

# Computational Design and Fabrication

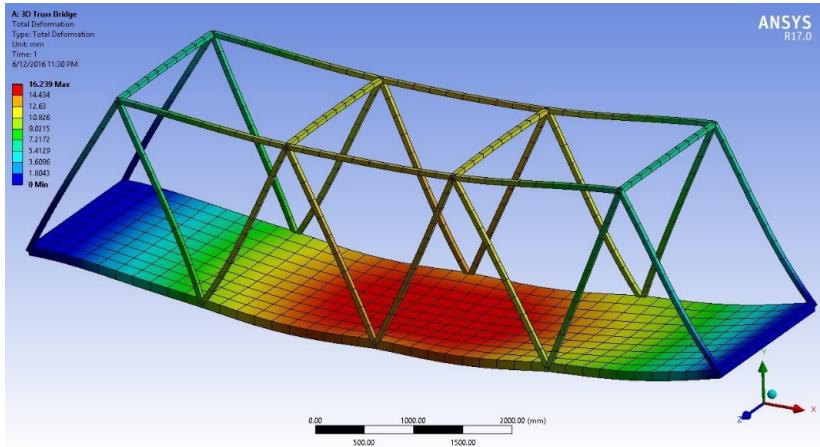
Technical University of Munich  
Professorship of Structural Design  
Prof. Dr. Pierluigi D'Acunto

# Conceptual Design of Structures

*“The resistant virtues of the structures that we make depend on their form. It is through their form that they are stable and not because of an awkward accumulation of materials. There is nothing more noble and elegant from an intellectual point of view than this, resistance through form. “*

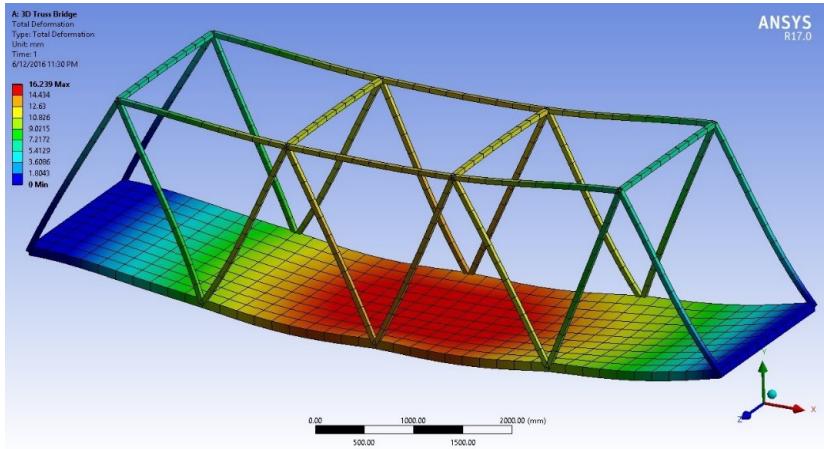
*E. Dieste in R. Pedreschi: The Engineer’s Contribution to Contemporary Architecture, 2000*

# Conceptual Design of Structures

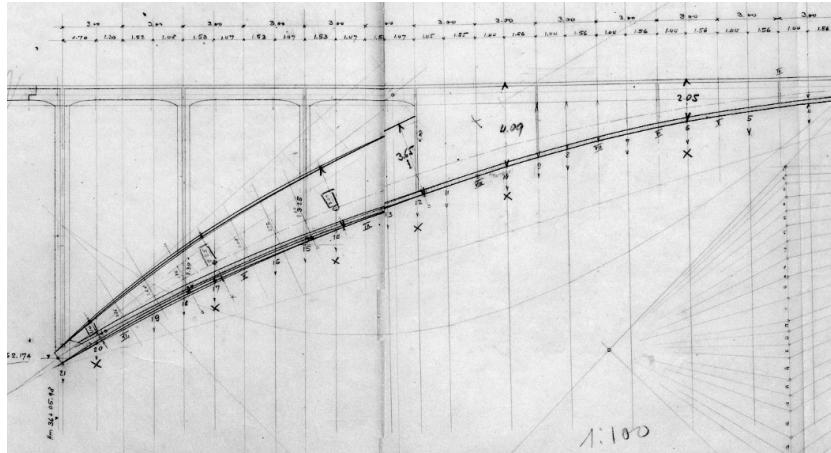


FEM-analysis – stress plot

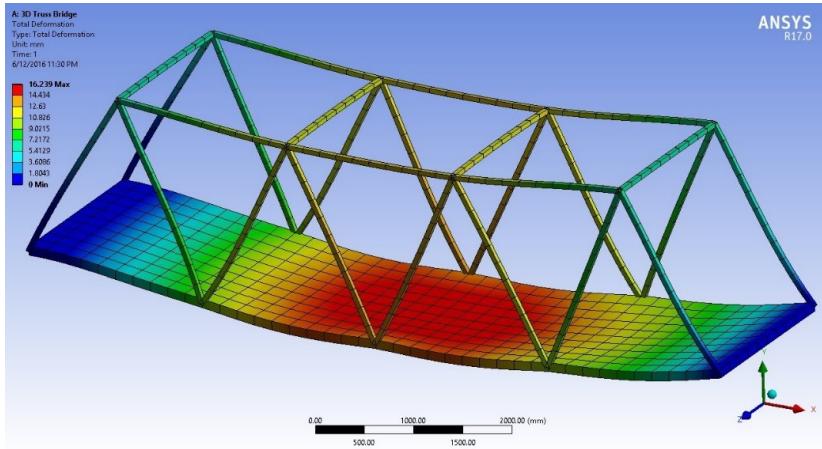
# Conceptual Design of Structures



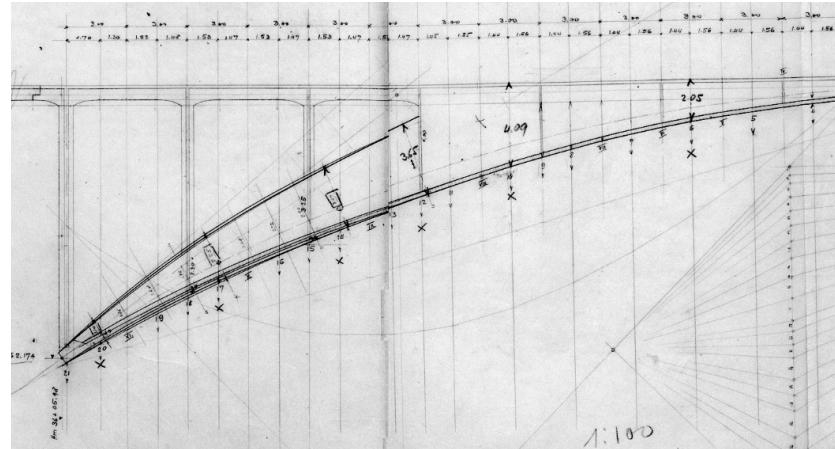
FEM-analysis – stress plot



# Conceptual Design of Structures



FEM-analysis – stress plot



**ANALYSIS** of the forces

≠

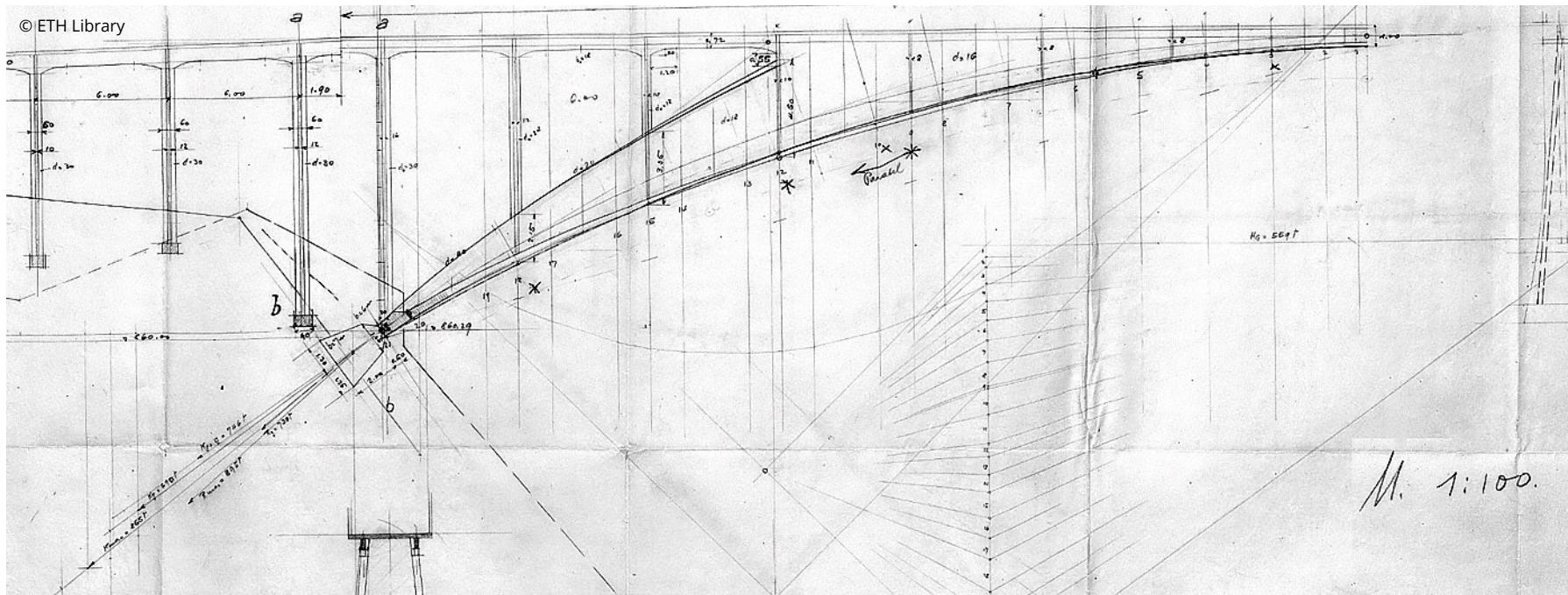
**DESIGN** with the forces

# Conceptual Design of Structures



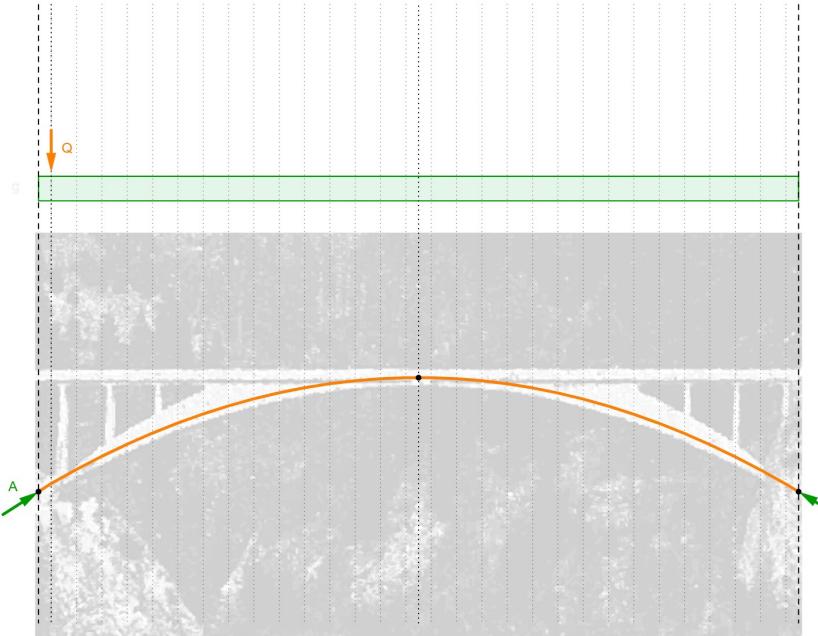
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# Conceptual Design of Structures

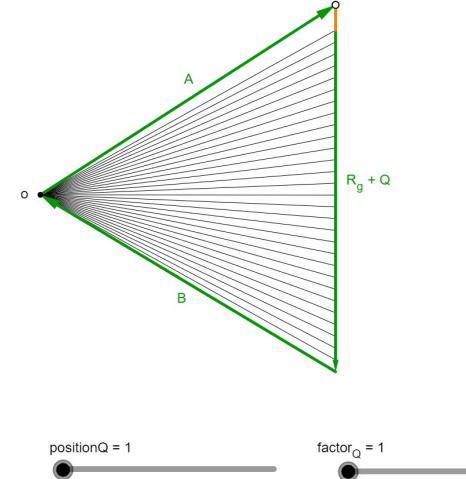


# Conceptual Design of Structures

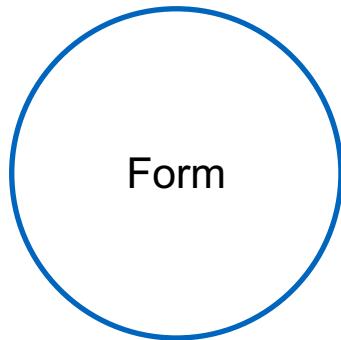
Form Diagram



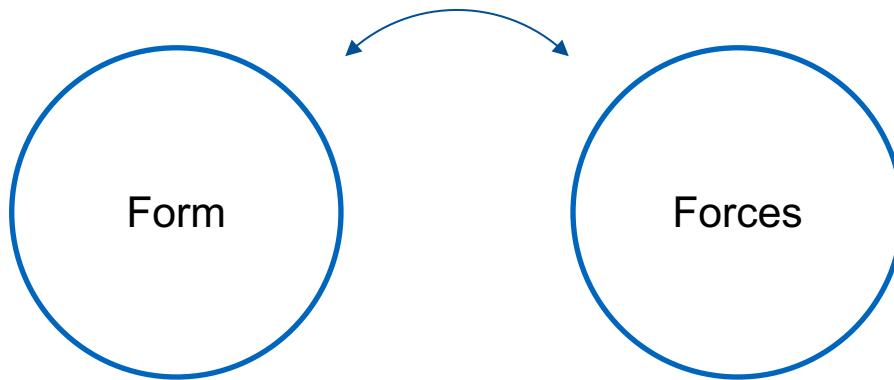
Force Diagram



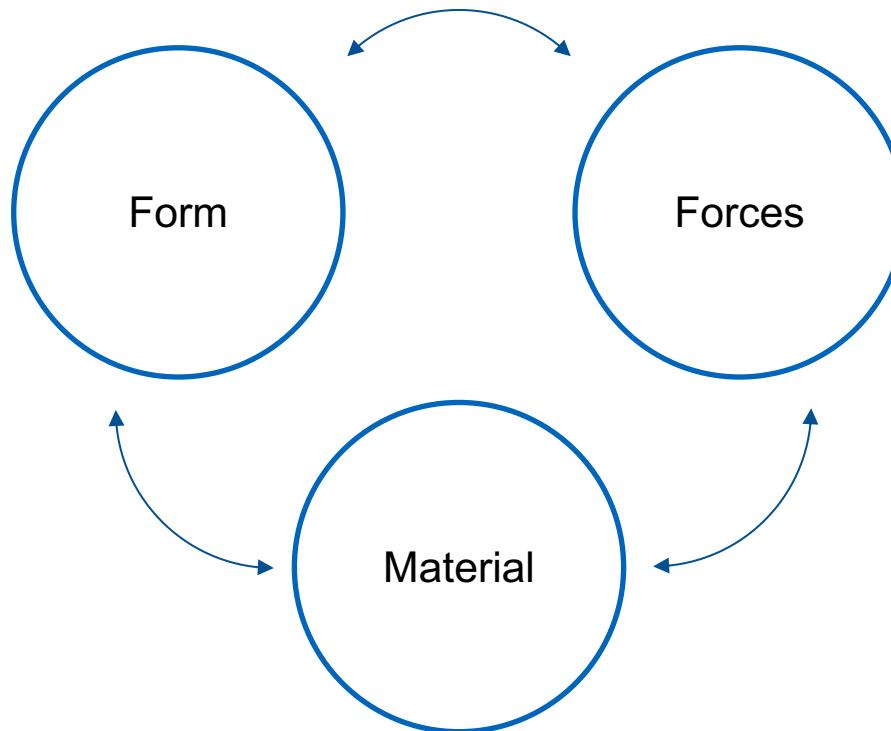
# Conceptual Design of Structures

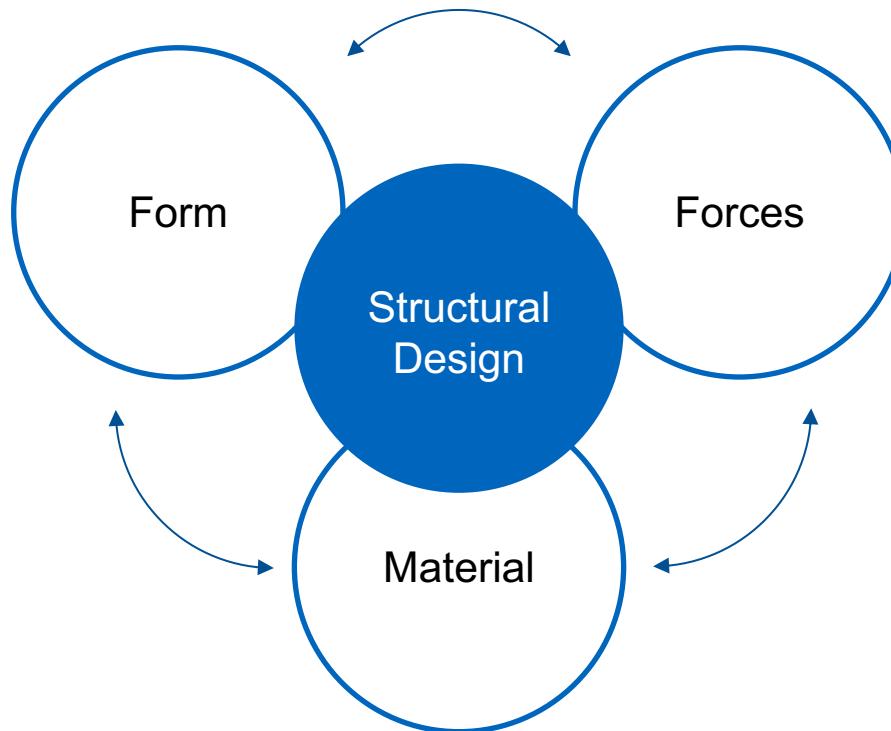


# Conceptual Design of Structures



# Conceptual Design of Structures





# Computational Form-Finding

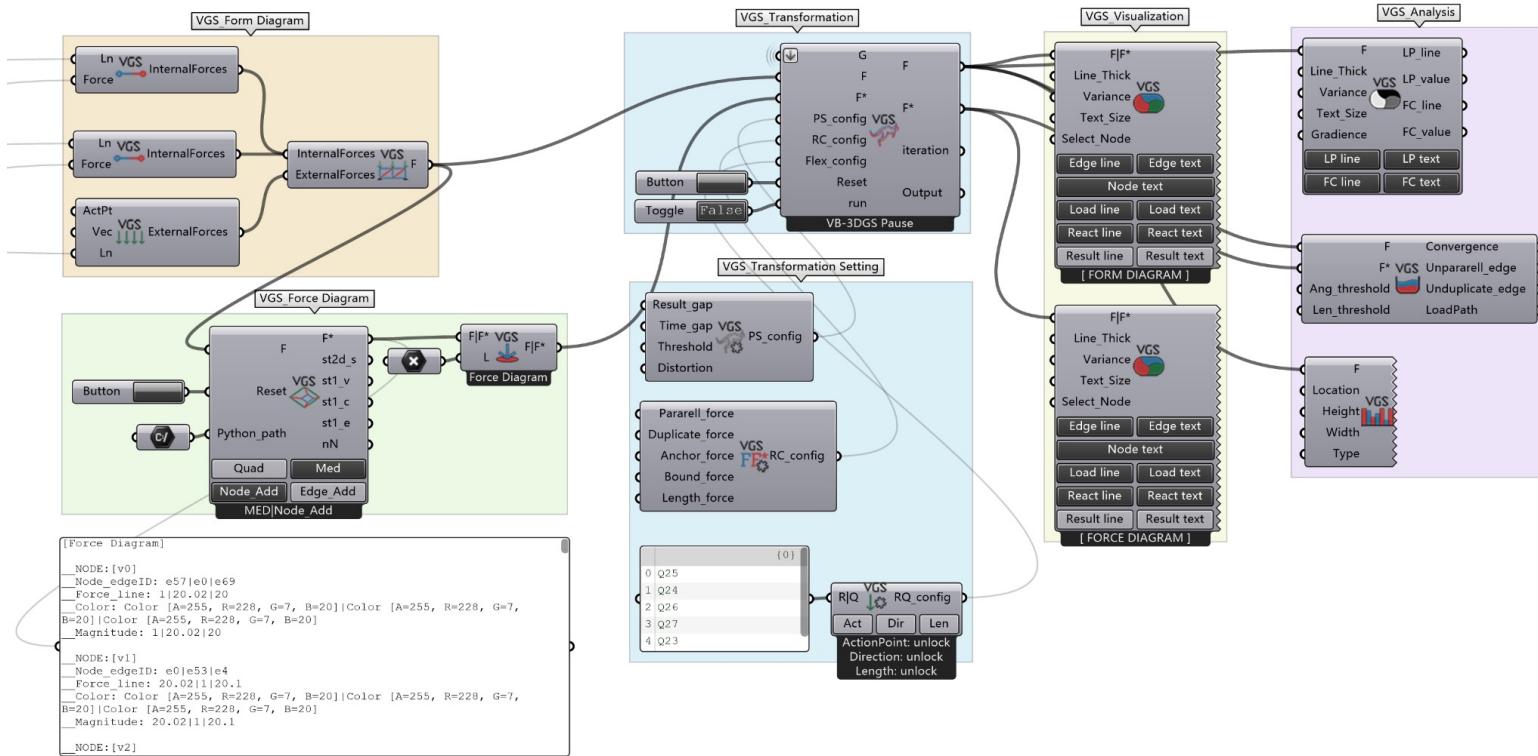
# Computational Form-Finding



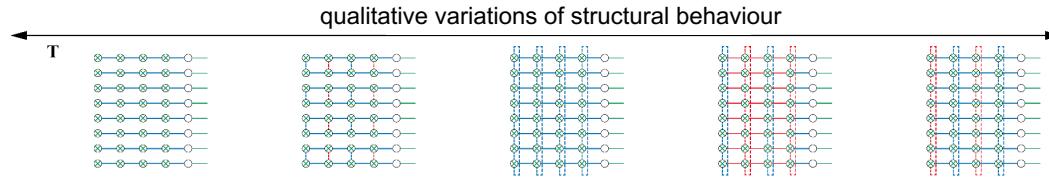
*“Don’t fight forces, use them.”*

*R. Buckminster Fuller in J. Krausse C. Lichtenstein: Your Private Sky: Discourse, 2001*

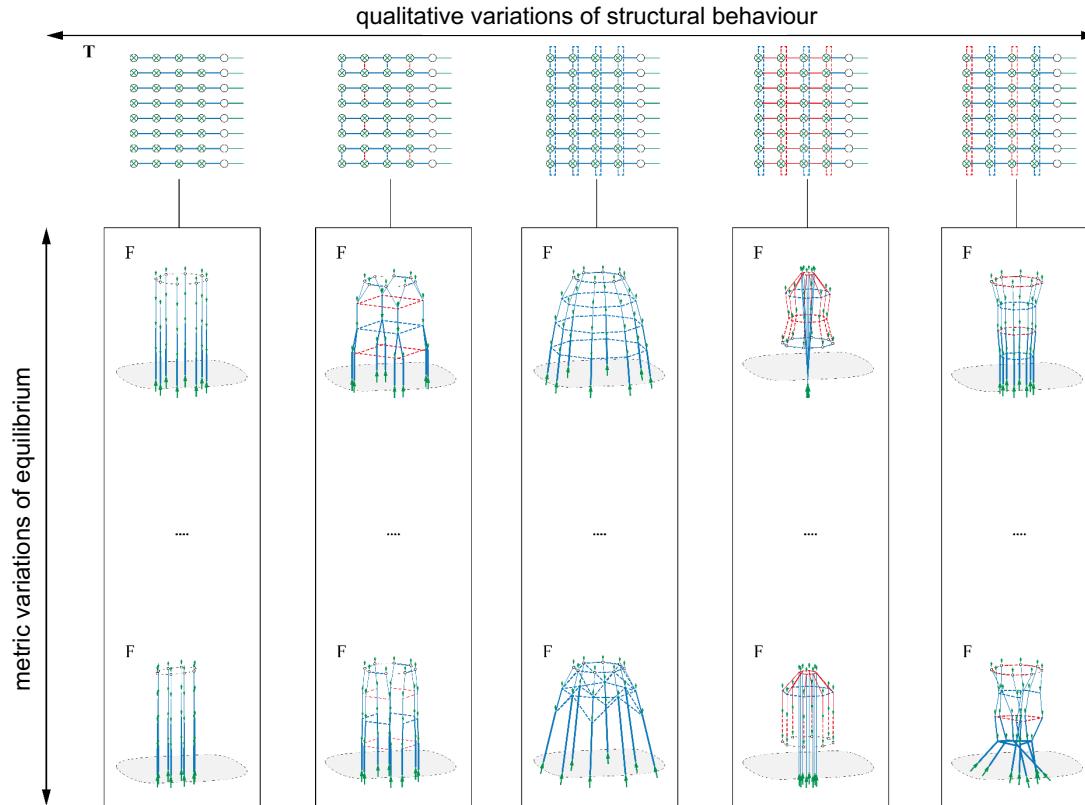
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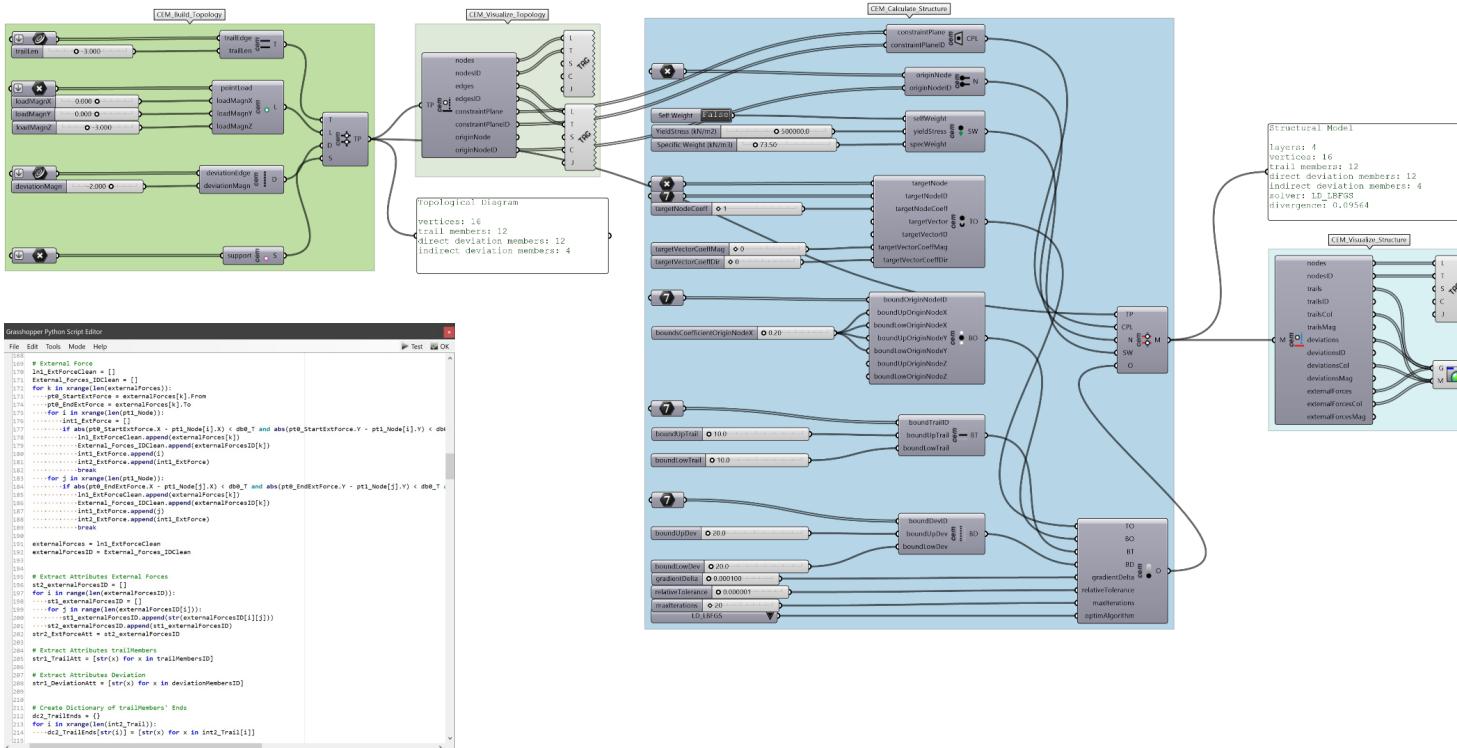
# Computational Form-Finding



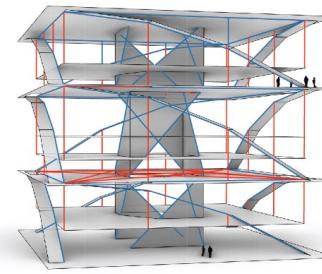
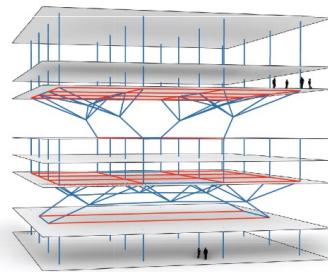
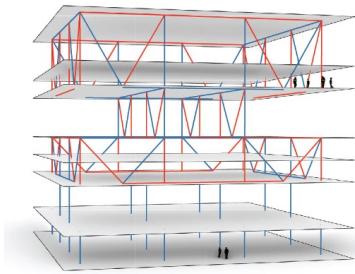
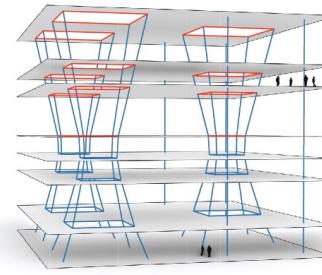
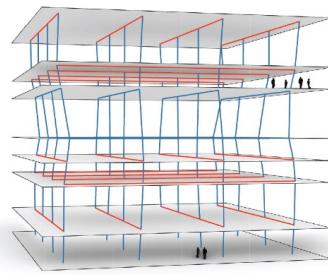
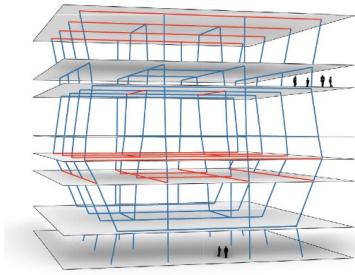
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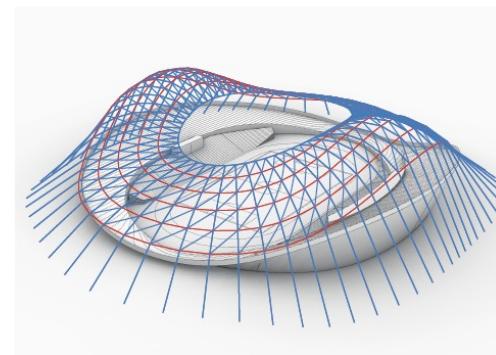
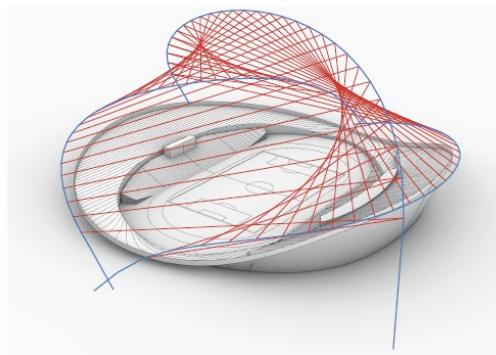
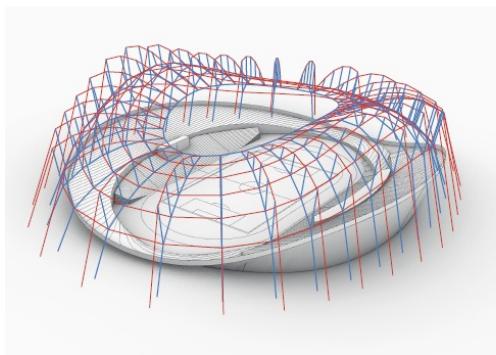
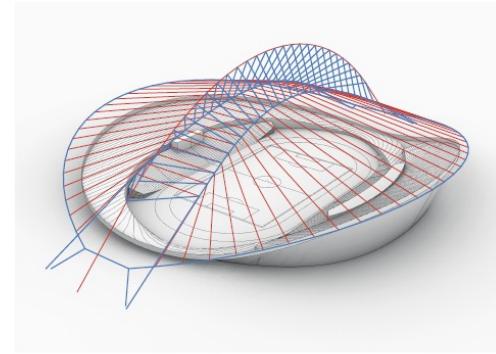
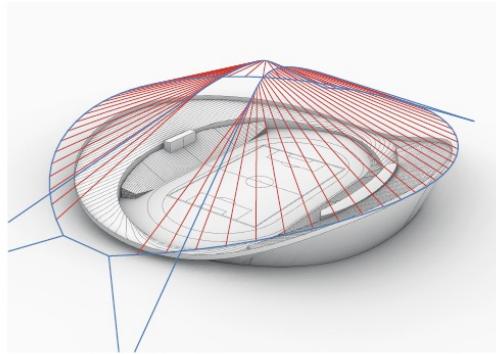
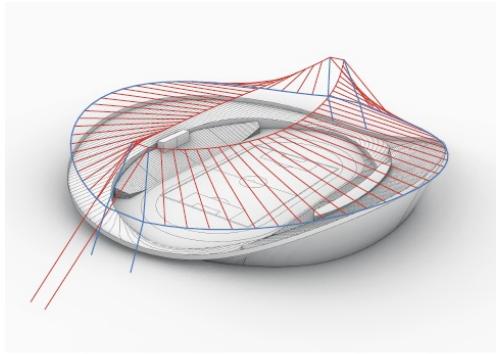
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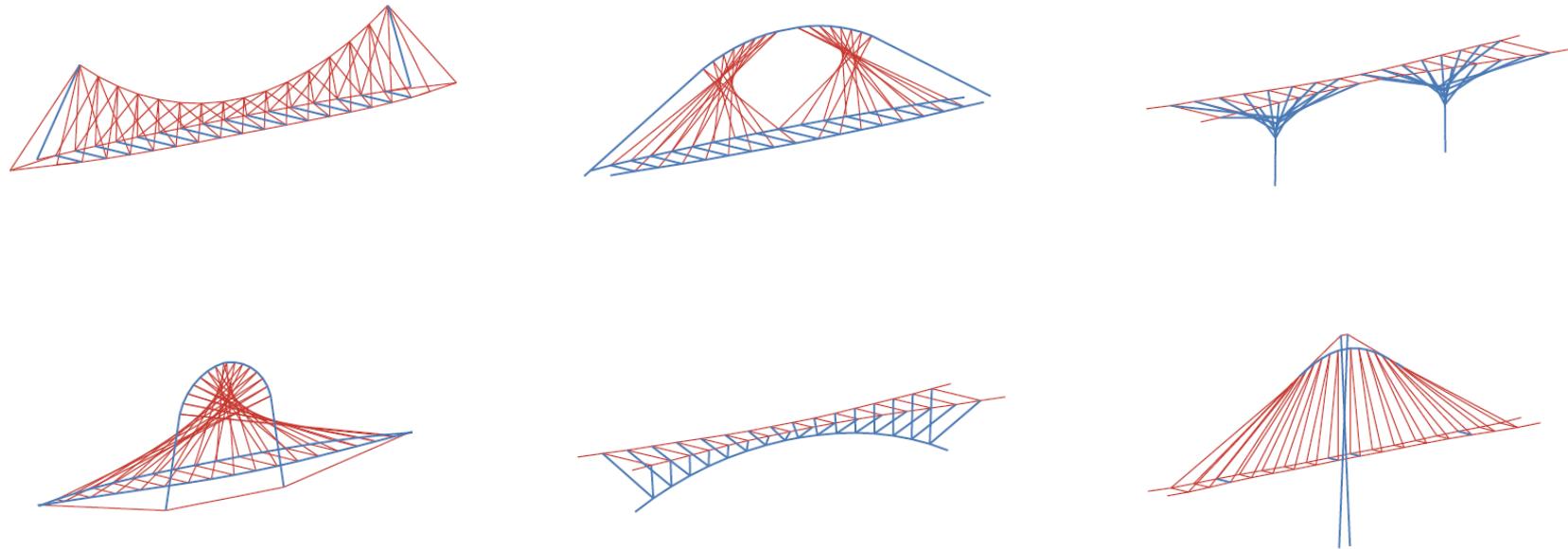
# Computational Form-Finding



# Computational Form-Finding

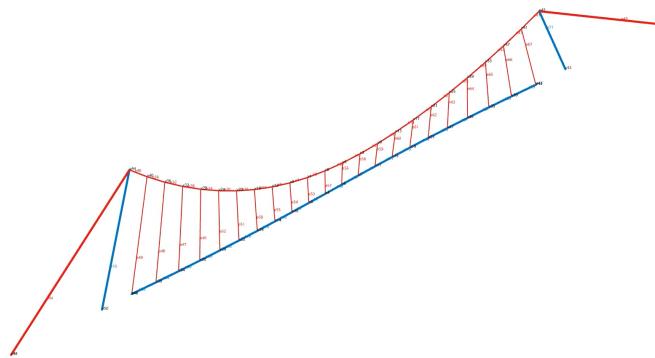


# Computational Form-Finding

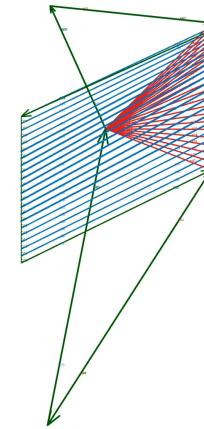


# Computational Form-Finding

F



F\*



— tension  
— compression

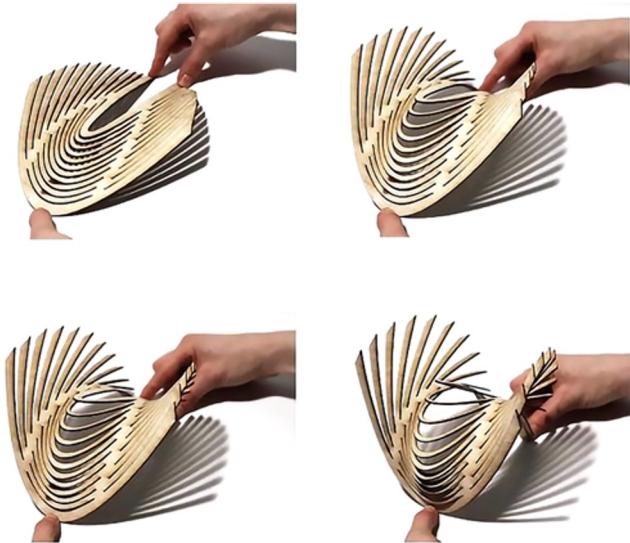
# Form, Material, Forces

*“The method of bringing . . . loads down to the foundations. . . with the minimum use of materials were interesting, but never enough. I still remember the long and patient work to find an agreement between the static necessities. . . and the desire to obtain something which for me would have a satisfying appearance. “*

*Pier Luigi Nervi, Aesthetics and Technology in Building, 1966*

# Form, Material, Forces

TUM



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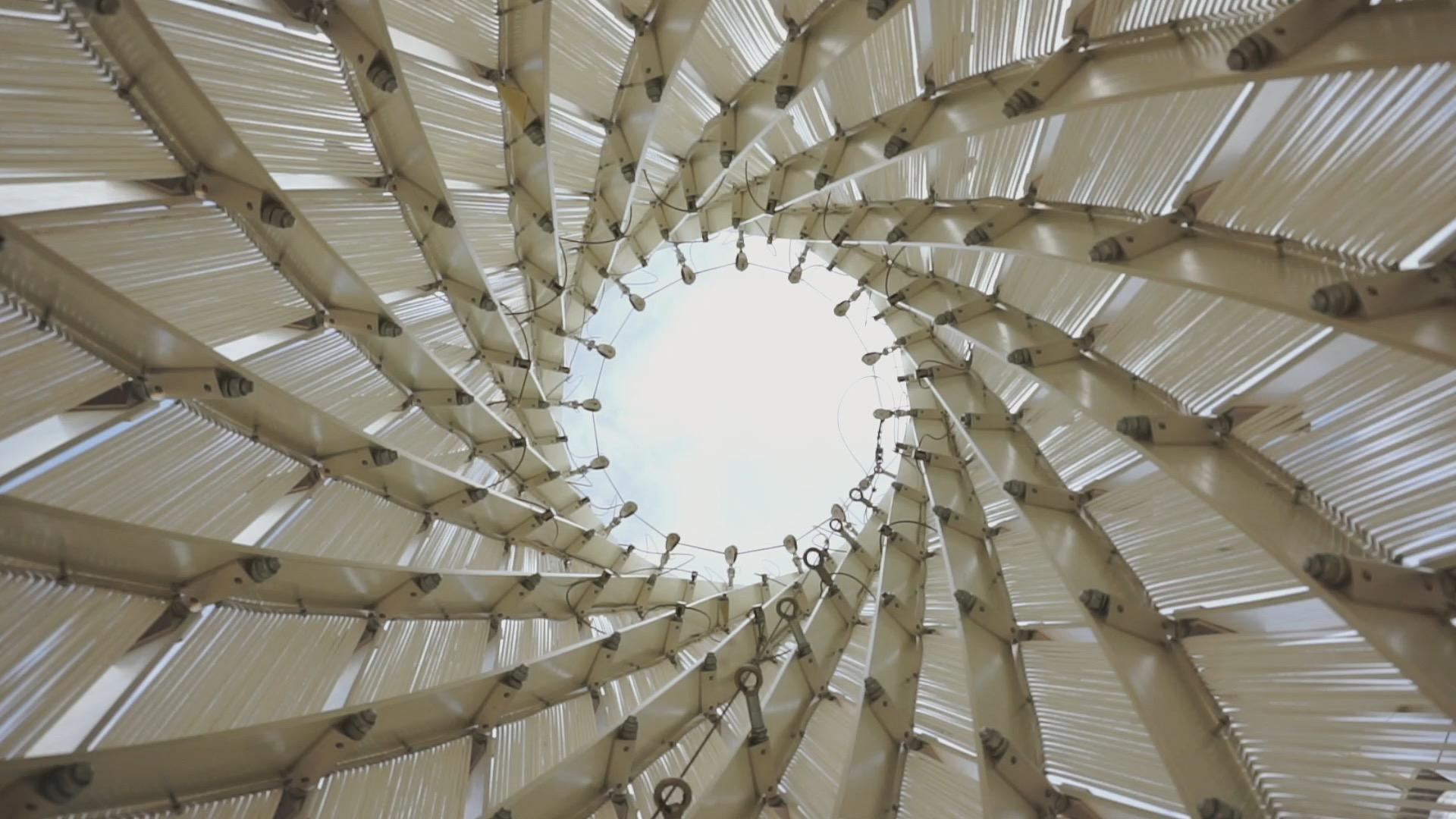
# Form, Material, Forces



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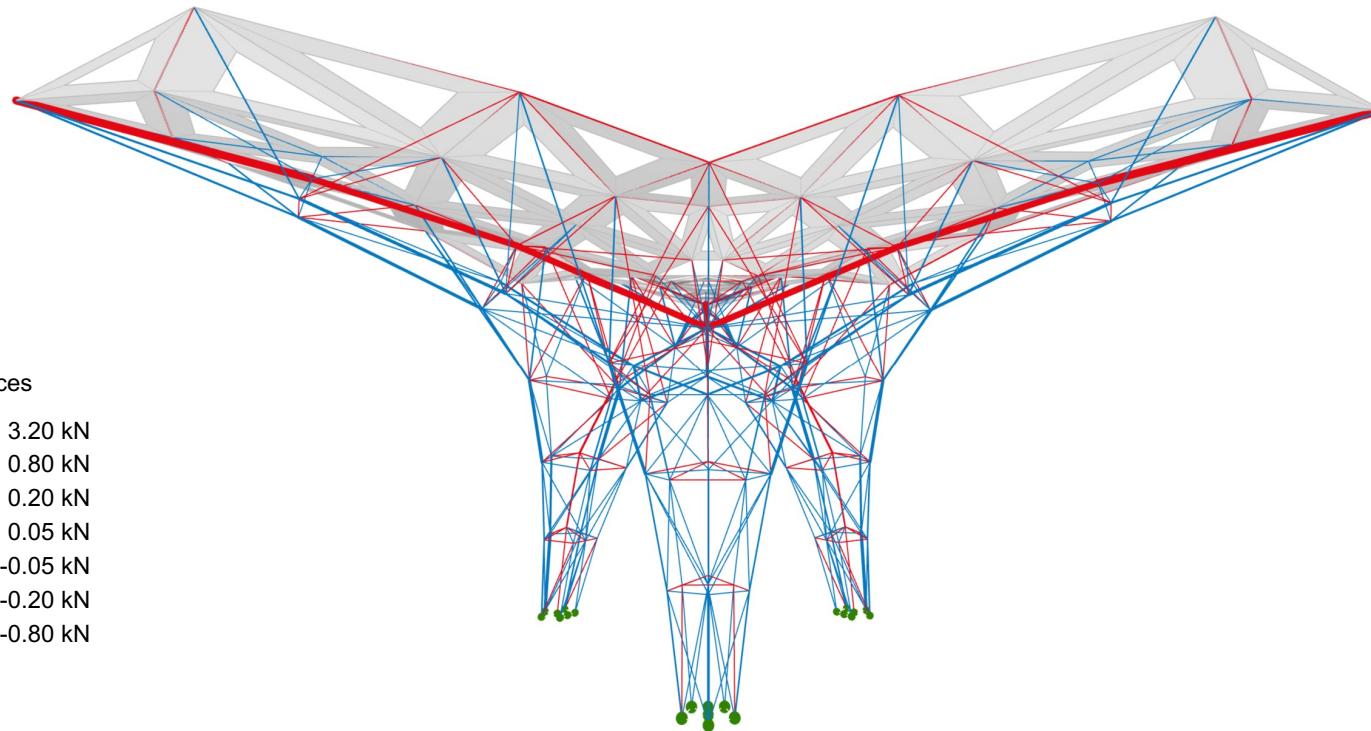
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Digital Bamboo Pavilion, Chair Structural Design and Digital Building Technology, ETH Zurich, 2020

# Form, Material, Forces







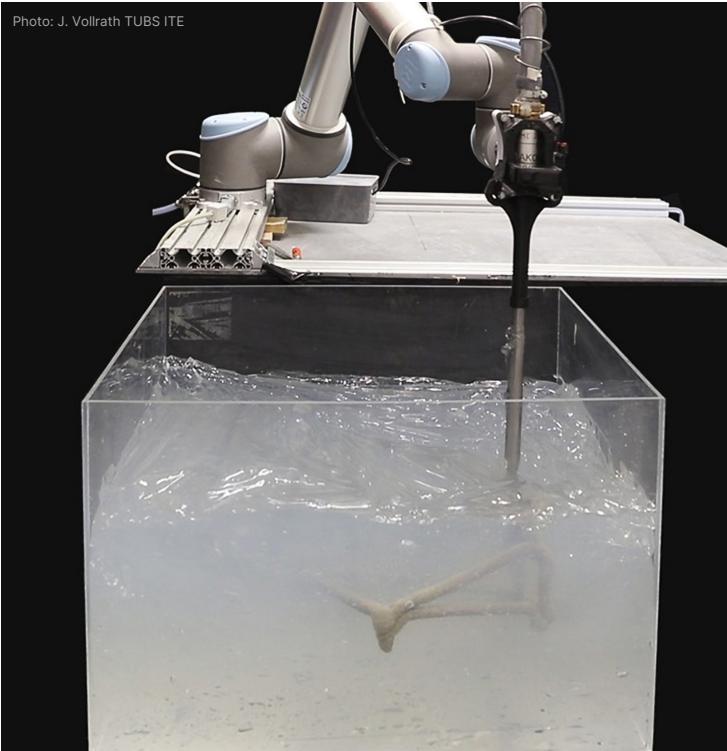
**ETH** zürich

**86**  
National Centre of Competence  
In Research  
Digital Fabrication

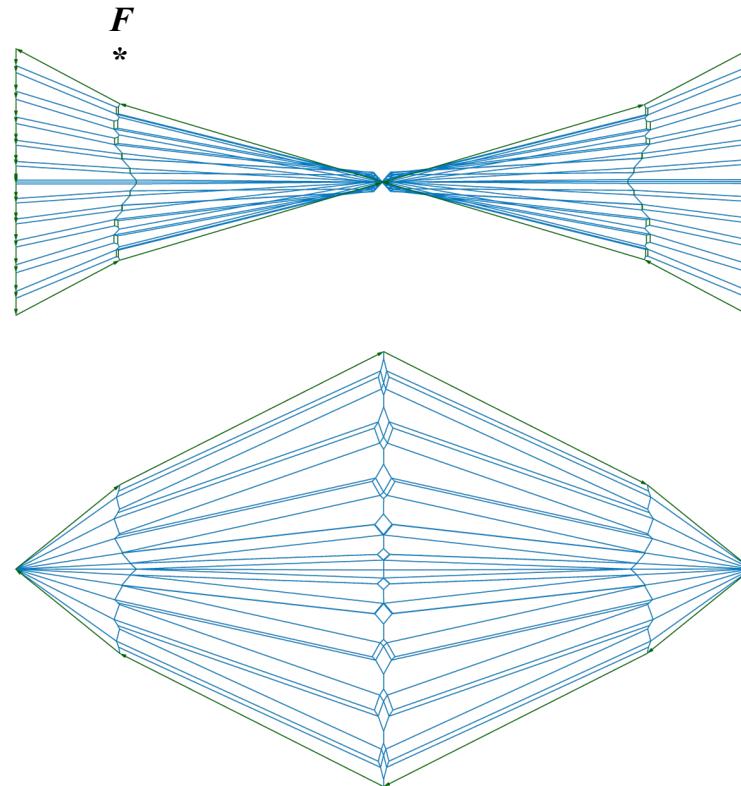
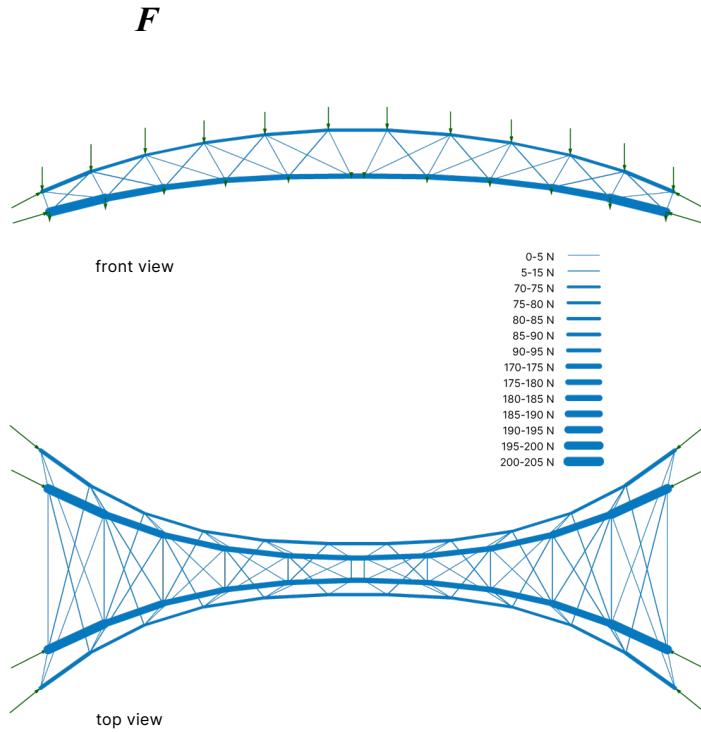
**dbt**  
Digital Building  
Technologies

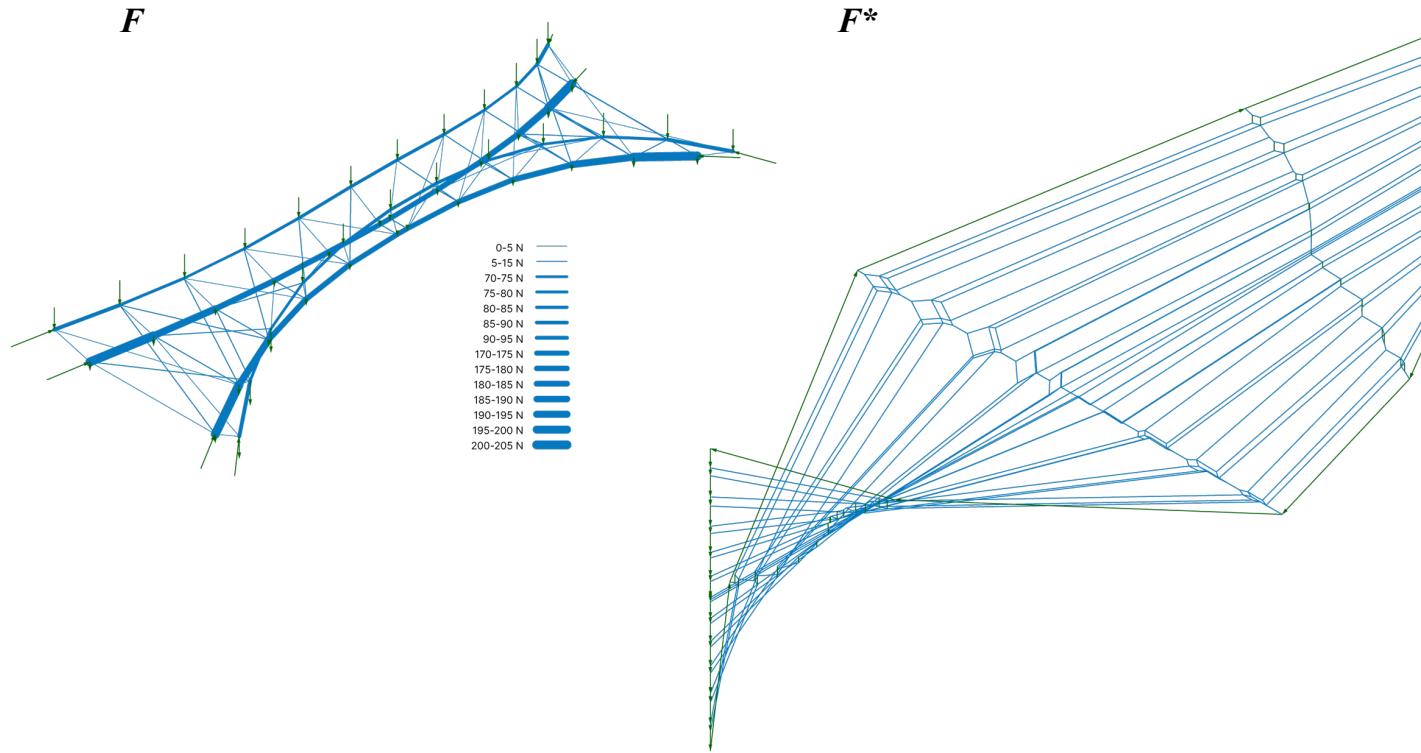
**DARCH**  
structural design

# Form, Material, Forces



# Form, Material, Forces

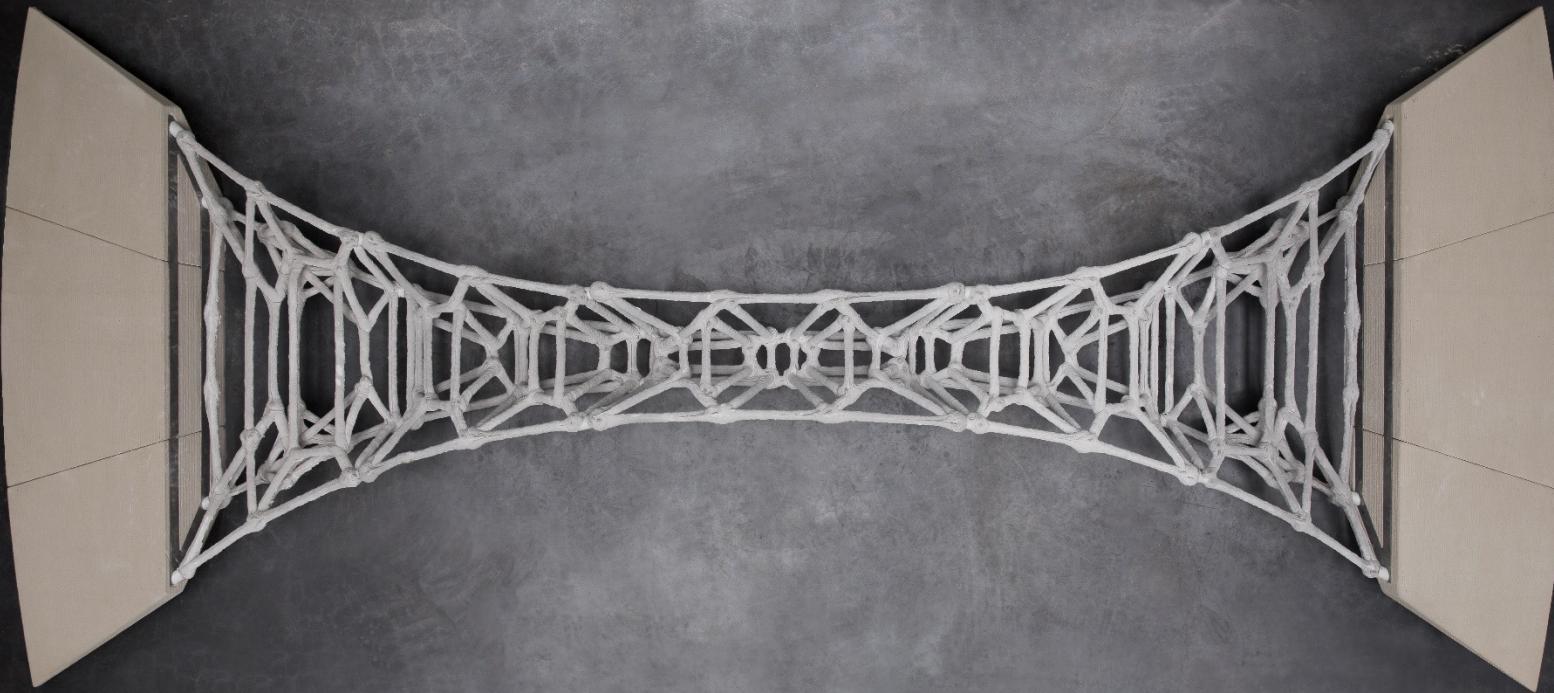




# Form, Material, Forces

TUM

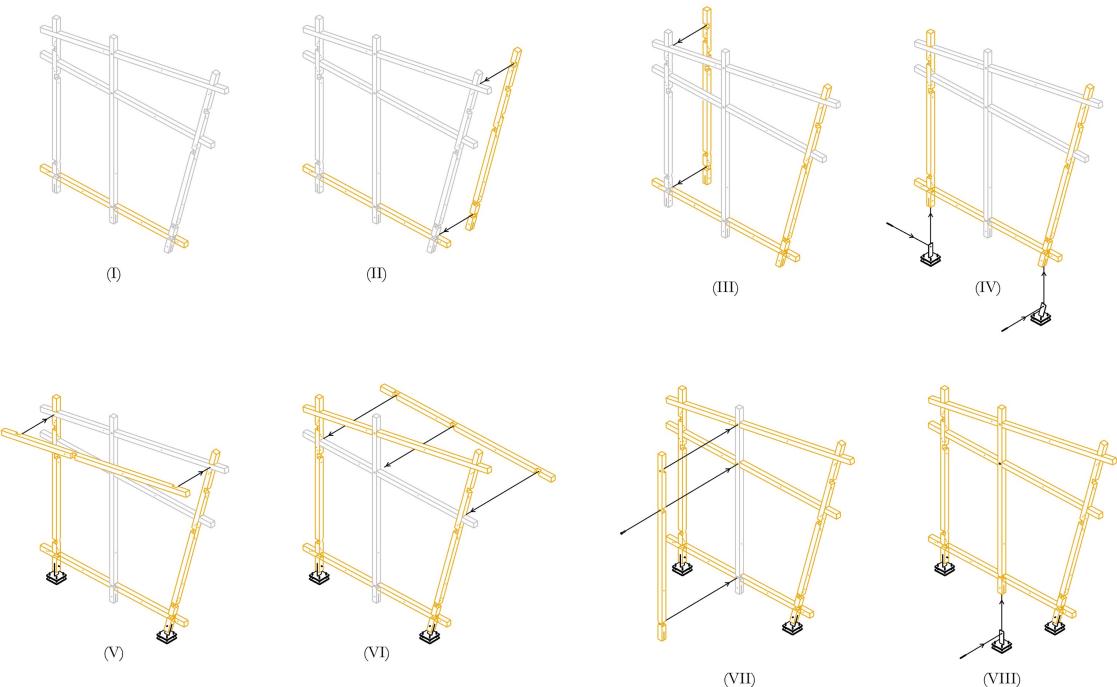
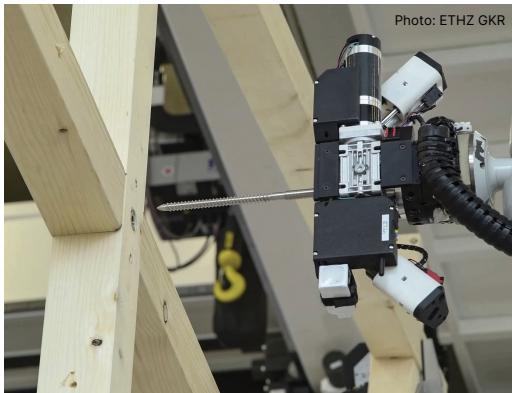
Photo: Y. Xiao TUBS ITE



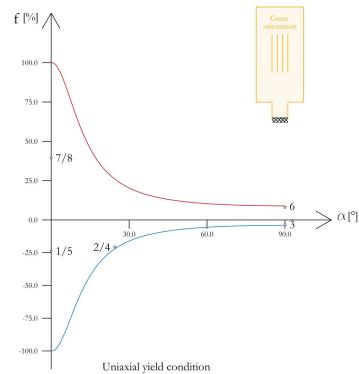
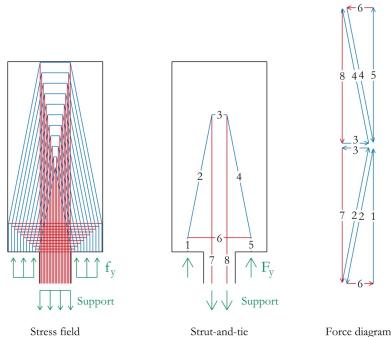
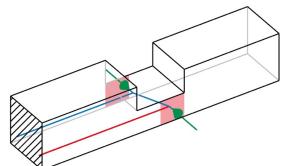
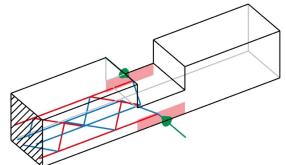
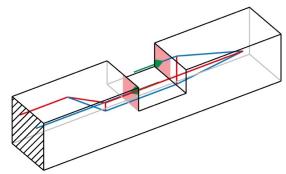
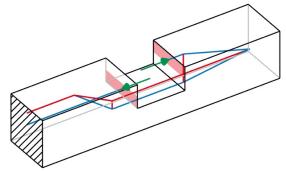


CantiBox, Chair of Structural Design and Gramazio & Kohler Research ETH Zurich, Professorship of Structural Design TUM, Digital Structures MIT, 2022

# Form, Material, Forces



# Form, Material, Forces





*“When I am working on a problem, I never think about beauty. I only think about how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong.”*

*R. Buckminster Fuller in D. Darling: The Universal Book of Mathematics, 2004*