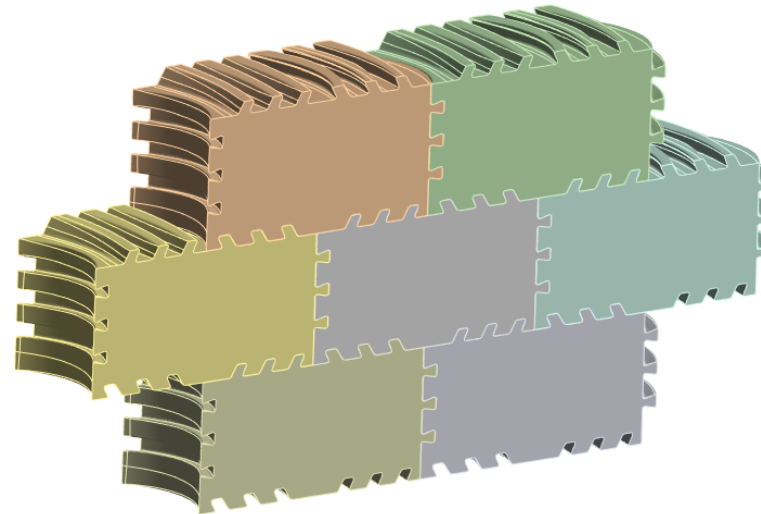


FEA Simulation Report

Project: Interlocking Keyed Bricks , Y-924-1

Client: Van Cor Threads LLC



by: **TetraElements**

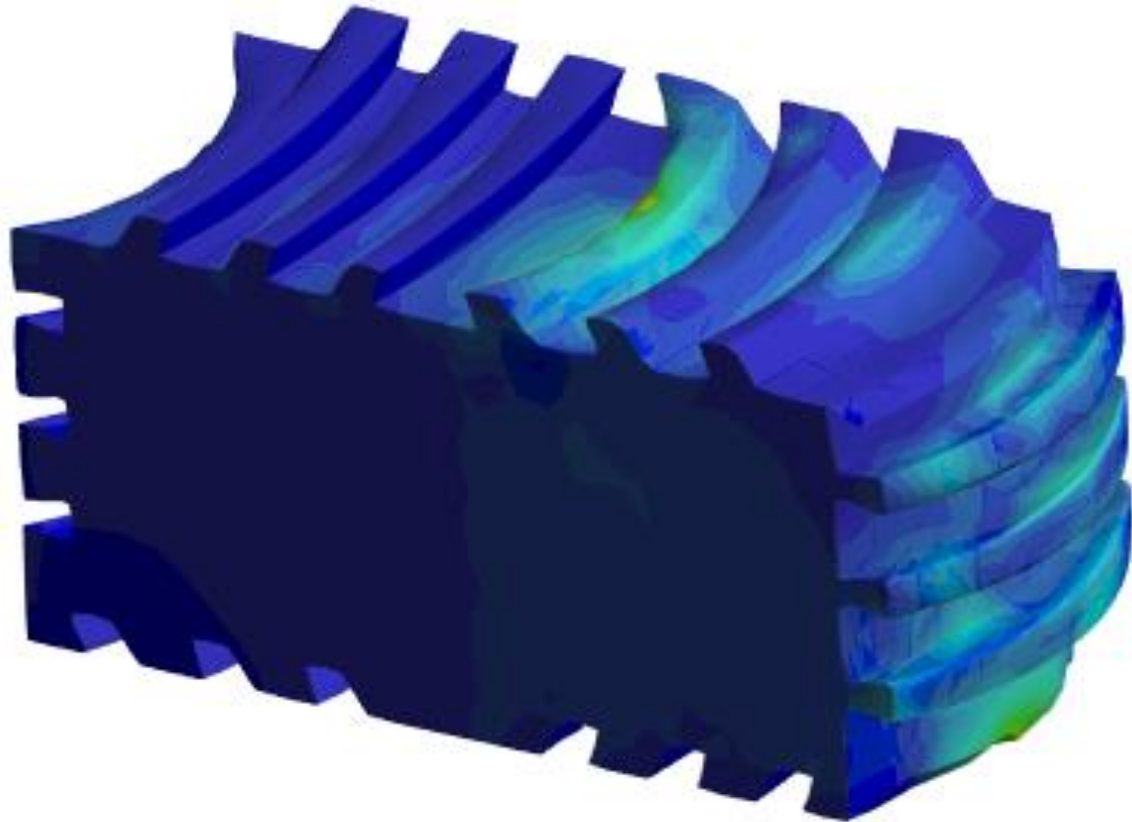
August 2024

**Preliminary Visual results:
Work in Progress**

Outline

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- Executive Summary
- Objectives
- FE model Setup:
 - Methodology and assumptions
 - Geometry and Meshing
 - Material Properties
 - Boundary Conditions
 - Loadings
- Analysis Results
- Discussion
- Recommendations

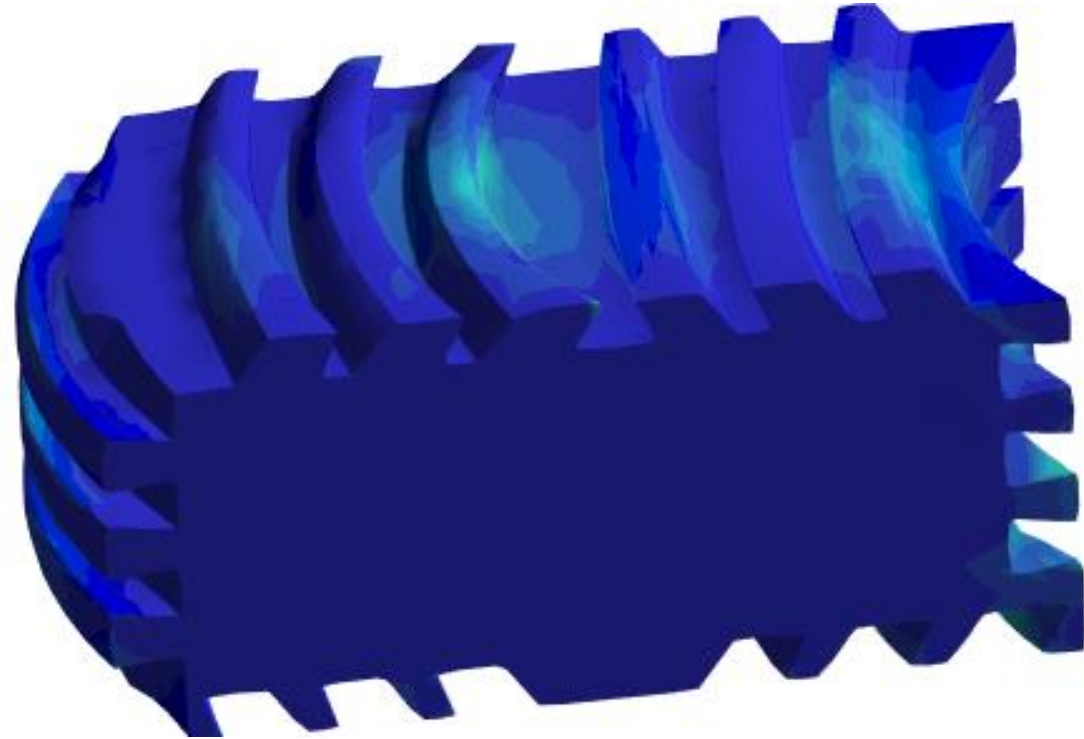


Single keyed brick stress distribution

Executive Summary

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- Conversion of STL to Solid CAD Models
- Simplification of Geometrical Complexities
- Advanced Material Modeling Techniques
- High-Precision Meshing
- Application of Load Conditions
- Comprehensive Contact Modeling
- Static Nonlinear Analysis
- Detailed Stress Distribution Assessment
- Contact Pressure Analysis
- Strategic Recommendations

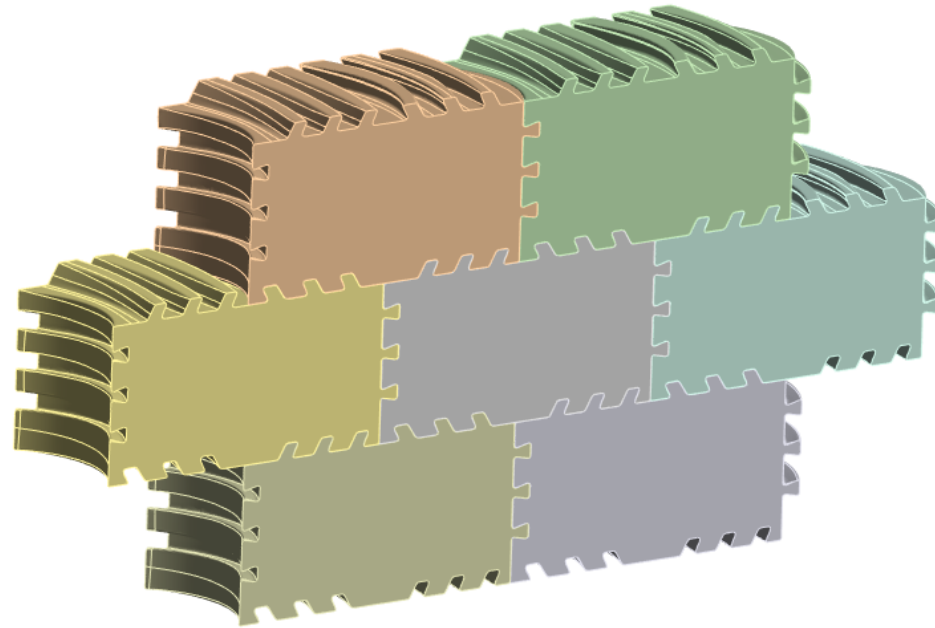


Stress distribution on the central brick

Objectives

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To develop only visual contents such as graphs, images, and reports for use in websites, grant applications, and other documents aimed at fundraising.



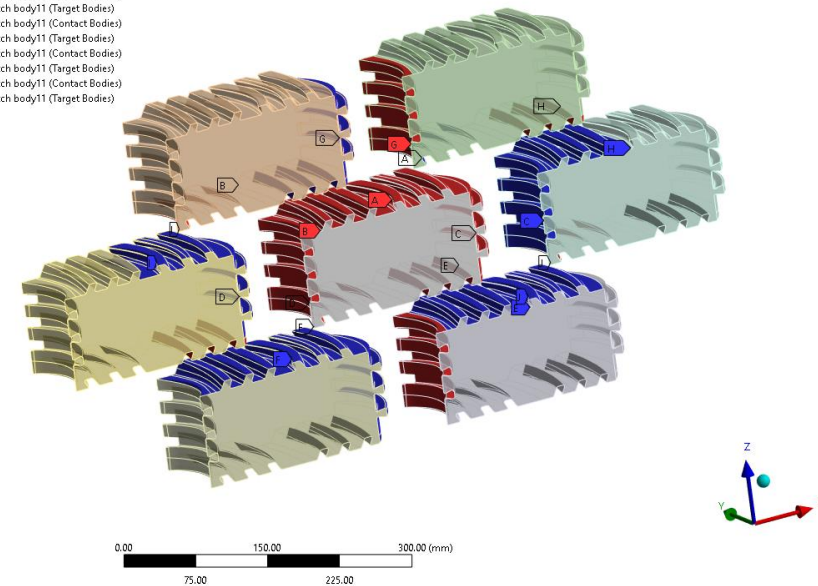
Assembled keyed bricks

FE Model Setup: Methodology

- Utilized Ansys Mechanical for comprehensive analysis.
- Converted STL files to solid STEP files for accurate modeling.
- Implemented detailed meshing techniques.
- Conducted precise contact modeling.
- Performed static nonlinear analysis.

Frictionless - Assembled/Patch body 11 To Assembled/Patch body 11
Items: 10 of 12 indicated
8/9/2024 10:26 PM

A	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Contact Bodies)
B	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Target Bodies)
C	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Contact Bodies)
D	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Target Bodies)
E	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Contact Bodies)
F	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Target Bodies)
G	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Contact Bodies)
H	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Target Bodies)
I	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Contact Bodies)
J	Frictionless - GJT1332 Qx Qy/Patch body 11 To Assembled/Patch body 11 (Target Bodies)

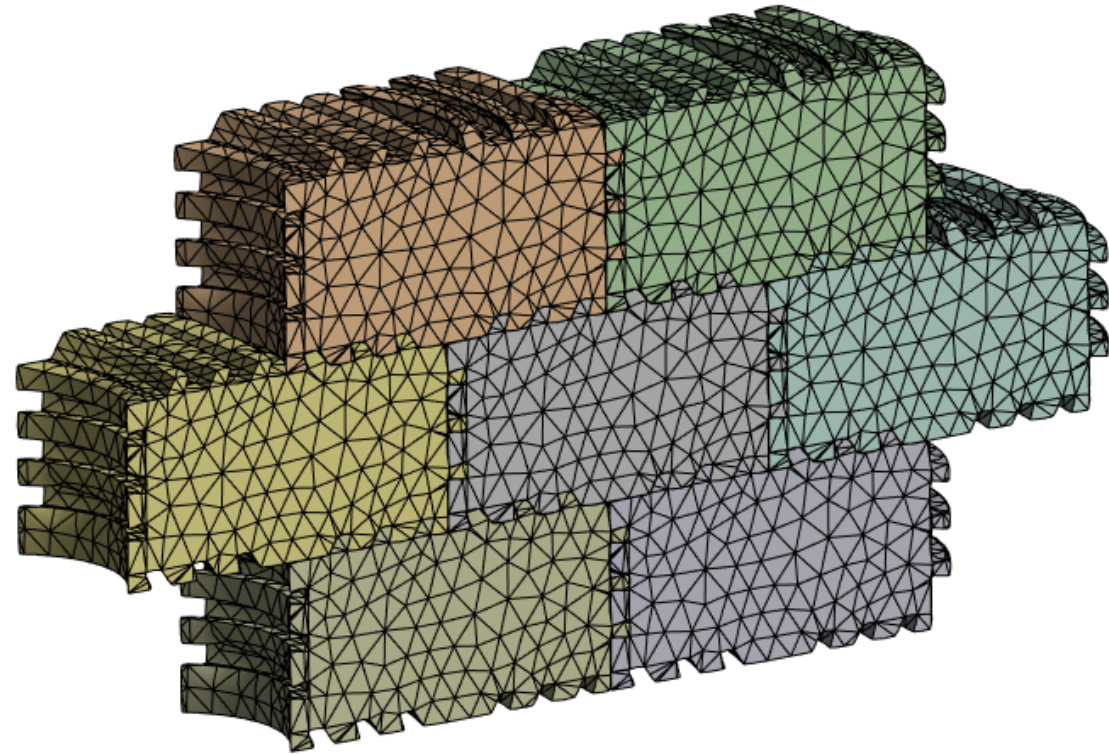


Modeling the Contacts among the bricks

FE Model Setup: Geometry and Meshing

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Statistics		
<input type="checkbox"/>	Nodes	72271
<input type="checkbox"/>	Elements	41390



Meshing the geometry


FE Model Setup: Material Properties

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 **Aluminum Alloy** 

General aluminum alloy. Fatigue properties come from MIL-HDBK-5H, page 3-277.

Density	2.77e-06 kg/mm ³
---------	-----------------------------

Structural 

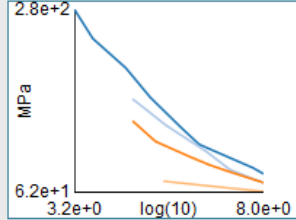
▼ Isotropic Elasticity

Derive from	Young's Modulus and Poisson's Ratio
Young's Modulus	71000 MPa
Poisson's Ratio	0.33
Bulk Modulus	69608 MPa
Shear Modulus	26692 MPa


Isotropic Secant Coefficient of Thermal Expansion: 2.3e-05 1/°C


Compressive Ultimate Strength: 0 MPa


Compressive Yield Strength: 280 MPa

S-N Curve 

Tensile Ultimate Strength	310 MPa
Tensile Yield Strength	280 MPa

Thermal 

Electric 

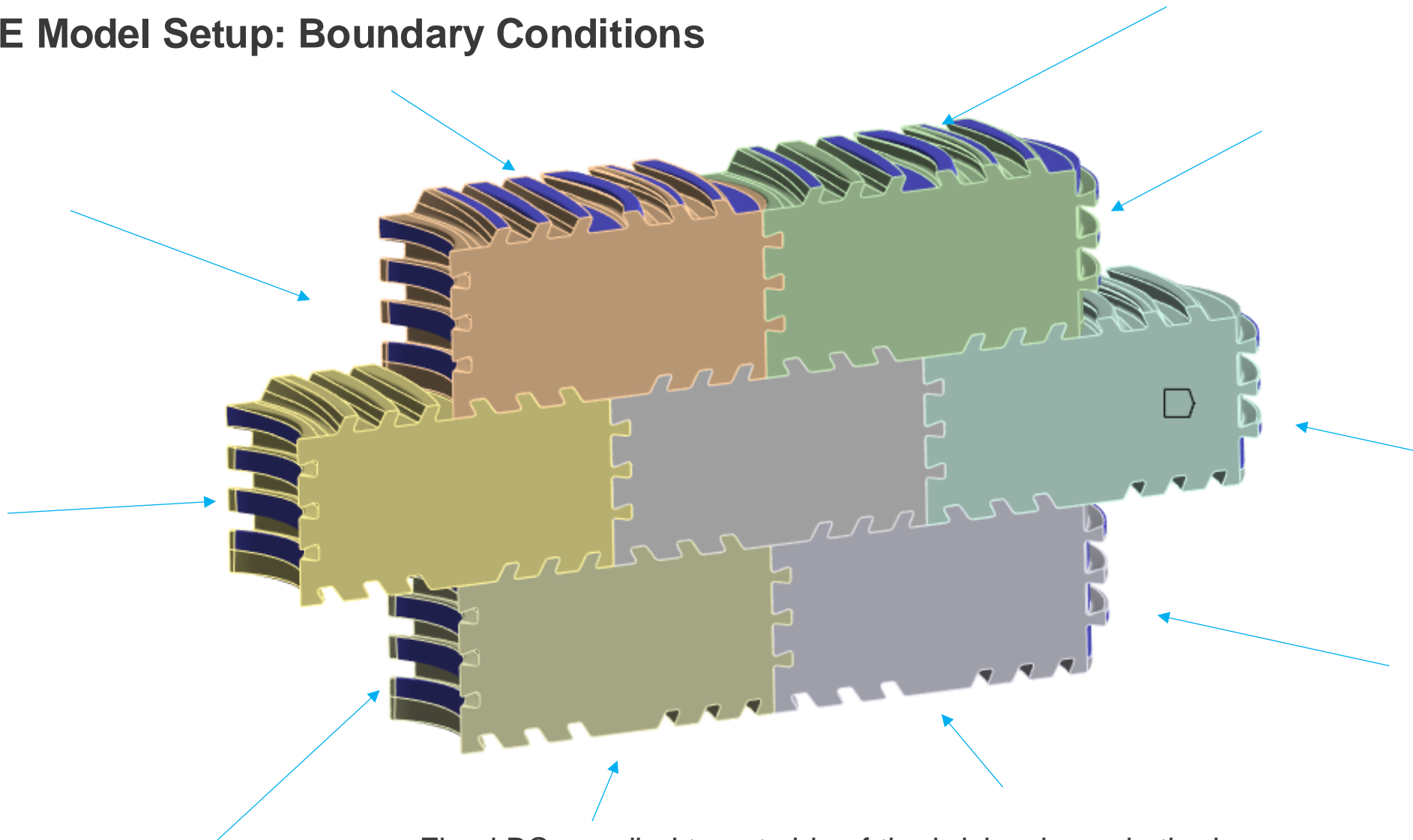
Magnetic 

Isotropic Relative Permeability	1
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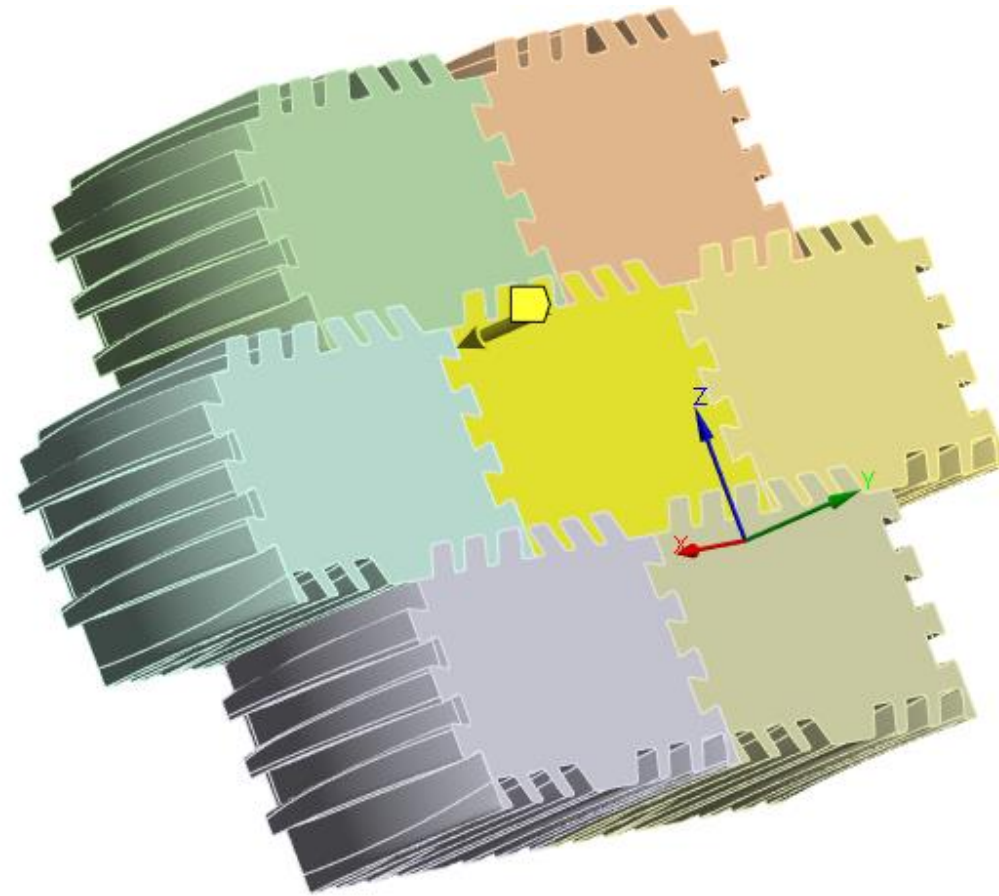
Materials' behavior modeling

FE Model Setup: Boundary Conditions

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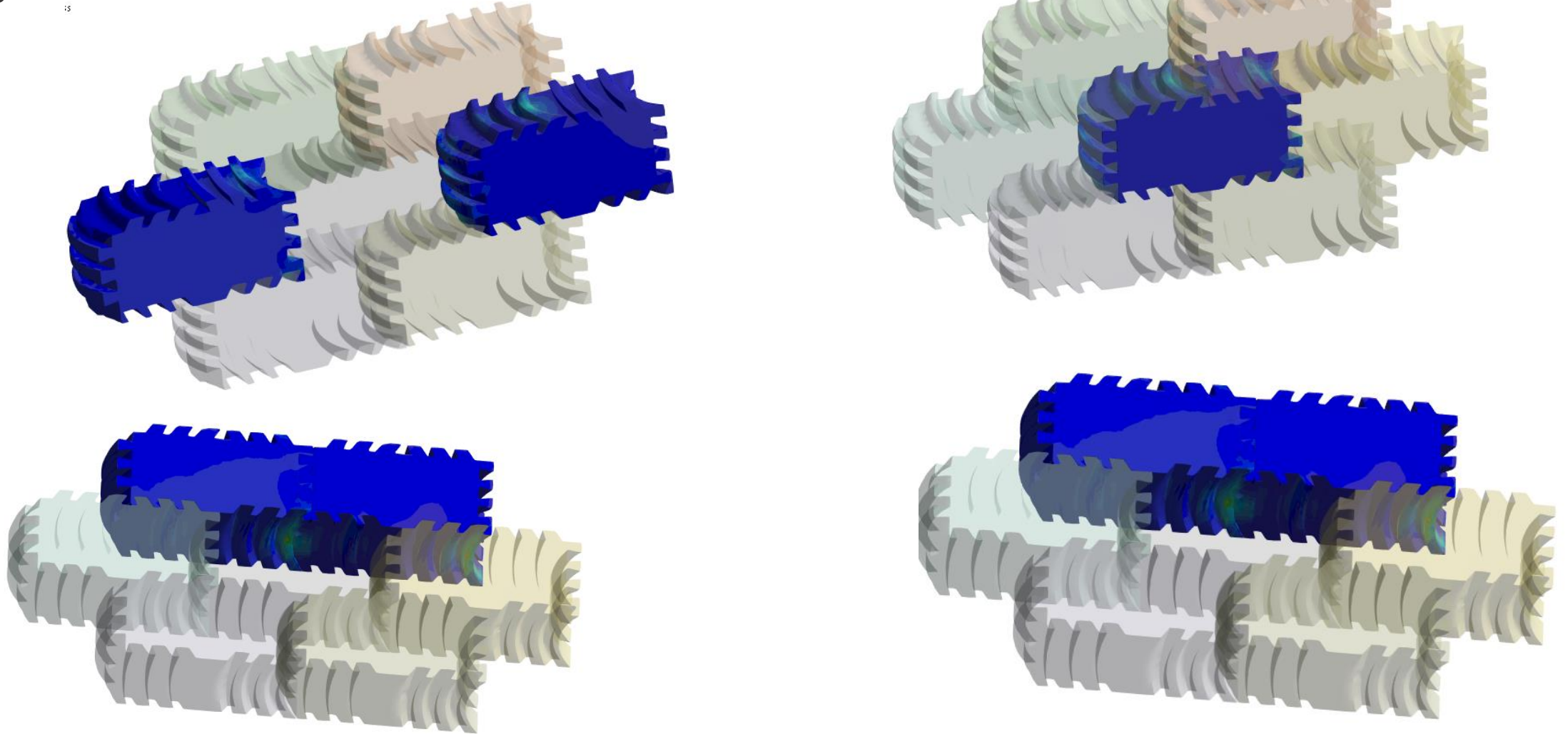
Fixed BCs applied to out side of the bricks shown in the image



Evenly distributed displacement load applied to the side of the central brick

Analysis Results _Stress Distribution

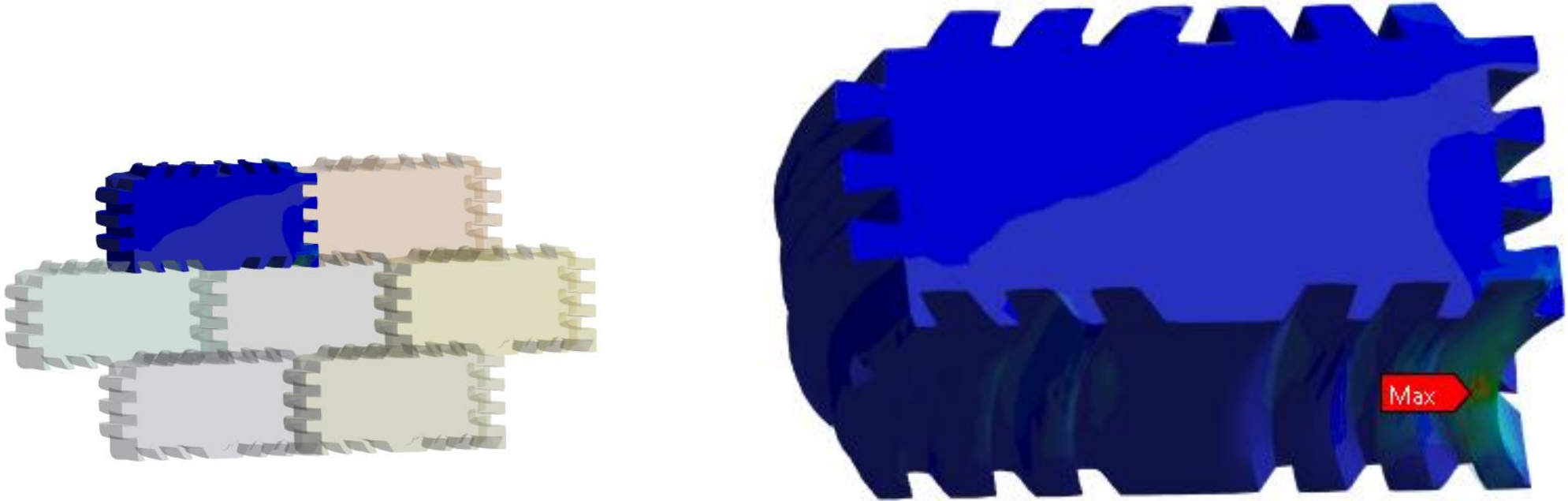
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Stress distributions on Bricks

Analysis Results _Stress Distribution

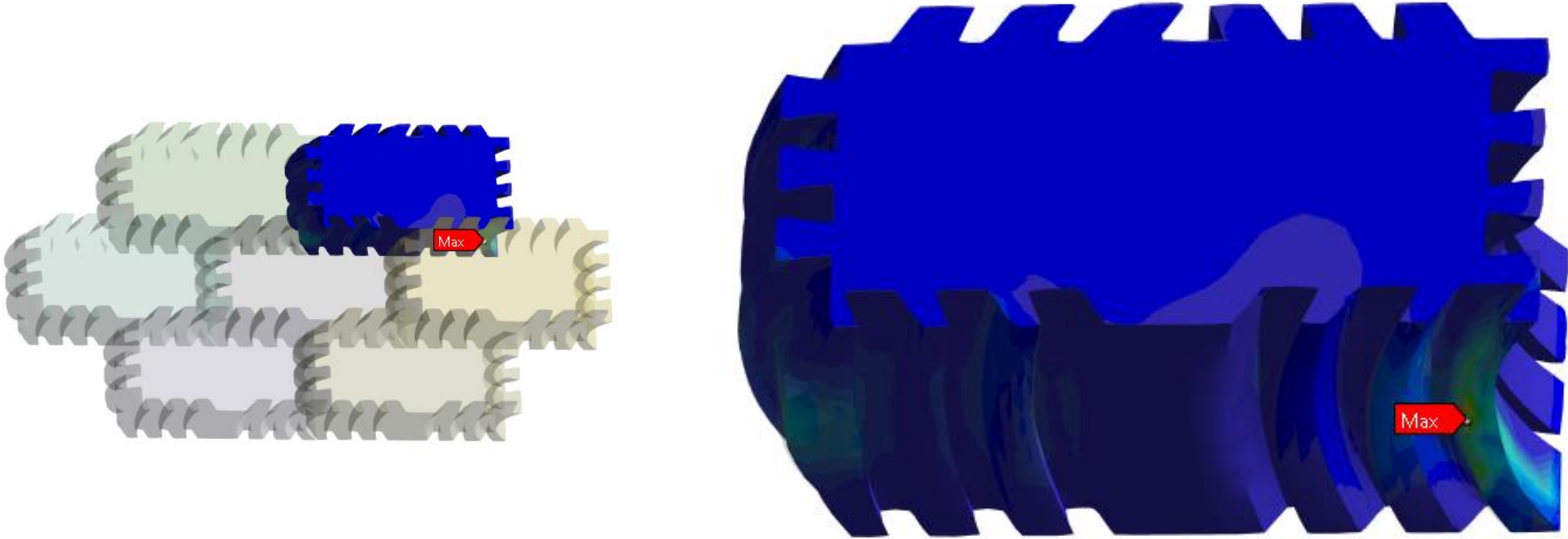
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Stress distributions on Bricks

Analysis Results _Stress Distribution

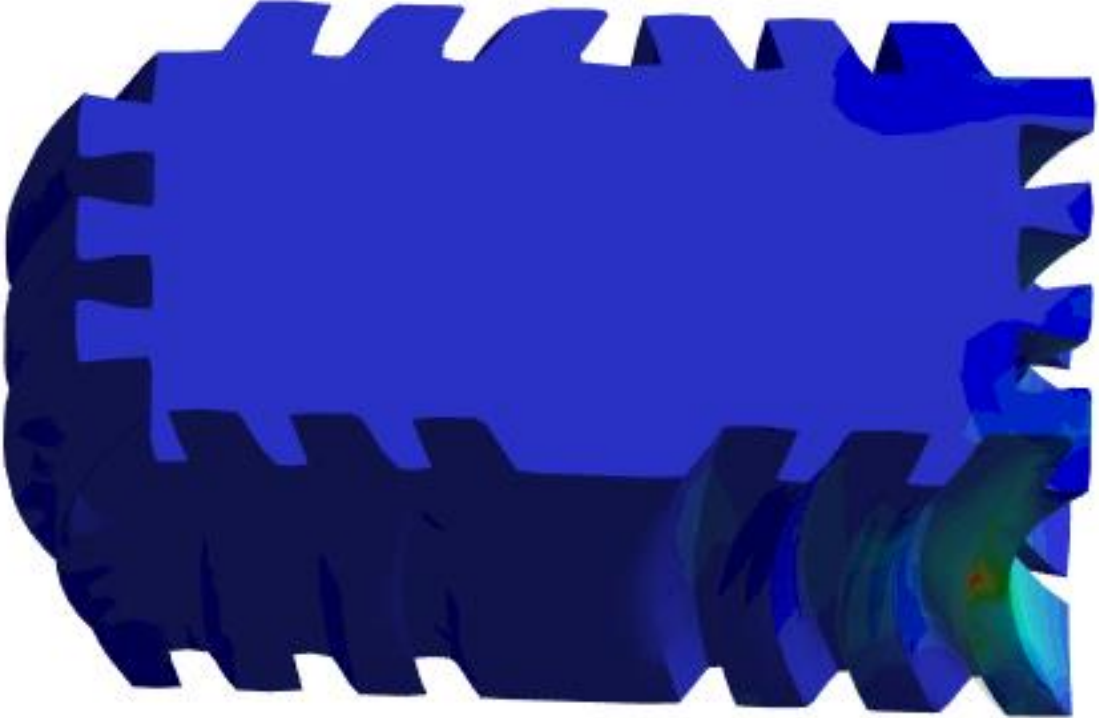
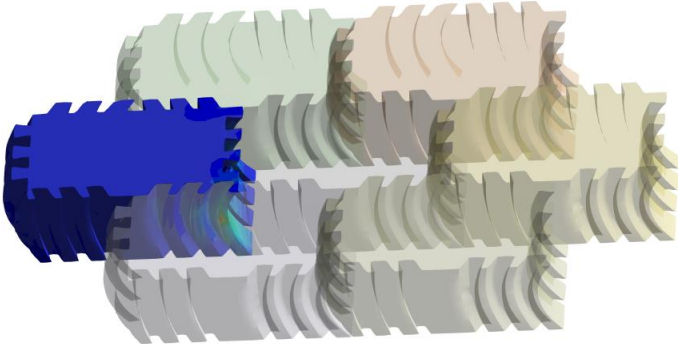
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Stress distributions on Bricks

Analysis Results _Stress Distribution

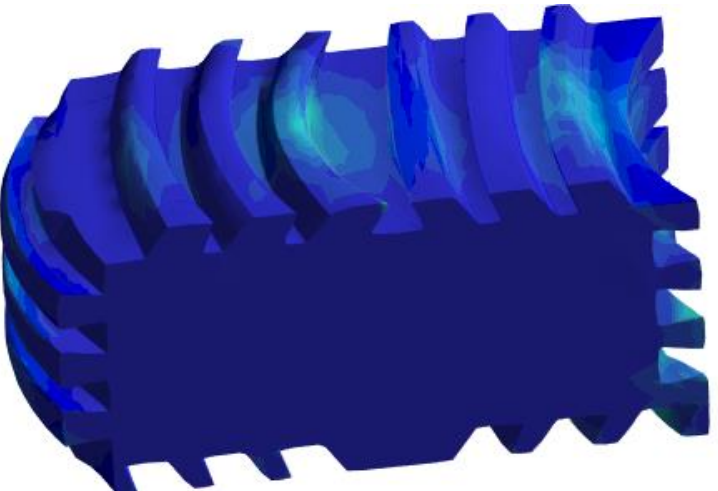
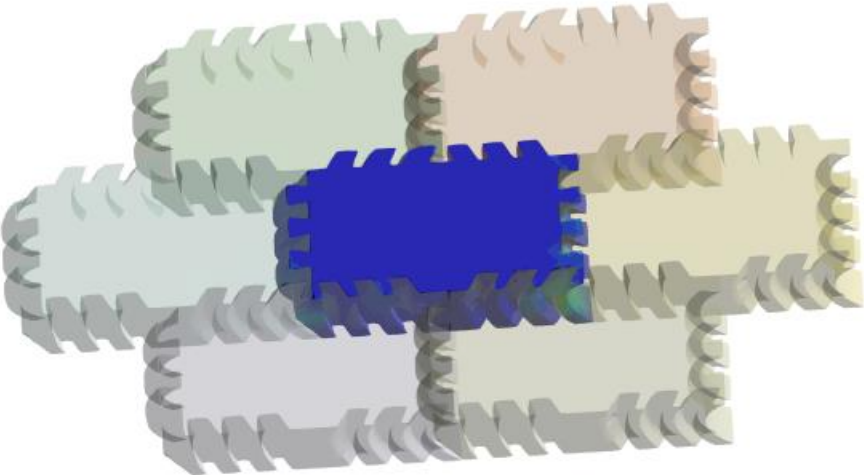
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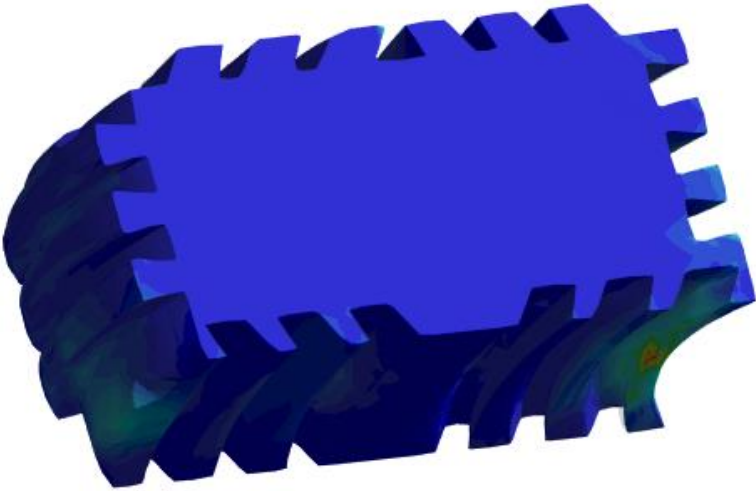
Stress distributions on Bricks

Analysis Results _Stress Distribution

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View 1

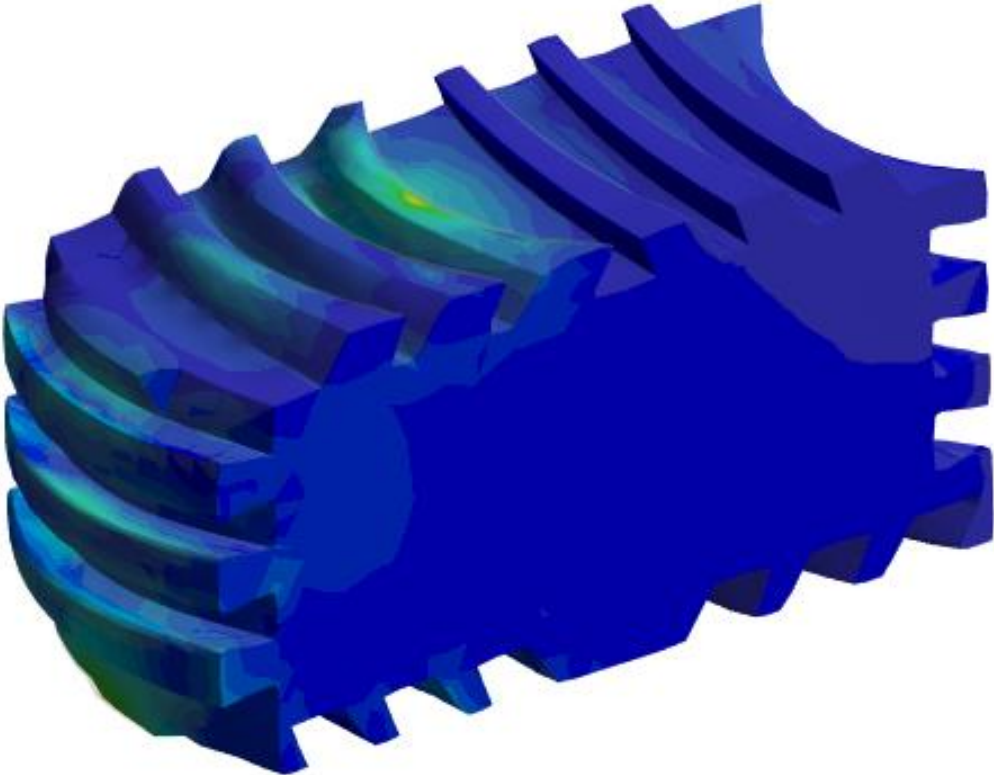
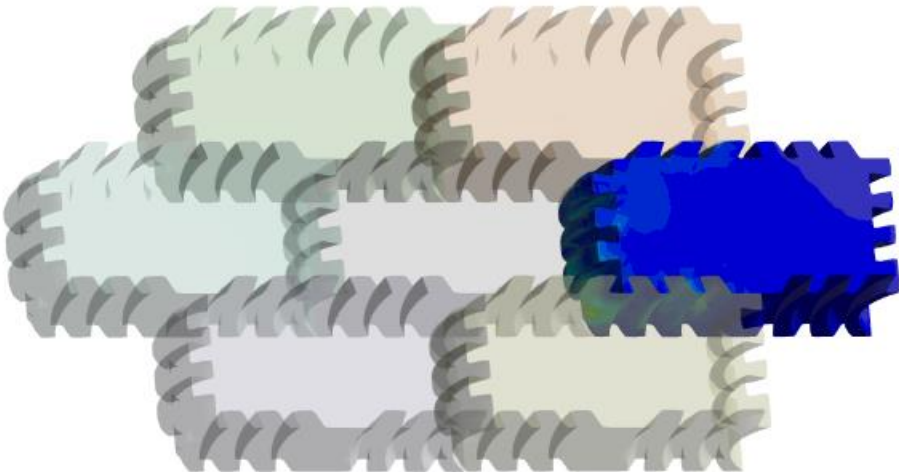


View 2

Stress distributions on Bricks

Analysis Results _Stress Distribution

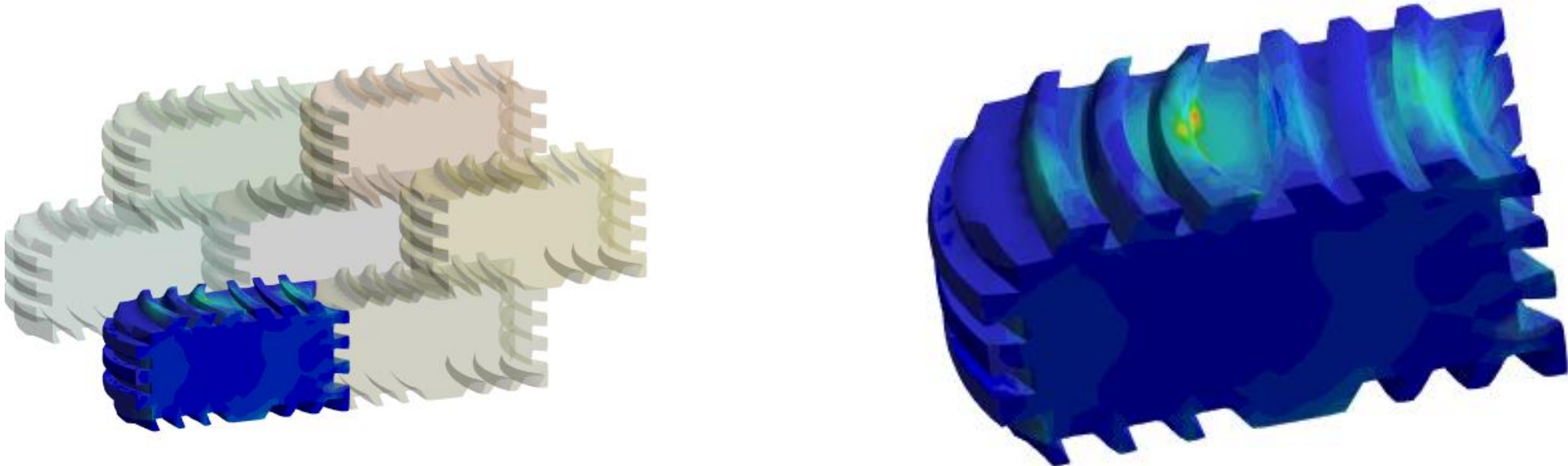
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Stress distributions on Bricks

Analysis Results _Stress Distribution

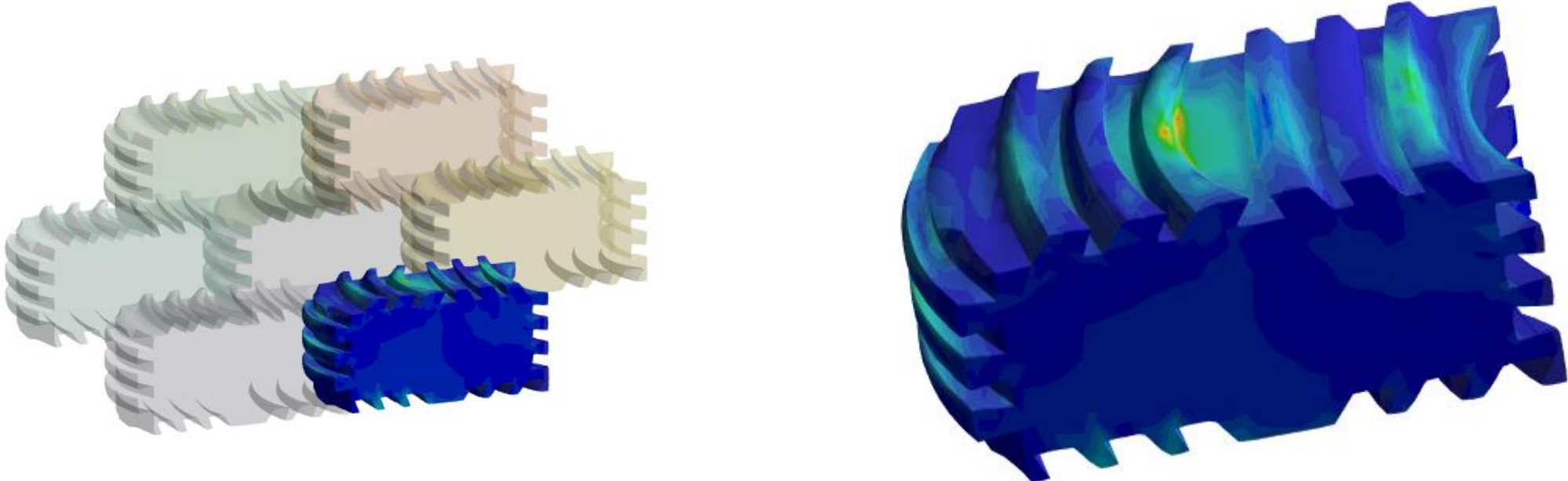
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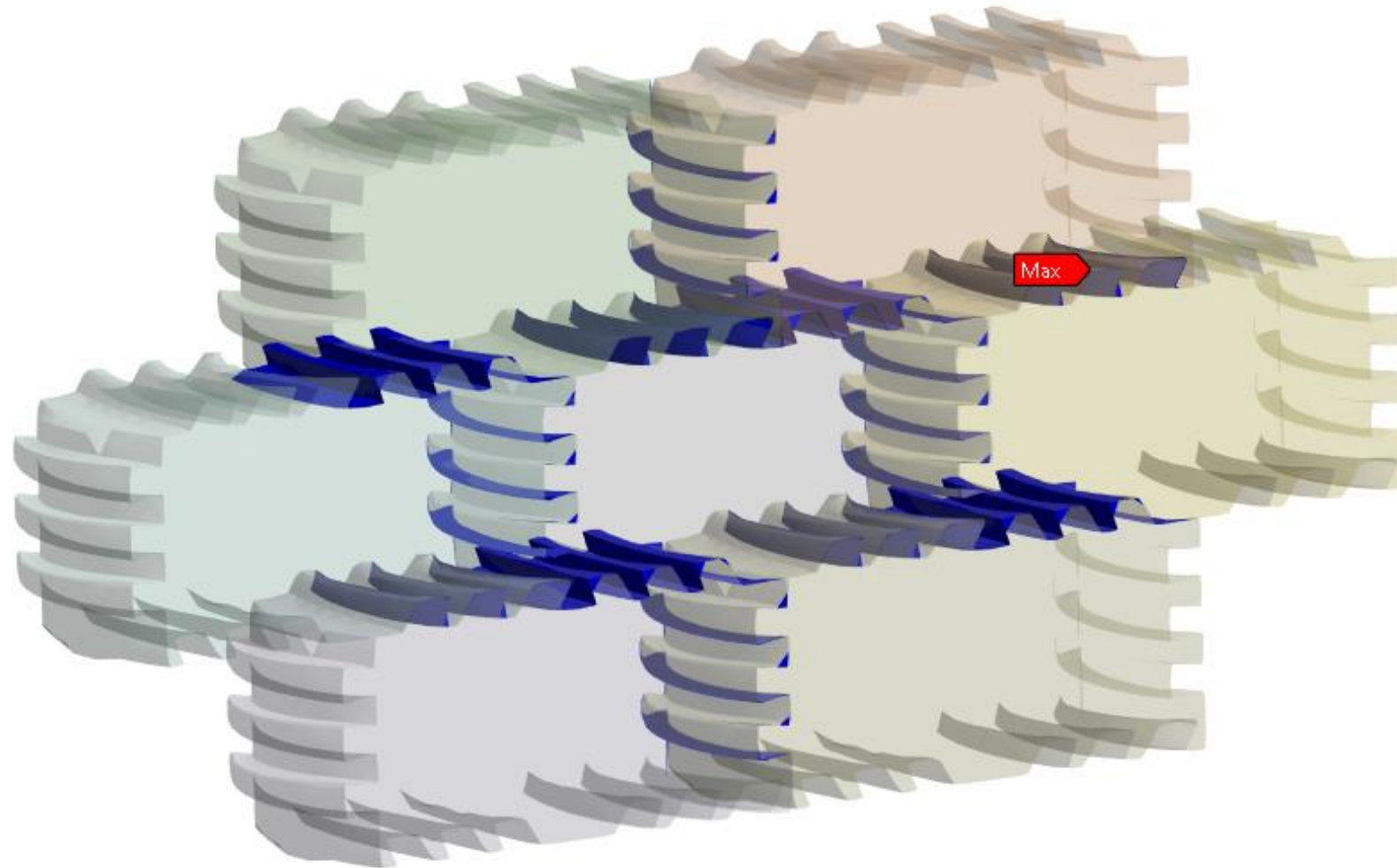
Stress distributions on Bricks

Analysis Results _Stress Distribution

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Stress distributions on Bricks



Stress distributions on contacts

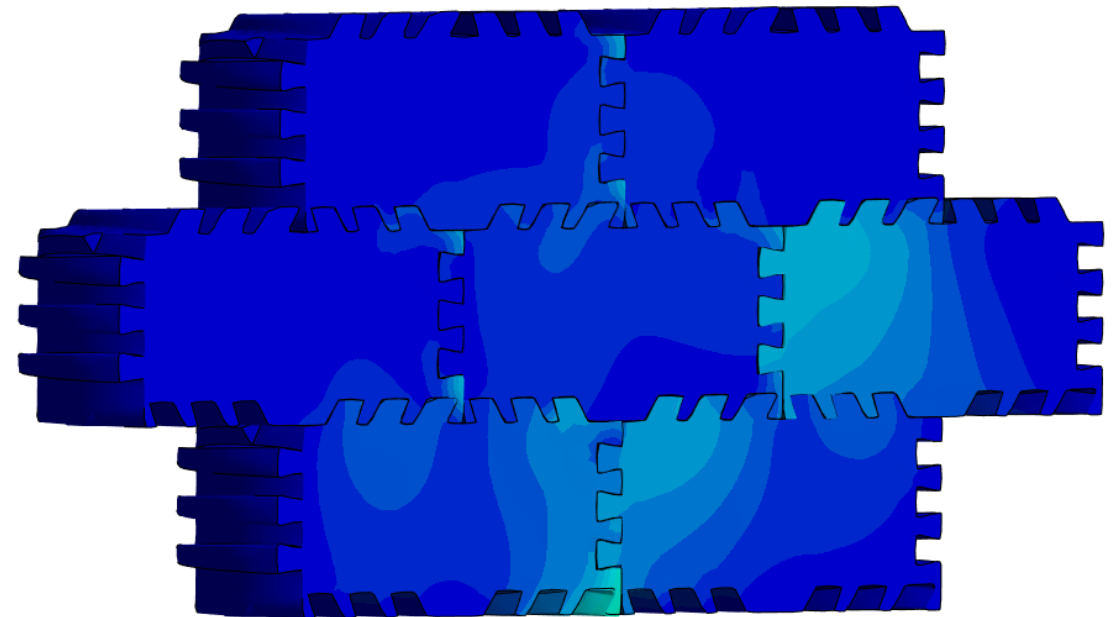
Discussion and Recommendations

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It is noted that this report is aimed to develop visual content such as graphs, images, and reports for use in websites, grant applications, and other documents aimed at fundraising.

The following analyses are recommended to product design, performance, and reliability:

- Analysis of various load patterns
- Comprehensive nonlinear static analysis
- Material selection optimization
- Thermal performance analysis
- Dynamic behavior analysis
- Load capacity assessment



Stress distributions

Thank You!