

ENGINEERING PORTFOLIO

ilkem Kiral

Mechanical Engineer · Mechanical Design

I work across the full product development cycle, from concept design to finite element validation and manufacturing documentation, on projects ranging from high- and medium-voltage switchgear and thermoforming molds to vehicle suspension and renewable energy systems.

SOFTWARE

SOLIDWORKS

3D modeling, assemblies, sheet metal, drawings

SOLIDWORKS Simulation

Static, modal and thermal analysis

ANSYS Workbench

Structural analysis and fatigue assessment

AutoCAD

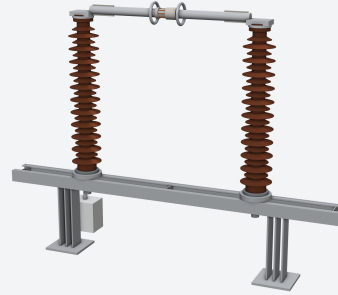
2D manufacturing drawings, sheet metal laser-cutting layouts

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2026

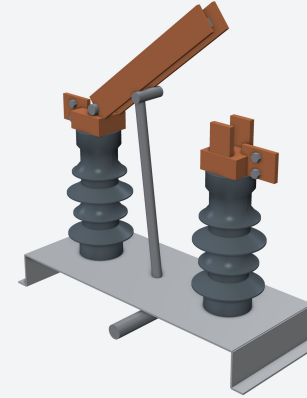
Projects

From concept to validation: design, analysis and manufacturing readiness



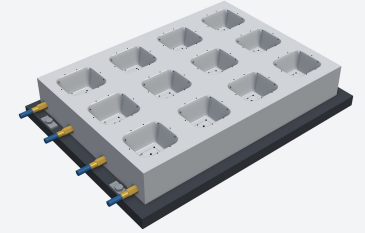
01 High-voltage disconnector
(72.5/420 kV)

Industrial Project · p. 2



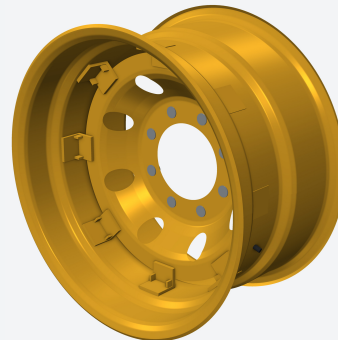
02 Medium-voltage
disconnector (24/36 kV)

Industrial Project · p. 3



03 Mold design for
thermoforming machines

Industrial Project · p. 4



04 Effect of lug profile on
agricultural wheel fatigue
life

University Project · p. 5



05 Control arm design for
motor vehicles

University Project · p. 6



06 Solar-powered lighting
system

University Project · p. 7

01

INDUSTRIAL PROJECT
Switchgear · 72.5 – 420 kV

Design and optimization of a high-voltage disconnecter (72.5/420 kV)

SOLIDWORKS

SOLIDWORKS Simulation

AutoCAD · Laser cutting

PROBLEM

High-voltage disconnectors must maintain contact reliability under electrodynamic forces from short-circuit currents, conductor tensile loads, and wind, ice and seismic effects. As the voltage level rises, insulation clearances and moment arms grow, creating governing loads on the operating mechanism, the post insulators and the support structure.

APPROACH

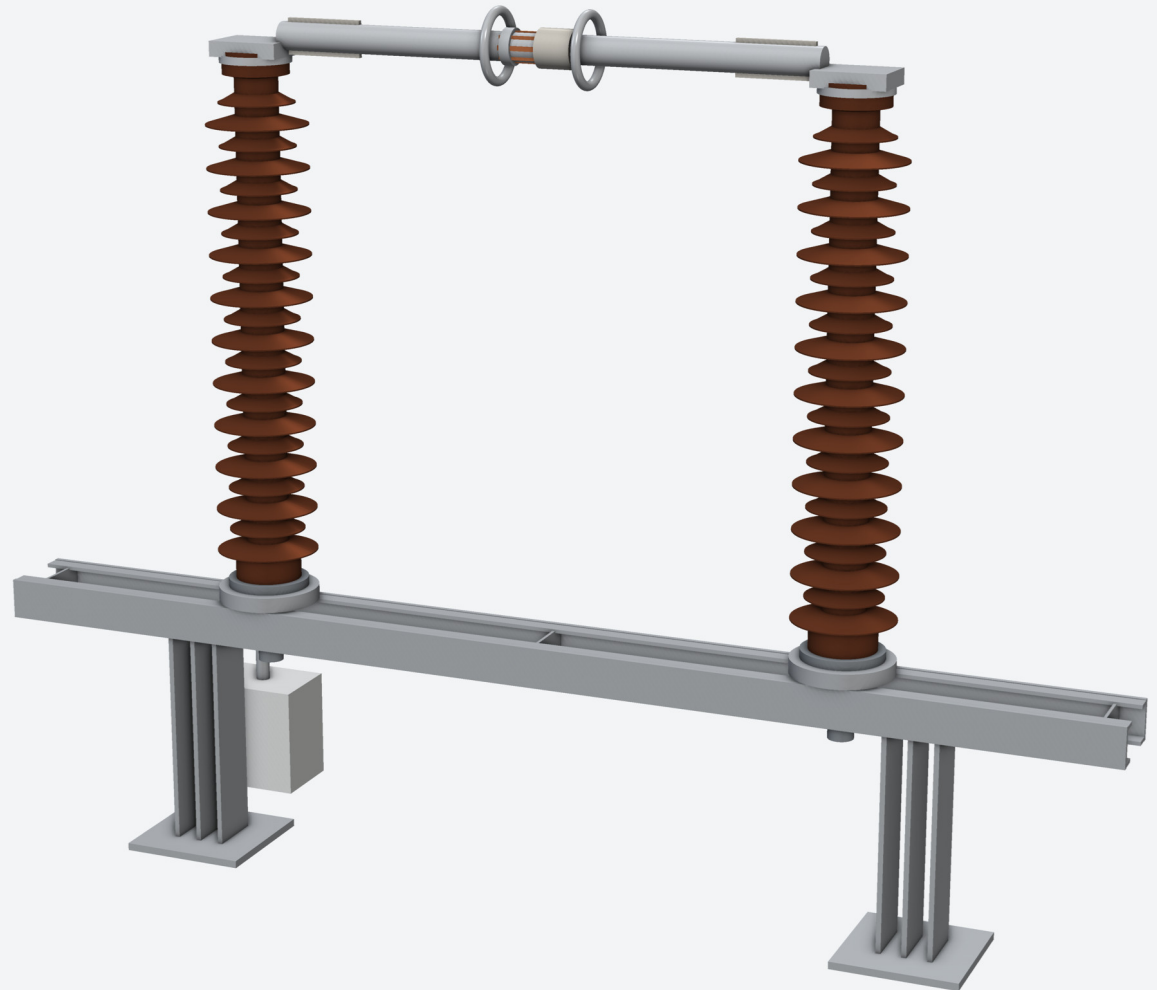
I approach the product family with a modular architecture that scales across voltage levels. By modeling the operating and interlocking mechanism kinematically, I optimize dead-center positions and the required drive torque, and I size the current path and contact system for contact pressure and temperature-rise criteria. I validate the support structures with static and modal analyses, aligning the design with IEC 62271-102 type test requirements.

OUTCOME

A product family with a high share of common parts, quickly adaptable to different voltage levels and with simplified site assembly.

MY ROLE

Mechanical design, mechanism kinematics, structural analysis, technical documentation



3D CAD MODEL · SOLIDWORKS

02

INDUSTRIAL PROJECT
Switchgear · 24 – 36 kV

Design and optimization of a medium-voltage disconnecter (24/36 kV)

SOLIDWORKS

SOLIDWORKS Simulation

AutoCAD · Laser cutting

PROBLEM

In medium-voltage panels, the disconnecter must maintain insulation clearances within a limited volume, keep its mechanical integrity at short-time withstand current and operate reliably over thousands of opening-closing cycles. These requirements must be met together with cost and manufacturability targets.

APPROACH

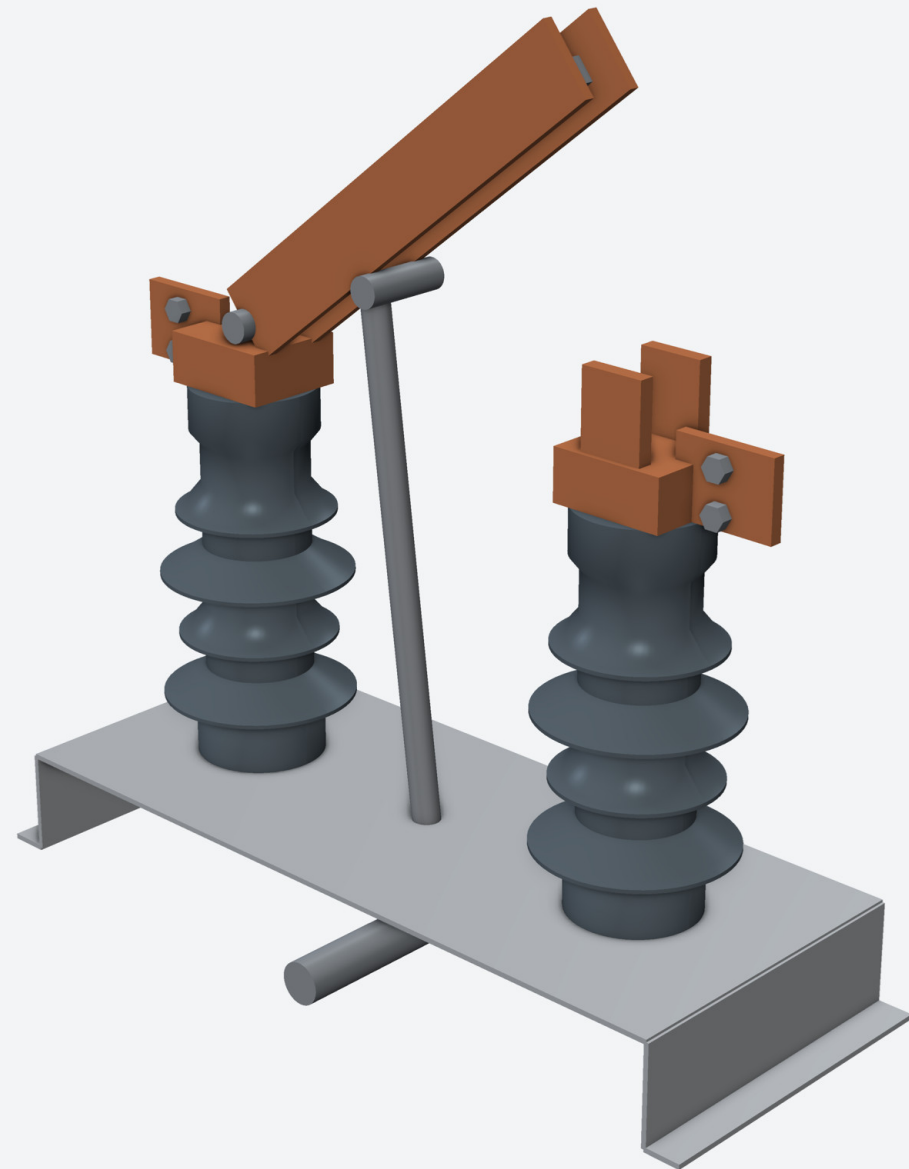
I compared alternative geometries and materials for the contact blades, post insulators and frame. Identifying the critical design parameters, I restructured the tolerances of sheet metal and machined parts according to manufacturing capability. I verified mechanism life and contact pressure through analysis and prototype testing.

OUTCOME

A design with fewer parts and assembly steps, less sensitive to production variation and ready for mechanical endurance testing.

MY ROLE

Concept and detail design, tolerance analysis, prototype and test coordination



3D CAD MODEL · SOLIDWORKS

03

INDUSTRIAL PROJECT
Tooling · Thermoforming

Mold design and optimization for thermoforming machines

SOLIDWORKS

SOLIDWORKS Simulation

PROBLEM

In thermoforming, the wall thickness distribution of the part depends directly on mold surface temperature, vacuum channel layout and plug-assist geometry. Unbalanced cooling and insufficient venting lengthen the cycle time and cause thinning, warpage and forming defects.

APPROACH

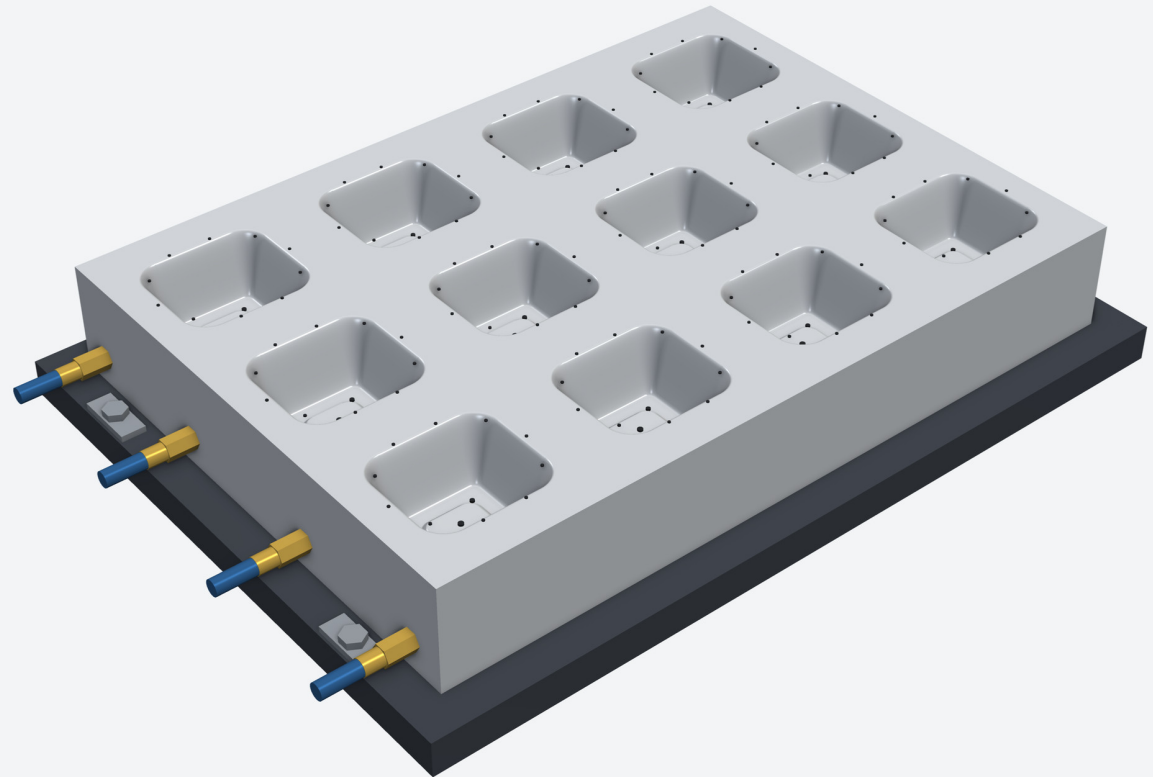
I repositioned the cavities, vacuum holes and cooling channels according to the part geometry and material behavior. I balanced the wall thickness distribution with the plug-assist geometry, and made the mold components modular for easier machining and maintenance.

OUTCOME

More uniform wall thickness, a shorter cycle time and a modular mold structure suited to fast changeovers.

MY ROLE

Mold design, manufacturing drawings, trial production and improvement



3D CAD MODEL · SOLIDWORKS

04

UNIVERSITY PROJECT
Agricultural machinery · Fatigue

Computer-aided analysis of the effect of lug profile on the fatigue life of wide-base agricultural wheels

SOLIDWORKS

ANSYS Workbench

PROBLEM

Agricultural wheels are subjected to variable-amplitude, multiaxial loads in field conditions. Geometric discontinuities in the lug region connecting the wheel disc to the hub cause stress concentrations and early fatigue failure.

APPROACH

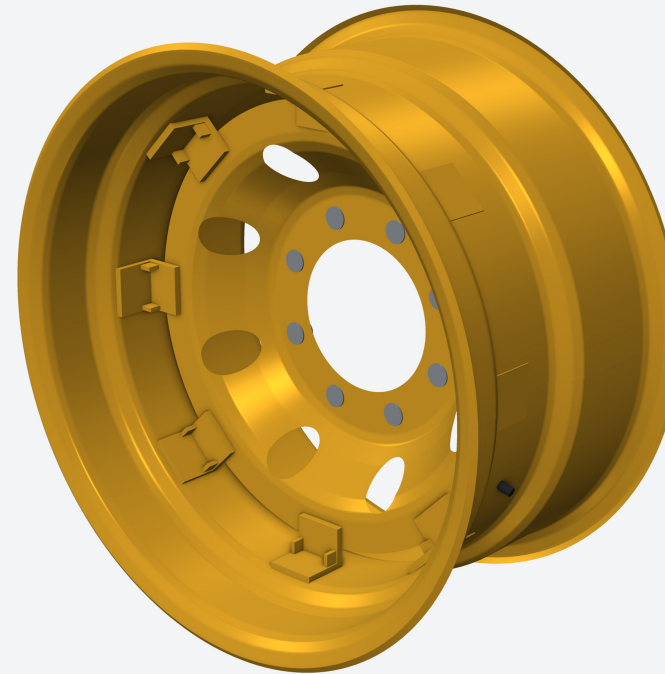
I modeled different lug profile geometries parametrically. Analyzing rotating bending and radial load cases with the finite element method, I determined stress amplitudes in the critical regions and estimated fatigue life with the S-N approach using mean stress corrections.

OUTCOME

The effect of lug profile parameters on stress concentration and fatigue life was established comparatively, and geometry recommendations that improve durability were developed.

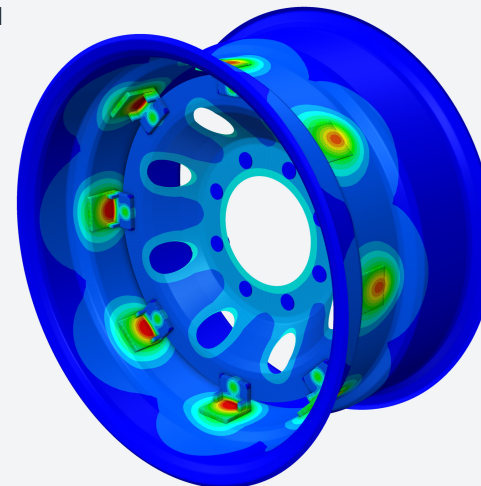
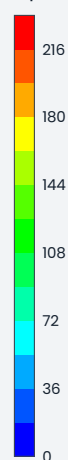
MY ROLE

Parametric modeling, finite element analysis, fatigue assessment, reporting



3D CAD MODEL · SOLIDWORKS

Equivalent stress [MPa]



ANALYSIS

Structural analysis + fatigue – lug region

Stress concentration at the lug-rim joint under radial and rotating bending loads. Stress amplitudes in the critical region were converted to fatigue life with the S-N approach.

ANSYS WORKBENCH

05

UNIVERSITY PROJECT
Automotive · Suspension

Design and mechanical analysis of a control arm for motor vehicles

SOLIDWORKS

ANSYS Workbench

PROBLEM

The control arm must transfer vertical, longitudinal and lateral wheel forces to the chassis while preserving suspension geometry. It needs to be both lightweight and sufficiently stiff under critical load cases such as braking, cornering and pothole impacts.

APPROACH

I designed the control arm by defining its mounting points from the suspension kinematics. I defined the critical driving load cases, ran static analyses and refined the cross-sections based on stress and displacement results to balance mass and stiffness.

OUTCOME

A lightweight, manufacturable control arm geometry that is safe under the defined load cases.

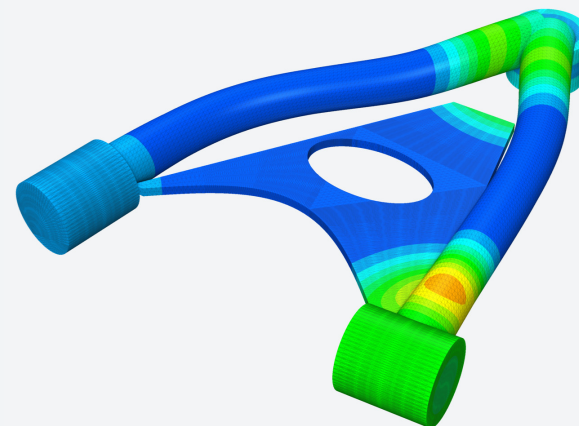
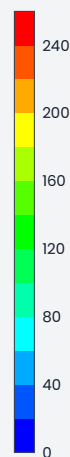
MY ROLE

Design, load analysis, finite element analysis, reporting



3D CAD MODEL · SOLIDWORKS

Von Mises [MPa]



ANALYSIS

Static structural analysis – combined load case

Von Mises stress distribution in the control arm under combined braking and cornering loads; cross-section refinements were based on these results.

ANSYS WORKBENCH

06

UNIVERSITY PROJECT
Renewable energy · Lighting

Solar-powered lighting system

SOLIDWORKS

PROBLEM

Off-grid lighting systems must operate uninterrupted through the night under varying solar conditions. If panel power, battery capacity and pole structure are not sized together correctly, the system either falls short or incurs unnecessary cost.

APPROACH

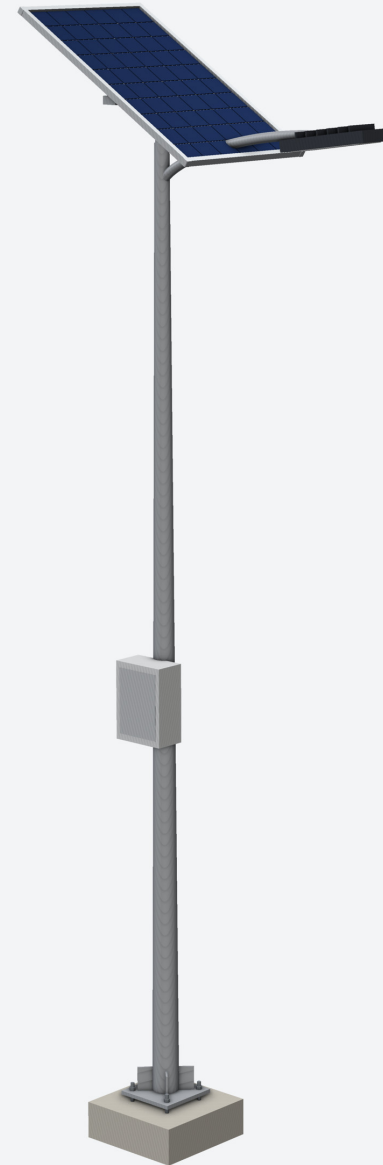
I built an energy balance from local solar irradiation data and lighting demand to determine panel power, battery capacity and charge control requirements. I optimized the panel tilt angle for efficiency and evaluated the pole and fasteners mechanically under wind load.

OUTCOME

A lighting system design sized for uninterrupted operation, mechanically safe and requiring low maintenance.

MY ROLE

Energy calculations, system sizing, mechanical design



3D CAD MODEL · SOLIDWORKS