

RAVENSBURG-WEINGARTEN UNIVERSITY FORMULA STUDENT



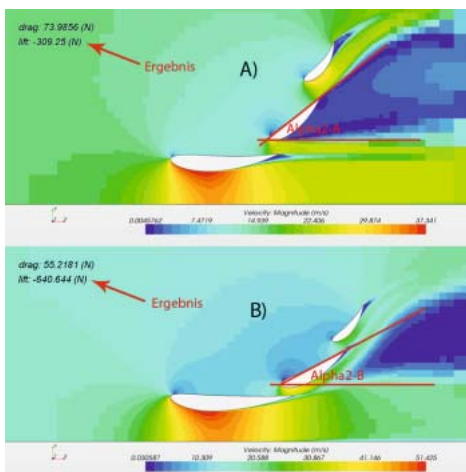
Racing car "Stinger 14"

Objectives of the project aerodynamics concept "Stinger 14"

- Development of an optimal spoiler design
- Application of computational fluid dynamics
- Determination of influential geometrical parameters regarding the spoiler design by variant calculation and statistical analysis
- Optimization of geometry
- Process automation

Methods

- Definition of the spoiler geometry and the objective function according to NACA profiles (National Advisory Committee for Aeronautics)
- Definition of the design space for parameter variation using the optiSLang/Excel interface
- 3d modeling based on the Excel value table
- Discretization and simulation of the wing circulation using the solver StarCCM+ by CD-adapco
- Determination of the absolute values of the wing profile regarding downforce and aerodynamic resistance by multiplying the actual length, as well as result transferring to a text file for the optiSLang interface
- Automation of all value processing by macro generation



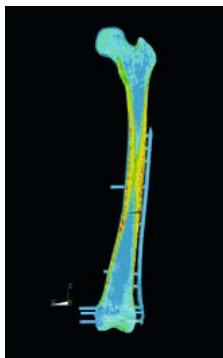
Beside angle Alpha 2, the sensitivity analysis identified Alpha 1, the lengths of the wing 2 (L2) and 3 (L3) as well as the curvature of wing 1 (M1) as the most important parameters regarding the optimization task.

Sensitivity analysis and optimization using optiSLang

- Scanning of the design space using Latin Hypercube Sampling
- Determination and quantification of the most influential parameters regarding the objective value (downforce) by input variation and statistical analysis
- Determination of the optimal spoiler design by maximizing the objective value

Biomechanics

ASSESSMENT OF MAXIMUM STRESSES IN FEM MODELLING



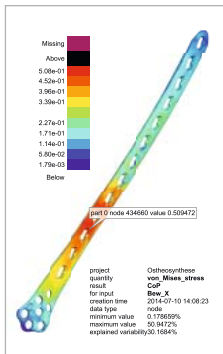
Input parameter	F-CoP
Bew_X	30.2%
Schraube_13	16.1%
Schraube_15	11.6%
Schraube_12	5.2%
Schraube_20	3.4%
Schraube_16	1.8%
Schraube_11	1.2%
Whole model	62.9%

Optimisation of the position of the plate (locking compression plate in diaphyseal fractures) and of the screws. Dominant constraint: maximum von Mises stress in plate.

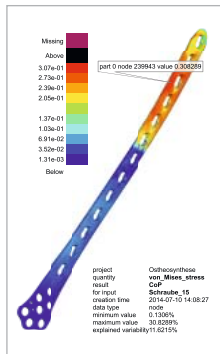
Challenges

- Each design with incompatible meshes
- Maximum stresses at varying positions, typically at notches of screw holes

optiSlang: no sufficiently accurate meta model for max. stress (23% CoP). **Solution: application of Statistics on Structures (SoS)**



Influence of Bew_X (F-CoP)



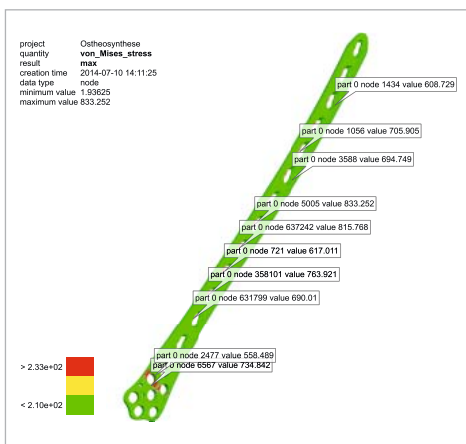
Influence of Schraube_15 (F-CoP)

Strategy 1: Global sensitivity analysis

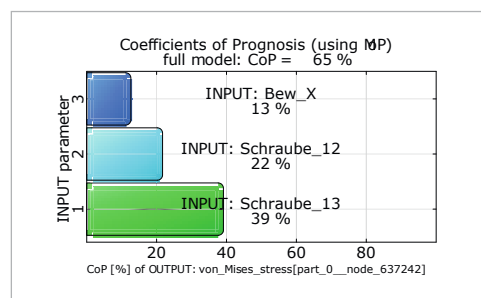
- DoE created with optiSlang, solver: ANSYS Workbench, export of field data to SoS using APDL
- F-MOP for the whole stress field: 65% F-CoP
- Visualise the influence of each input parameter on the respective parts of the plate

Strategy 2: Local sensitivity analysis at hot spots

- SoS: Identify nodes with max. stress in DoE
- Export stress values for selected nodes to optiSlang
- optiSlang: create MOP for selected nodes
- identified sensitivities equivalent with those found by F-MOP



Identification of hot spots



MOP at hot spot 637242



SoS

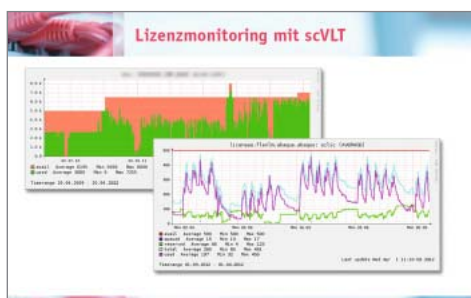
HPC-LÖSUNGEN UND IT-SERVICES AUS EINER HAND



IT-Services für komplexe Rechnerumgebungen

Das scIT-Services-Portfolio

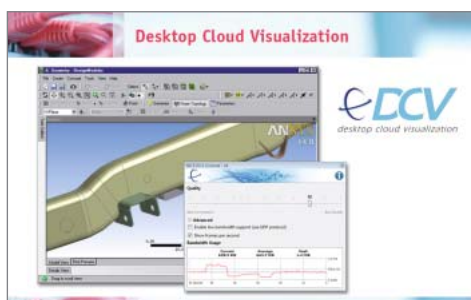
- Outsourcing: Konzentrieren Sie sich auf Ihr Kerngeschäft, wir kümmern uns um Ihre IT
- Outtasking: Nutzen Sie flexibel unser Expertenwissen, wann immer Sie es brauchen
- Projekte: Verwirklichen Sie Ihr spezielles IT-Vorhaben mit unserer Unterstützung



scVENUS License Tracker

Software-Kosten senken durch intelligentes Lizenzmonitoring

- Transparente Lizenznutzung: Anzahl und Nutzung der verfügbaren Lizenzen schnell überblicken
- Koordinierte Nutzung von Lizenzen: Softwarelizenzen abteilungsübergreifend besser auslasten
- Einfache Lizenzabrechnung: Lizenzverbrauch schnell und einfach nach Benutzergruppen oder Projekten abrechnen
- Heterogenes Lizenzmanagement: Verschiedenartige Lizenzmechanismen effizient verwalten



NICE Desktop Cloud Visualization

Remote-Visualisierung im Technical Computing

- Hochperformanter Remote-Zugriff: 3D-Software auch in Netzwerken mit niedriger Bandbreite bzw. hoher Latenz nutzen
- Schneller ROI: Ressourcen (GPU, Speicher, ...) gemeinsam nutzen und Kosten senken
- Plattformübergreifender Zugriff: Heterogene Umgebungen (Linux, Windows, ...) nutzen
- Mehr Sicherheit: Daten verbleiben im Rechenzentrum

HPC-LÖSUNGEN UND IT-SERVICES AUS EINER HAND



Workloadmanagement-Lösungen

Bestmögliche Nutzung von Compute-Ressourcen

- Leistung steigern, Kosten senken: Hardware und Lizenzen optimal ausnutzen
- Herstellerunabhängige Beratung: LSF, Grid Engine, MOAB u.a. passgenau auswählen
- Installation, Konfiguration und Integration: Alle Leistungen aus einer Hand beziehen
- Professioneller Support: Von der s+c-Erfahrung aus hunderten von Projekten profitieren



HPC für den Mittelstand

Entwicklungszeiten verkürzen, Qualität steigern

- Schnell einsatzbereit: Vorkonfigurierte, kostengünstige Compute-Cluster
- Alles aus einer Hand: Installation, Integration und Service durch Bull/s+c
- Auf der sicheren Seite: Rundum-Service während der Nutzungszeit



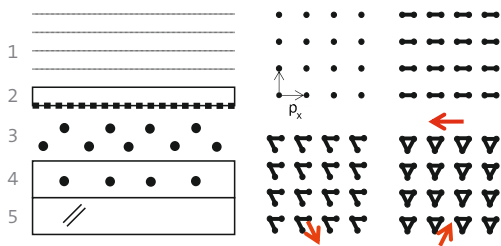
High Performance Computing aus der Cloud

Rechnerressourcen bei Bedarf temporär nutzen

- Volle Kostenkontrolle: Rechenleistung mieten statt kaufen
- Engpässe überbrücken: HPC-Ressourcen bei Bedarf sofort abrufen
- Einfacher und sicherer Zugang: Auf das Extreme Factory Webportal zugreifen
- Maßgeschneiderte Lösungen: Auf viele vorkonfigurierte Anwendungen zugreifen

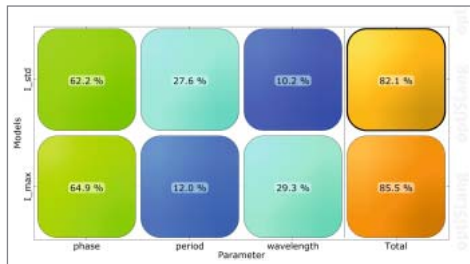
Microoptics

WAVE-OPTICAL SIMULATION FOR LITHOGRAPHIC EXPOSURE

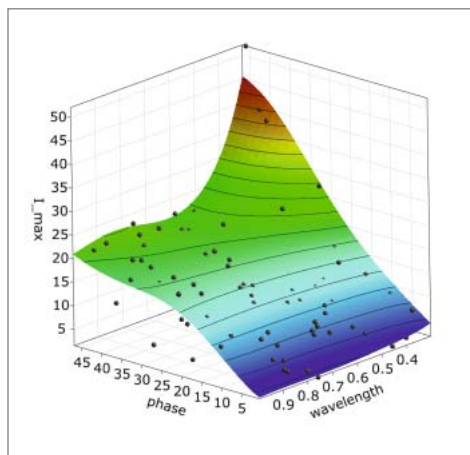


1-wave front, 2-mask,
3-Talbot image, 4-Resist,
5-substrate

By moving within the unit cell, the entire layer to be exposed will be structured.



CoP-matrix representing the individual importances of each input parameter (horizontal=input parameters/vertical=results)



Metamodel of Optimal Prognosis of maximum spot intensity versus phase height of the mask and wavelength

Objectives

- Shorter manufacturing time of micro-optical components
- Analysis of requirements for exposure setting
- Development of an efficient mask design for exposure
- Process implementation of wave-optical simulation and sensitivity analysis with optiSLang

Talbot lithography

- Based on Talbot effect ($Zt = 2 \cdot p^2 / \lambda$)
- Generation of high-energy imaging spots on x - y plane
- Moving the mask towards the substrate layer within the unit cell induces an uniform exposure
- Highly efficient manufacturing of periodic microstructures

Sensitivity analysis with optiSLang

Input parameters

- Period p of the mask
- Wavelength λ of the monochromatic mask
- Phase height ph of the mask

Output parameters

- Maximum spot intensity I_{max}
- Standard deviation of maximum intensity spots

Results of the analysis

- Phase has the highest influence on I_{max}
- The higher the phase the more unstable becomes I_{max}
- The smaller λ the higher becomes I_{max}
- Influence of period is negligible

Conclusions and prospects

The determined optimum regarding wavelength of the wave front and phase height of the mask enables a stable structured exposure. The requirements for the design were specified and sensitivities of input parameters were identified for high reproducibility.