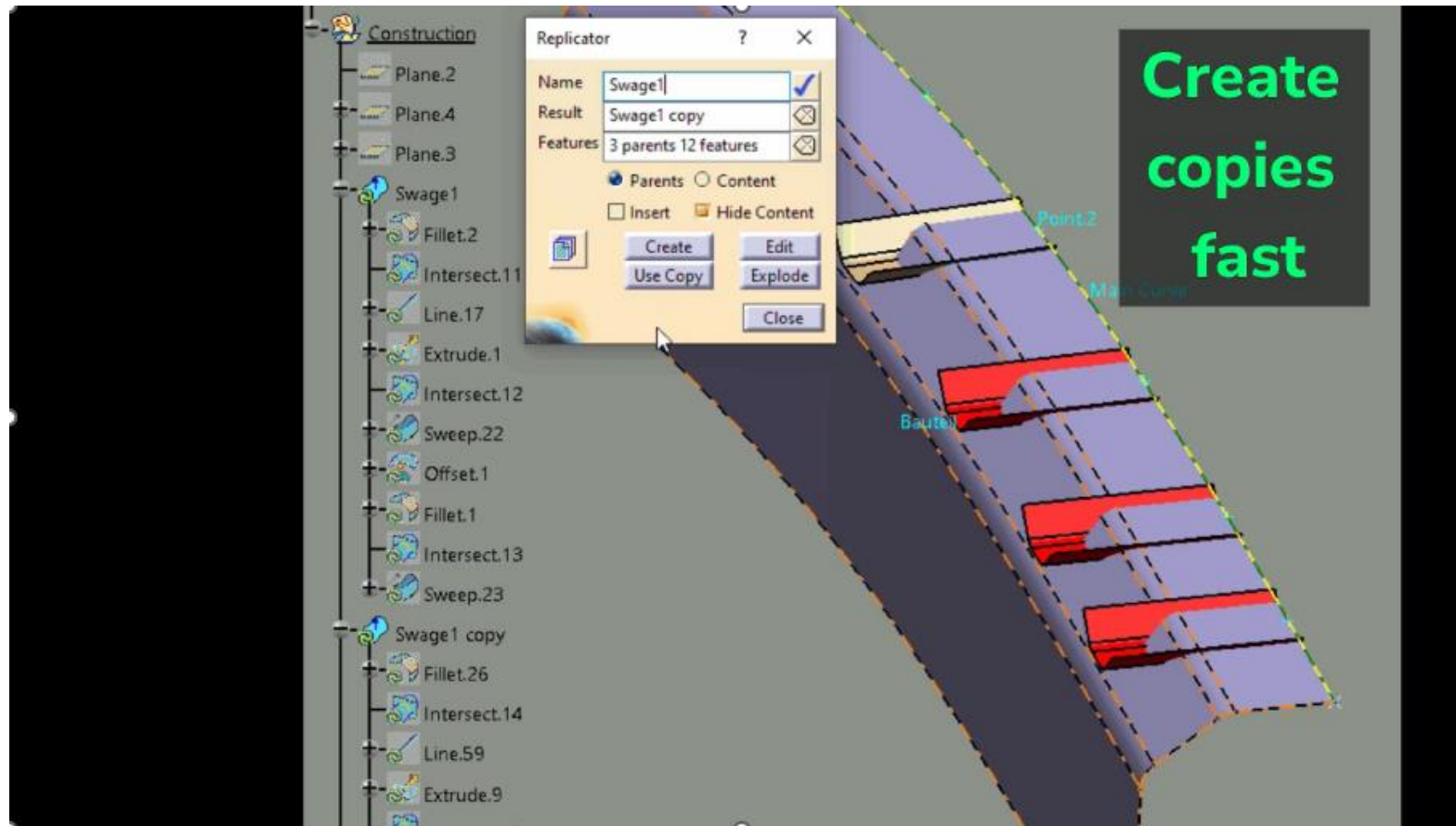
sketch capabilities

translate, orient, copy, ...

filters

FCM CAT.Assistant

Productivity Pack



Geometry Operation

extend & cut edges,
surface

remove holes

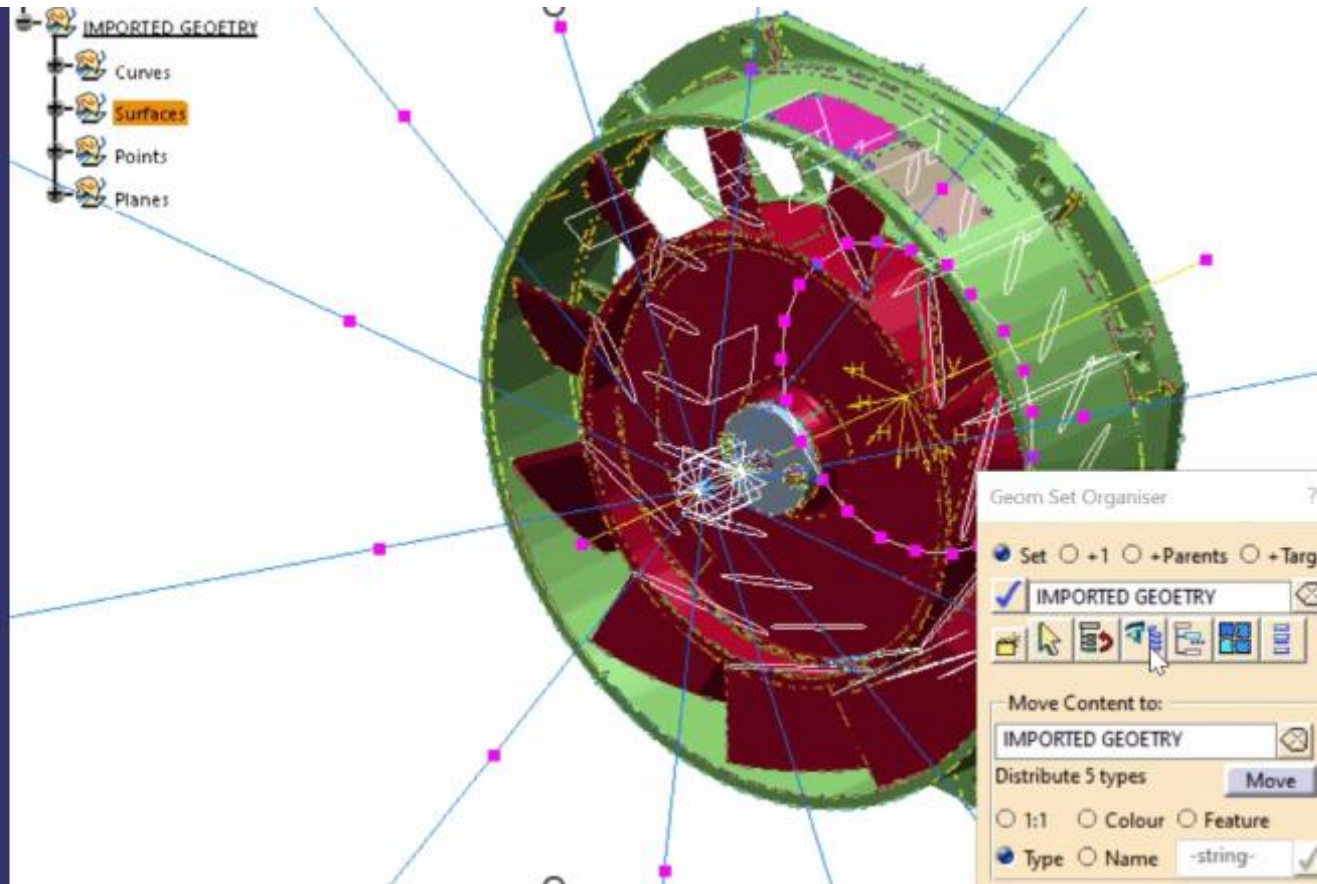
replicate features

create multiple planes

FCM CAT.Assistant

Productivity Pack

Geom Set Organiser



Model Management

Set Organizer

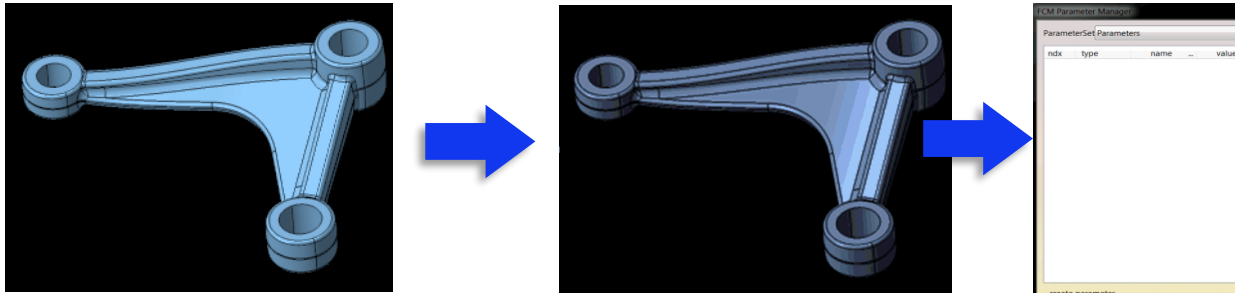
Multi-Object Operator

FCM CAT.Assistant

Productivity Pack

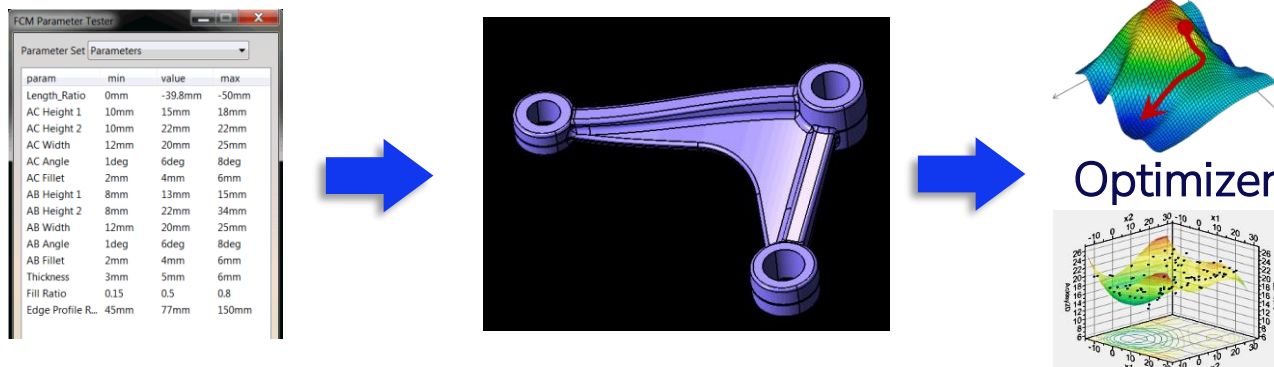
Parameter Manager

- Captures and organizes parameters from the part e. g. for an optimisation



Parameter Tester

- Test the parameters to find the extremes
- tests min-max-values of parameters & provides them to the optimizer
- Send the max and min values to the optimizer



Parameter Toolkit

Manager

Tester

FCM CAT.Assistant

Productivity Pack

DoE Tester - automate

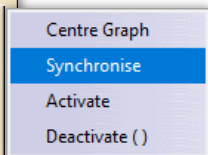
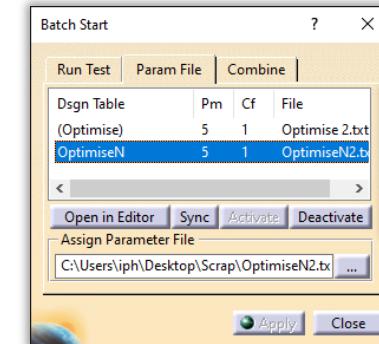
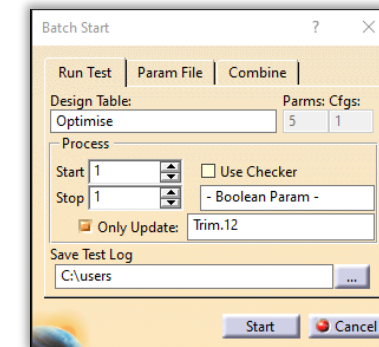
- run a DoE and test 100s of values (LHC) right from inside CATIA
- Auto-Skip for unfeasible values (rule-based)
- precise geometry error report displays the cause of any errors right in 3D
- manual options freely apply, generate, switch and combine parameter sets

DoE Tester - manage

- manage design tables and parameter files
- list of all design table objects in the CATpart
- replace the parameter file of any Design Table object
- Centre Graph on the selected Design Table object in the tree

DoE Tester - combine

- combine parameter file configurations
- switch easily between multiple configurations, see the model change
- convert many single value (configuration) parameter files into a single file with multiple configurations for each parameter → takes 2 seconds instead of 1 hour of careful, manual work



Single Configuration Files

| | |
|--------|-------|
| Z-Move | 0mm |
| Y-Move | 50mm |
| X-Move | 20mm |
| Frame | 2mm |
| Thickn | 52mm |
| Radius | 30mm |
| Z-Move | 4mm |
| Y-Move | 56mm |
| X-Move | 40mm |
| Frame | 6mm |
| Thickn | 58mm |
| Radius | 50mm |
| Z-Move | 6mm |
| Y-Move | 58mm |
| X-Move | 50mm |
| Frame | 19mm |
| Thickn | 3mm |
| Radius | 1.1mm |



Combined File

| | | | | | | | | |
|--------|------|-------|-------|-------|-------|-------|-------|-------|
| Z-Move | 0mm | 2mm | 4mm | 6mm | 8mm | 10mm | 12mm | 16mm |
| Y-Move | 50mm | 52mm | 56mm | 58mm | 60mm | 62mm | 64mm | 66mm |
| X-Move | 20mm | 30mm | 40mm | 50mm | 60mm | 60mm | 80mm | 90mm |
| Frame | 20mm | 11mm | 14mm | 19mm | 21mm | 17mm | 12mm | 11mm |
| Thickn | 2mm | 1.9mm | 1.7mm | 3mm | 1.4mm | 2.9mm | 3.6mm | 2.1mm |
| Radius | 2mm | 2.2mm | 3.1mm | 1.1mm | 2.9mm | 3.4mm | 5.0mm | 4.7mm |



FCM CAT.Assistant

CAT2VISION

Export Catia

Rendering

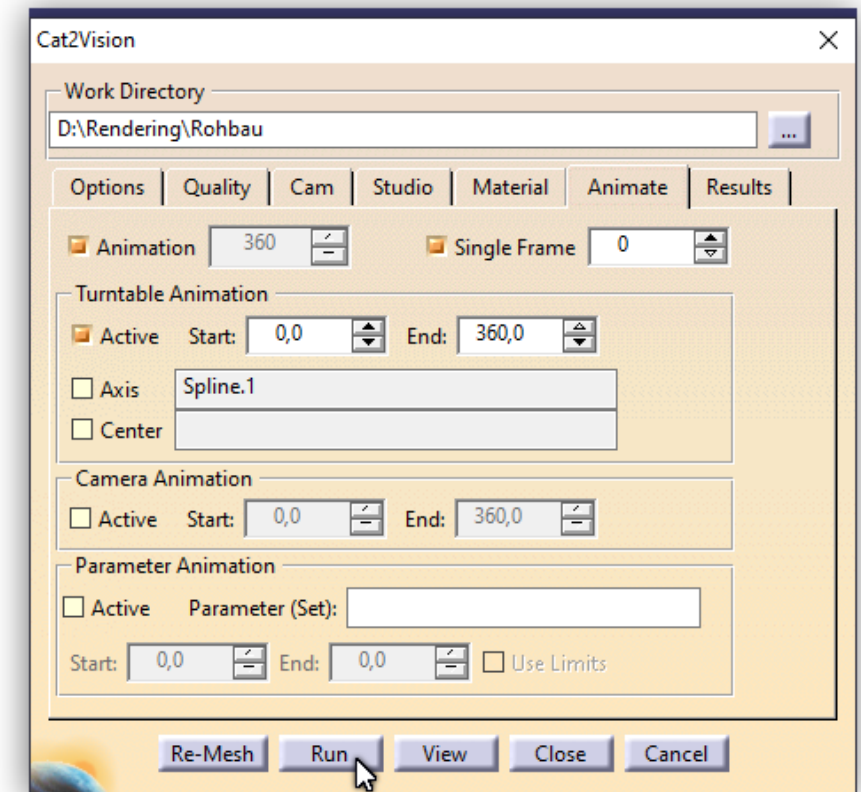
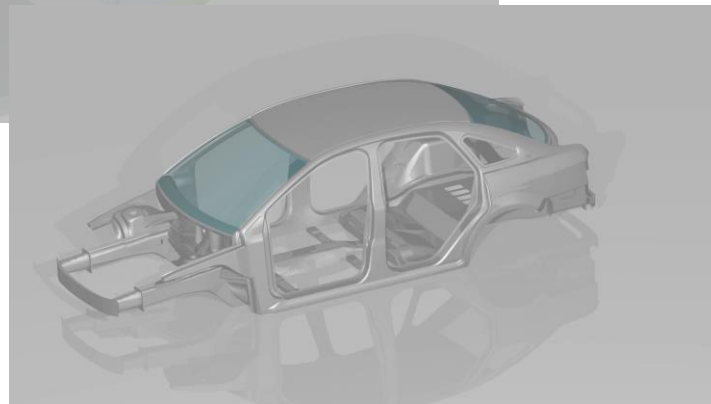
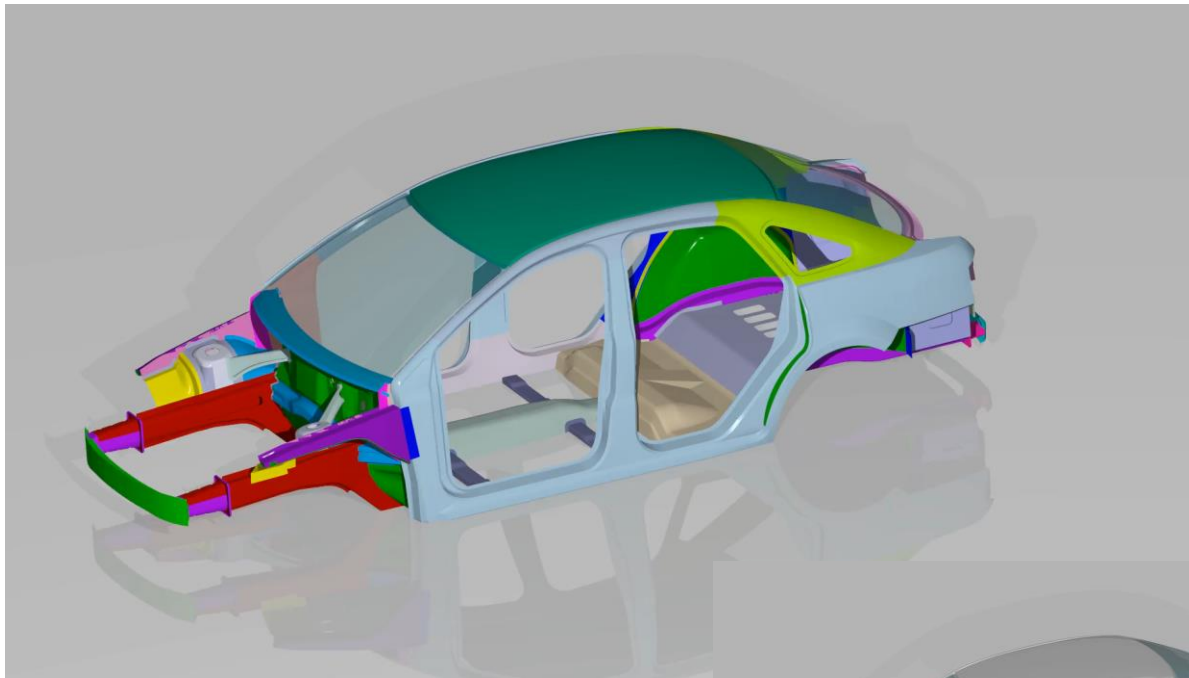
Einstellungen

„Showroom“

„Turntable“

Texturen

Finalisierung



FCM Process Command

for CATProducts

- Generate a CATProduct
 - part structure, naming convention
 - publications and links
 - CAE properties, connections like welds, glue etc.
- Generate from CATProduct
 - Excel sheet, text file
 - CAE solver deck via direct Mesher connection
 - connection (VT) and weld data

Bi-directional process:

- read existing CATProduct
- auto check, update or modify manually

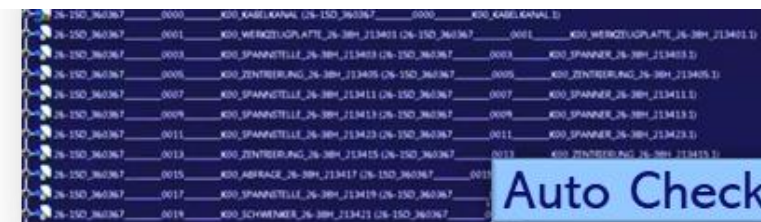
User defined customization

Outputs

- automated
- modified CATProduct
- Excel sheet
- text file
- PowerPoint

Inputs

- interactive
- existing CATProduct
- Excel sheet
- text File



Generate

Generate

Apply

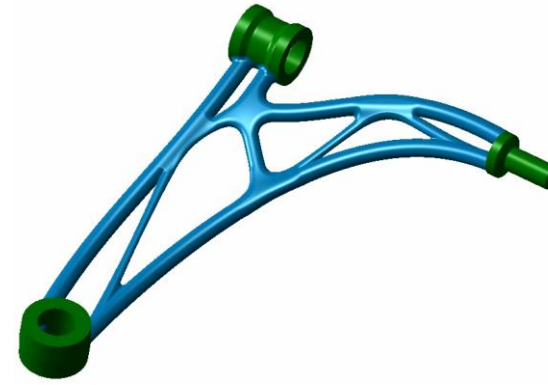
| Apply | | | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM | AN | AO | AP | AQ | AR | AS | AT | AU | AV | AW | AX | AY | AZ | BA | BB | BC | BD | BE | BF | BG | BH | BI | BJ | BK | BL | BM | BN | BO | BP | BQ | BR | BS | BT | BU | BV | BW | BX | BY | BZ | CA | CB | CC | CD | CE | CF | CG | CH | CI | CJ | CK | CL | CM | CN | CO | CP | CQ | CR | CS | CT | CU | CV | CW | CX | CY | CZ | DA | DB | DC | DD | DE | DF | DG | DH | DI | DJ | DK | DL | DM | DN | DO | DP | DQ | DR | DS | DT | DU | DV | DW | DX | DY | DZ | EA | EB | EC | ED | EE | EF | EG | EH | EI | EJ | EK | EL | EM | EN | EO | EP | EQ | ER | ES | ET | EU | EV | EW | EX | EY | EZ | FA | FB | FC | FD | FE | FF | FG | FH | FI | FJ | FK | FL | FM | FN | FO | FP | FQ | FR | FS | FT | FU | FV | FW | FX | FY | FZ | GA | GB | GC | GD | GE | GF | GG | GH | GI | GJ | GK | GL | GM | GN | GO | GP | GQ | GR | GS | GT | GU | GV | GW | GX | GY | GZ | HA | HB | HC | HD | HE | HF | HG | HH | HI | HJ | HK | HL | HM | HN | HO | HP | HQ | HR | HS | HT | HU | HV | HW | HX | HY | HZ | IA | IB | IC | ID | IE | IF | IG | IH | II | IJ | IK | IL | IM | IN | IO | IP | IQ | IR | IS | IT | IU | IV | IW | IX | IY | IZ | JA | JB | JC | JD | JE | JF | JG | JH | JI | IJ | JK | KL | KM | KN | KO | KP | KQ | KR | KS | KT | KU | KV | KW | KX | KY | KZ | LA | LB | LC | LD | LE | LF | LG | LH | LI | LJ | LK | LL | LM | LN | LO | LP | LQ | LR | LS | LT | LU | LV | LW | LX | LY | LZ | MA | MB | MC | MD | ME | MF | MG | MH | MI | MJ | MK | ML | MM | MN | MO | MP | MQ | MR | MS | MT | MU | MV | MW | MX | MY | MZ | NA | NB | NC | ND | NE | NF | NG | NH | NI | NJ | NK | NL | NM | NN | NO | NP | NQ | NR | NS | NT | NU | NV | NW | NX | NY | NZ | OA | OB | OC | OD | OE | OF | OG | OH | OI | OJ | OK | OL | OM | ON | OO | OP | OQ | OR | OS | OT | OU | OV | OW | OX | OY | OZ | PA | PB | PC | PD | PE | PF | PG | PH | PI | PJ | PK | PL | PM | PN | PO | PP | PQ | PR | PS | PT | PU | PV | PW | PX | PY | PZ | QA | QB | QC | QD | QE | QF | QG | QH | QI | QJ | QK | QL | QM | QN | QO | QP | QQ | QR | QS | QT | QU | QV | QW | QX | QY | QZ | RA | RB | RC | RD | RE | RF | RG | RH | RI | RJ | RK | RL | RM | RN | RO | RP | RQ | RR | RS | RT | RU | RV | RW | RX | RY | RZ | SA | SB | SC | SD | SE | SF | SG | SH | SI | SJ | SK | SL | SM | SN | SO | SP | SQ | SR | SS | ST | SU | SV | SW | SX | SY | SZ | TA | TB | TC | TD | TE | TF | TG | TH | TI | TJ | TK | TL | TM | TN | TO | TP | TQ | TR | TS | TU | TV | TW | TX | TY | TZ | UA | UB | UC | UD | UE | UF | UG | UH | UI | UJ | UK | UL | UM | UN | UO | UP | UQ | UR | US | UT | UU | UV | UW | UX | UY | UZ | VA | VB | VC | VD | VE | VF | VG | VH | VI | VJ | VK | VL | VM | VN | VO | VP | VQ | VR | VS | VT | VU | VV | VW | VX | VY | VZ | WA | WB | WC | WD | WE | WF | WG | WH | WI | WJ | WK | WL | WM | WN | WO | WP | WQ | WR | WS | WT | WU | WV | WW | WX | WY | WZ | XA | XB | XC | XD | XE | XF | XG | XH | XI | XJ | XK | XL | XM | XN | XO | XP | XQ | XR | XS | XT | XU | XV | XW | XX | XY | XZ | YA | YB | YC | YD | YE | YF | YG | YH | YI | YJ | YK | YL | YM | YN | YO | YP | YQ | YR | YS | YT | YU | YV | YW | YX | YZ | ZA | ZB | ZC | ZD | ZE | ZF | ZG | ZH | ZI | ZJ | ZK | ZL | ZM | ZN | ZO | ZP | ZQ | ZR | ZS | ZT | ZU | ZV | ZW | ZX | ZY | ZZ | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM | AN | AO | AP | AQ | AR | AS | AT | AU | AV | AW | AX | AY | AZ | BA | BB | BC | BD | BE | BF | BG | BH | BI | BJ | BK | BL | BM | BN | BO | BP | BQ | BR | BS | BT | BU | BV | BW | BX | BY | BZ | CA | CB | CC | CD | CE | CF | CG | CH | CI | CJ | CK | CL | CM | CN | CO | CP | CQ | CR | CS | CT | CU | CV | CW | CX | CY | CZ | DA | DB | DC | DD | DE | DF | DG | DH | DI | DJ | DK | DL | DM | DN | DO | DP | DQ | DR | DS | DT | DU | DV | DW | DX | DY | DZ | EA | EB | EC | ED | EE | EF | EG | EH | EI | EJ | EK | EL | EM | EN | EO | EP | EQ | ER | ES | ET | EU | EV | EW | EX | EY | EZ | FA | FB | FC | FD | FE | FF | FG | FH | FI | FJ | FK | FL | FM | FN | FO | FP | FQ | FR | FS | FT | FU | FV | FW | FX | FY | FZ | GA | GB | GC | GD | GE | GF | GG | GH | GI | GJ | GK | GL | GM | GN | GO | GP | GQ | GR | GS | GT | GU | GV | GW | GX | GY | GZ | HA | HB | HC | HD | HE | HF | HG | HH | HI | HJ | HK | HL | HM | HN | HO | HP | HQ | HR | HS | HT | HU | HV | HW | HX | HY | HZ | IA | IB | IC | ID | IE | IF | IG | IH | II | IJ | IK | IL | IM | IN | IO | IP | IQ | IR | IS | IT | IU | IV | IW | IX | IY | IZ | JA | JB | JC | JD | JE | JF | JG | JH | JI | IJ | JK | KL | KM | KN | KO | KP | KQ | KR | KS | KT | KU | KV | KW | KX | KY | KZ | LA | LB | LC | LD | LE | LF | LG | LH | LI | LJ | LK | LL | LM | LN | LO | LP | LQ | LR | LS | LT | LU | LV | LW | LX | LY | LZ | MA | MB | MC | MD | ME | MF | MG | MH | MI | MJ | MK | ML | MM | MN | MO | MP | MQ | MR | MS | MT | MU | MV | MW | MX | MY | MZ | NA | NB | NC | ND | NE | NF | NG | NH | NI | NJ | NK | NL | NM | NN | NO | NP | NQ | NR | NS | NT | NU | NV | NW | NX | NY | NZ | OA | OB | OC | OD | OE | OF | OG | OH | OI | OJ | OK | OL | OM | ON | OO | OP | OQ | OR | OS | OT | OU | OV | OW | OX | OY | OZ | PA | PB | PC | PD | PE | PF | PG | PH | PI | PJ | PK | PL | PM | PN | PO | PP | PQ | PR | PS | PT | PU | PV | PW | PX | PY | PZ | QA | QB | QC | QD | QE | QF | QG | QH | QI | QJ | QK | QL | QM | QN | QO | QP | QQ | QR | QS | QT | QU | QV | QW | QX | QY | QZ | RA | RB | RC | RD | RE | RF | RG | RH | RI | RJ | RK | RL | RM | RN | RO | RP | RQ | RR | RS | RT | RU | RV | RW | RX | RY | RZ | SA | SB | SC | SD | SE | SF | SG | SH | SI | SJ | SK | SL | SM | SN | SO | SP | SQ | SR | SS | ST | SU | SV | SW | SX | SY | SZ | TA | TB | TC | TD | TE | TF | TG | TH | TI | TJ | TK | TL | TM | TN | TO | TP | TQ | TR | TS | TU | TV | TW | TX | TY | TZ | UA | UB | UC | UD | UE | UF | UG | UH | UI | UJ | UK | UL | UM | UN | UO | UP | UQ | UR | US | UT | UU | UV | UW | UX | UY | UZ | VA | VB | VC | VD | VE | VF | VG | VH | VI | VJ | VK | VL | VM | VN | VO | VP | VQ | VR | VS | VT | VU | VV | VW | VX | VY | VZ | WA | WB | WC | WD | WE | WF | WG | WH | WI | WJ | WK | WL | WM | WN | WO | WP | WQ | WR | WS | WT | WU | WV | WW | WX | WY | WZ | XA | XB | XC | XD | XE | XF | XG | XH | XI | XJ | XK | XL | XM | XN | XO | XP | XQ | XR | XS | XT | XU | XV | XW | XX | XY | XZ | YA | YB | YC | YD | YE | YF | YG | YH | YI | YJ | YK | YL | YM | YN | YO | YP | YQ | YR | YS | YT | YU | YV | YW | YX | YZ | ZA | ZB | ZC | ZD | ZE | ZF | ZG | ZH | ZI | ZJ | ZK | ZL | ZM | ZN | ZO | ZP | ZQ | ZR | ZS | ZT | ZU | ZV | ZW | ZX | ZY | ZZ |
|--------|-----|---------------------|------|-----|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--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| Part # | SPC | Product Description | MSRP | MAP | Product Type | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY | QTY</ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Parametrization Robustness

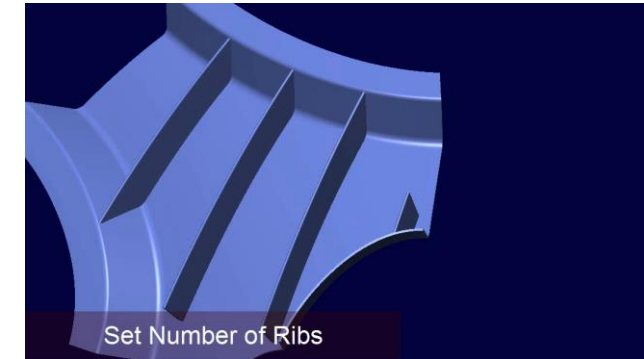
extended CAD-parametrization in the loop

Robust CAD Updates for CAD driven optimization

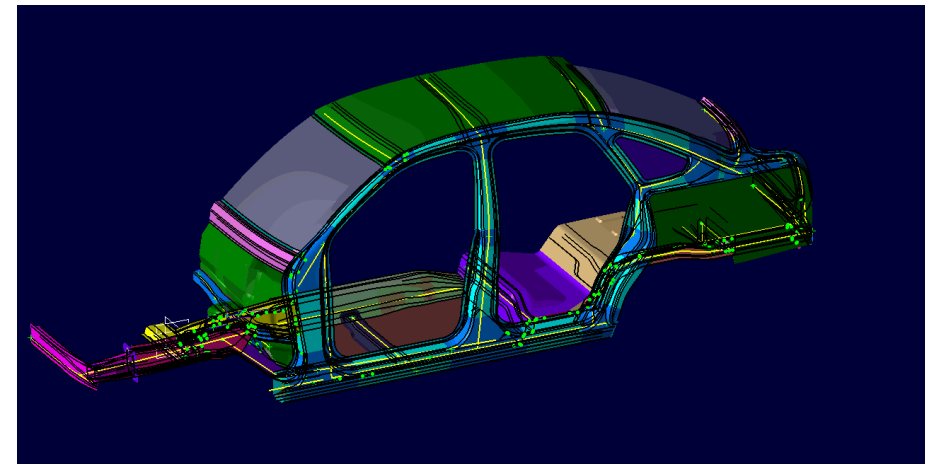
- wide ranges of parametric boundaries possible
($\gg 100\text{mm}$ movements)
- sophisticated check routines
- in-loop feasibility check (rule-based)
- in-loop switching between designs
(e. g. circle instead of quadrangle due to collision space)
- in-loop switching in/out geometry elements
(bulkhead plates or reinforcements)
- collision/penetration checker
(invalid variants are discarded)
- ...



Surface model from topology optimization parameters



Automated rib design



Large parameter modifications → robust updates

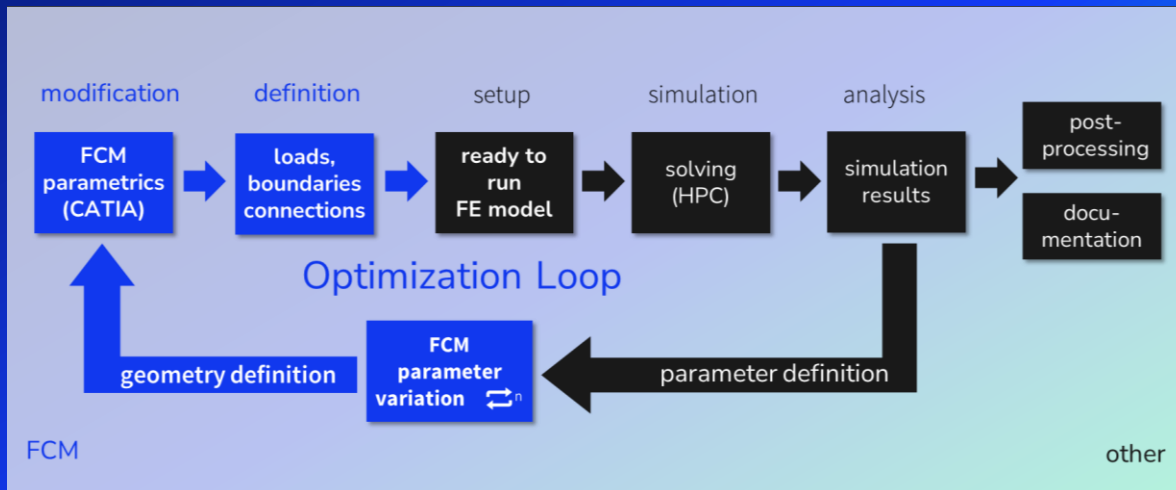


FCM CAT.CAE-Bridge

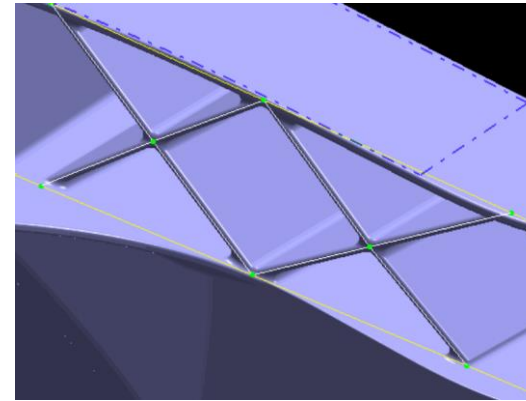
A seamless transition from CAD to CAE and back

CATIA V5 driven design optimization

- fully automated design variation incl. quality checks and dependency rules
- entire definition of simulation information incl. connectivity
- 100% update stability through FCM technology



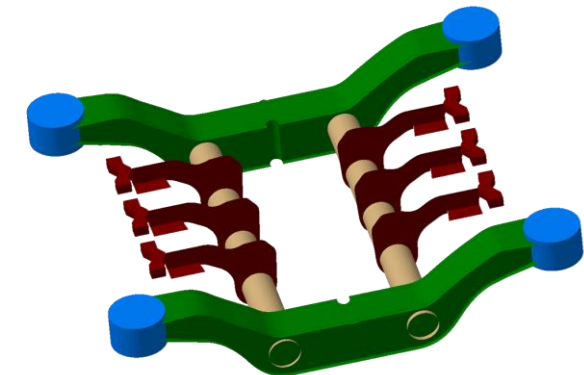
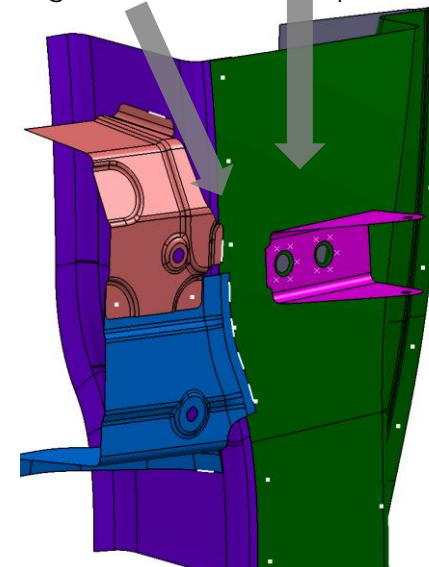
Samples automated design variations



automated rib design



variable number of welding lines
Welding spots depending on position of bolt



Complex design variations

UserGroup

join us

Common goal:
successively propose, define, test and use
new functionalities to bring significant
improvements to the designer's daily work!

Preconditions

- profound proficiency in CATIA V5 application
- awareness of existing improvement needs

Engagement

- regular attendance at meetings
- actively contribute your expertise and challenges
(we see your idea as a "command")

Meetings

- bi-monthly MS-Teams meetings lasting 2 hours
- physical presence meetings once or twice annually
at a member's location



Partners

Here could be your logo, too!



Danke!
Thank you!
Merci!
Gracias!



Michael Probst
michael.probst@caiq.eu



„Doing a job RIGHT the first time gets the job done.
Doing the job WRONG fourteen times gives you job security.“
(Stephen Hawking)

