Company (FESMARKET)

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Software Used (Solid Edge 2020)

Solver Used (NX NASTRAN)

Table of Contents

1. Introduction
2. Model Information
3. Study Properties
4. Study Geometry
5. Material Properties
6. Loads
7. Constraints
8. Mesh Information
9. Results
10. Conclusion

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1. Introduction

A structural simulation is carried out using the Finite Element Method (FEM) with Solid Edge 2022 on a model of a shopping cart chassis built from T-2024 aluminium alloy. The objective of the simulation was to evaluate the capacity of the structure and the material to withstand the maximum load in its most demanding use. To achieve this, distributed forces were applied at the point where the shopping basket is seated, which was assumed to contain an additional load of 32 kg (including the weight of the 8 kg basket itself), resulting in a total weight of 392,400 mN, taking into account the gravitational acceleration (9.81 m/s²). Subsequently, the displacement of the structure was analysed to determine its stability and prevent slippage.

2. Model Information

Document	C:\Users\mique\Downloads\CHASSIS SIMULATION.par

3. Study Properties

Study Property	Value
Study name	Static Study 1
Study Type	Linear Static
Mesh Type	Tetrahedral
Iterative Solver	On
NX Nastran Geometry Check	On
Surface results only option	On
Caveat text	One or more sections of the study were not in completed state when this report was generated.

4. Study Geometry

4.1 Solids

Solid Name	Material	Mass	Volume	Weight
CHASSIS SIMULATION.par	Aluminum, 2024-T4	25 kg	17138072,060 mm^3	352701,523 mN

5. Material Properties

5.1 Aluminum, 2024-T4

Property	Value
Density	2100,000 kg/m^3
Coef. of Thermal Exp.	0,0000 /C
Thermal Conductivity	0,189 kW/m-C
Specific Heat	920,000 J/kg-C
Modulus of Elasticity	73084,424 MegaPa
Poisson's Ratio	0,330
Yield Stress	289,580 MegaPa
Ultimate Stress	427,475 MegaPa
Elongation %	0,000

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7. Loads

Load Name	Load Type	Load Value	Load Distribution	Load Direction	Load Direction Option
Force 1	Force	Fx: 0 mN, Fy: 0 mN, Fz: -3,92e+05 mN	Total		Components

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9. Mesh Information

Mesh type	Tetrahedral
Total number of bodies meshed	1
Total number of elements	79.850
Total number of nodes	131.018
Subjective mesh size (1-10)	6

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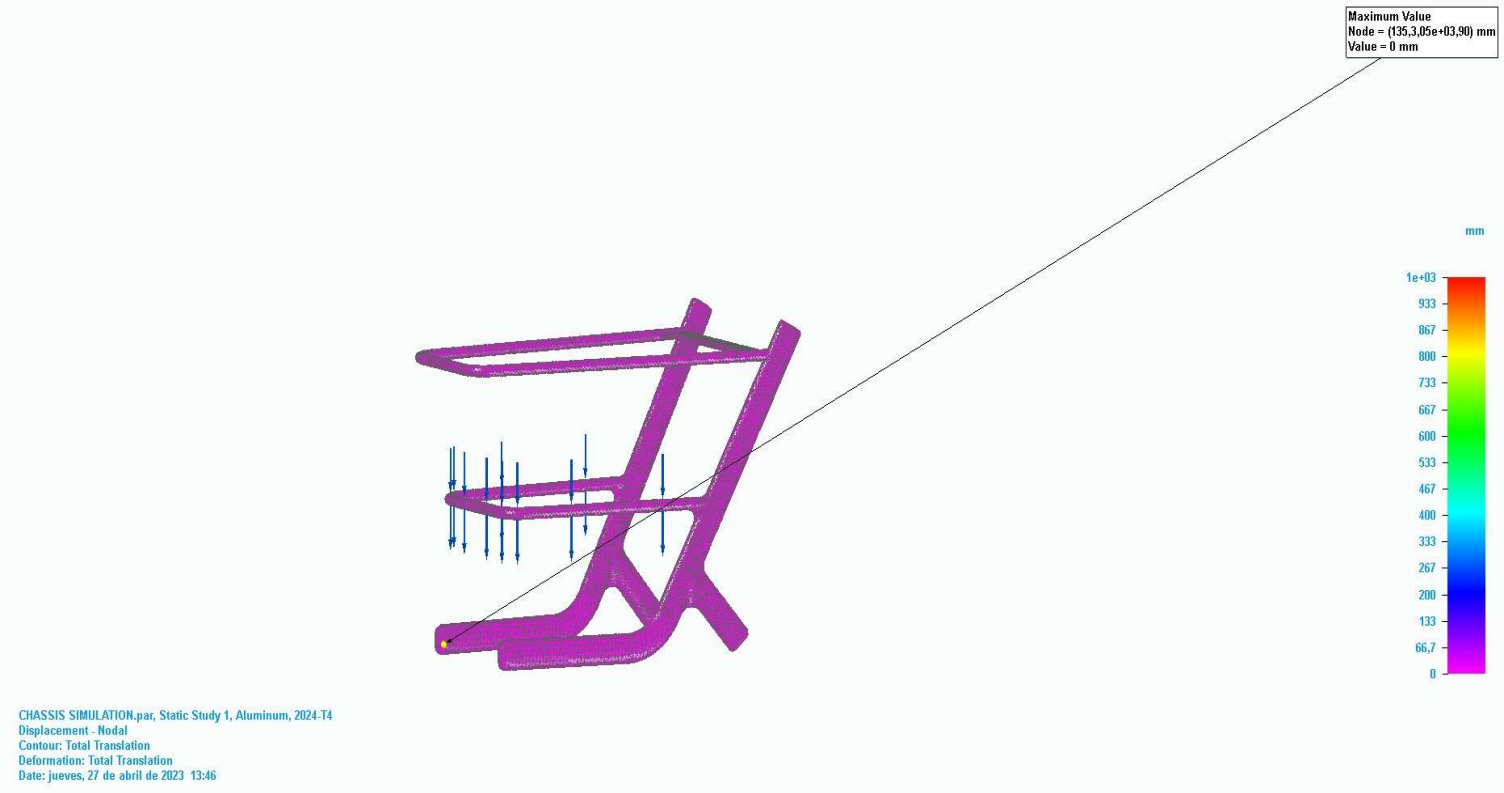
10. Results

10.1 Displacement Results

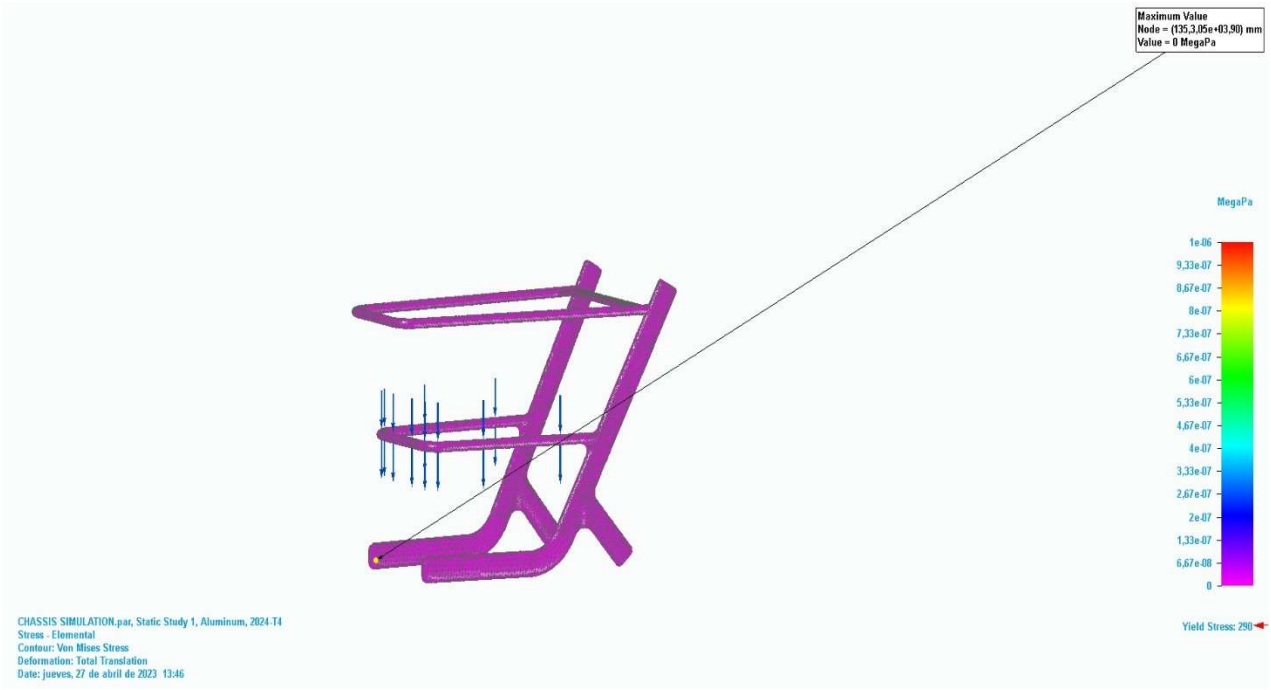
Result component: Total Translation					
Extent	Value	X	Y	Z	
Minimum	0 mm	134,502 mm	3049,834 mm	89,971 mm	
Maximum	1000 mm	134,502 mm	3049,834 mm	89,971 mm	



Total Translation

10.2 Stress Results

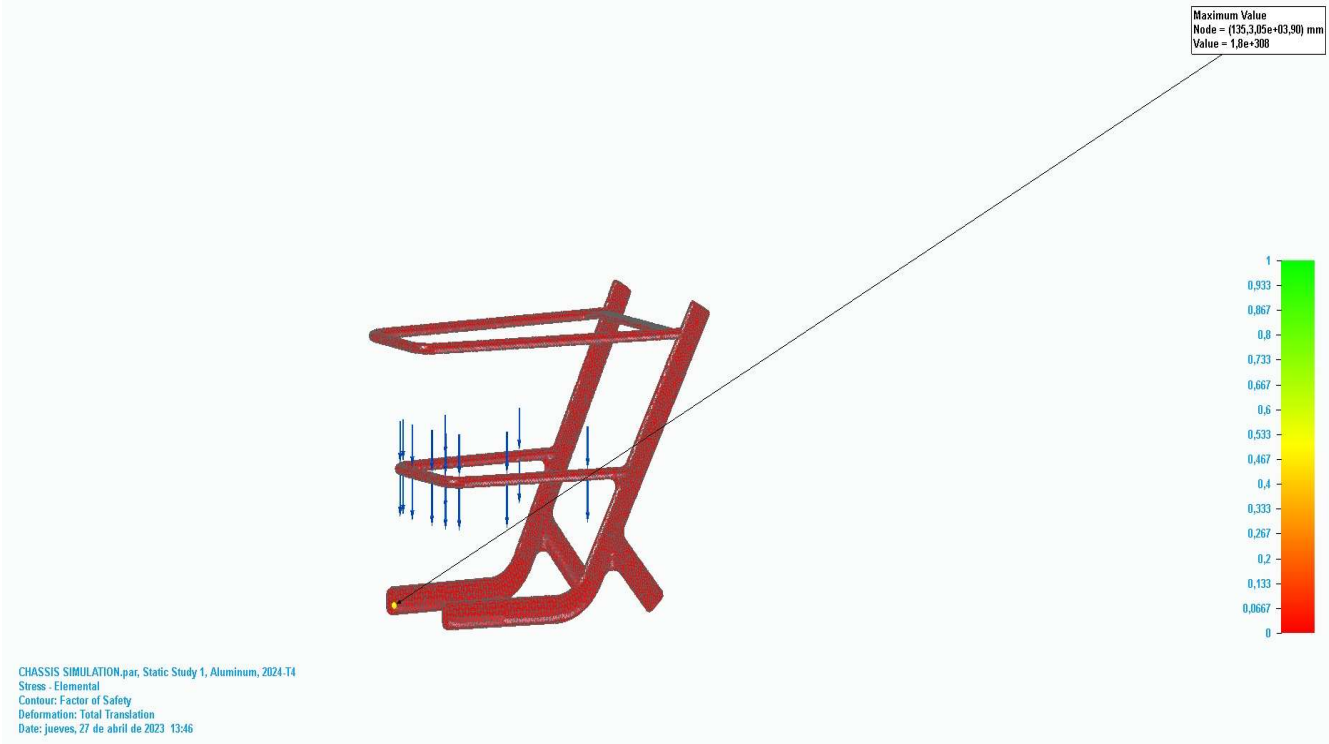
Result component: Von Mises					
Extent	**Value**	**X**	**Y**	**Z**	
Minimum	0 MegaPa	134,502 mm	3049,834 mm	89,971 mm	
Maximum	1e-06 MegaPa	134,502 mm	3049,834 mm	89,971 mm	



Von Mises

10.3 Factor of Safety Results

Result Component: Factor of Safety					
Extent	**Value**	**X**	**Y**	**Z**	
Minimum	0	134,502 mm	3049,834 mm	89,971 mm	
Maximum	1	134,502 mm	3049,834 mm	89,971 mm	



Factor of Safety

10.4 Equilibrium Check Results

Result Component: Total Summation					
Fx	**Fy**	**Fz**	**Mx**	**My**	**Mz**
0 mN	0 mN	0 mN	0 N-m	0 N-m	0 N-m

11.Conclusion

After performing a structural simulation using the finite element method (FEM) on a model of a shopping cart chassis constructed of T-2024 aluminum alloy, a solid and conclusive conclusion was obtained. The simulation evaluated the capacity of the structure and material to withstand the maximum load in its most demanding use. The results indicate that the material is optimal for the application employed, even under highly unfavorable working conditions. In particular, it was observed that the displacement of the parts of the structure is zero, indicating that the form and material are capable of very satisfactorily supporting the forces acting on it. Consequently, we can affirm that the structure fulfills its function perfectly and that the material is suitable for this specific application. It is important to highlight that these results were obtained through a virtual simulation, which allows analyzing the behavior of the structure before its physical construction, which can significantly reduce costs and product development time. In addition, the simulation allows evaluating different scenarios and variations in the design of the structure, providing valuable information to optimize its performance and efficiency. In summary, FEM structural simulation is an essential tool for the design and optimization of complex mechanical structures such as theshopping cart.

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13. Disclaimer

Important Information

This report should not be used to solely judge a design idea's suitability to a given set of environmental conditions. Siemens makes every effort to ensure that its products provide as much guidance and help as possible. However this does not replace good engineering judgment, which is always the responsibility of our users. A qualitative approach to engineering should ensure that the results of this evaluation are evaluated in conjunction with the practical experience of design engineers and analysts, and ultimately experimental test data. The results contained within this report are believed to be reliable but should not be construed as providing any sort of warranty for fitness of purpose.