

Dataset title: Design and Simulation Files for a Novel Lightweight Design of Additively Manufactured Structural Components through Biomimetics

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Context: The data is based on the paper with title “Novel Lightweight Design of Additively Manufactured Structural Components through Biomimetics” that was presented at the 2024 Powder Metallurgy World Congress & Exhibition (World PM2024), 13 - 17 October 2024, Yokohama, Japan. Additional information about the context and generation of this data can be found in the paper that was published in the Journal of the Japan Society of Powder and Powder Metallurgy (2025, Volume 72, Issue Supplement, Pages S1241-S1248). Link to article: <https://doi.org/10.2497/jjspm.16C-T11-10>

Remarks about this dataset:

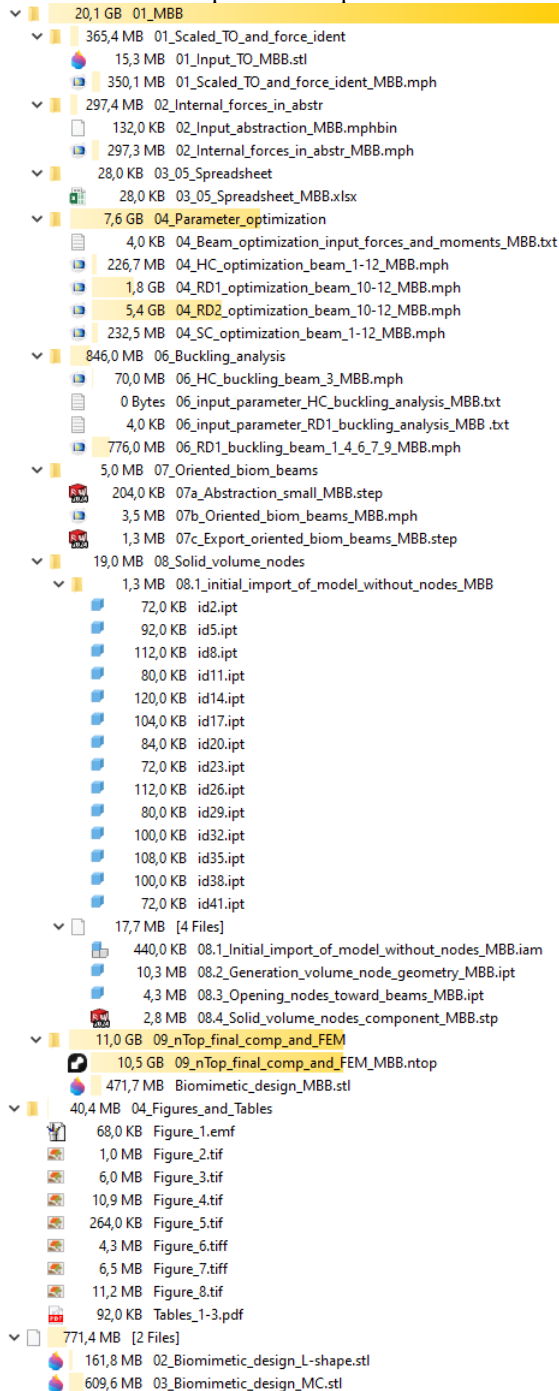
- This dataset provides exemplary files for the important steps presented in the paper for one example component (MBB beam).
- Three biomimetic component designs are provided. They were generated based on the design methodology presented in the paper.
- The file “01_input_MBB_beam_TO.stl” of this dataset is taken from the dataset “Supplementary material to article with title: Development and Assessment of a Methodology for Abstraction of Topology Optimization Results to Enable the Substitution of Optimized Beams” (<https://doi.org/10.15480/882.8168>) that is licensed under CC-BY 4.0 and is based on the corresponding paper “Development and assessment of a methodology for abstraction of topology optimization results to enable the substitution of optimized beams” (<https://doi.org/10.2351/7.0001185>). The file “02_Input_abstraction_MBB.mphbin” was generated using data and information from the previously mentioned dataset and paper.
- The parameter optimization files in the folder “04_Parameter_optimization” were modified and are based on the dataset “Parameter Optimization Files (COMSOL Multiphysics 6.0) for Dimensioning of Biomimetic Beams under Bending” (<https://doi.org/10.15480/882.9113>) that is licensed under CC-BY 4.0 and is based on the corresponding paper “Dimensioning of Biomimetic Beams under Bending for Additively Manufactured Structural Components” (<https://doi.org/10.3390/biomimetics9040214>).
- It is noted that during preparation of this dataset some models were recalculated and slightly different software versions might have been used. In addition, some parameters, values, and settings are slightly different to what is stated in the paper. It is noted that due to the changes, deviations might be present between the input and output of subsequent steps represented by the files of this dataset.
- Some of the deviations include:
 - Recalculation of the file “01_Scaled_TO_and_force_ident_MBB.mph” gave a force value of 16061 N instead of 16044 N as stated in the paper. The value from the paper of 16044 N was used for the subsequent steps of the methodology.
 - Recalculation of the file “02_Internal_forces_in_abstr_MBB.mph” gave internal force and internal moment values that were slightly different from what was generated in the work as stated in the paper. For the next steps of the methodology again the original values for internal forces and moments as used in the paper were used for the subsequent steps of the methodology. The detailed values can be found in the respective spreadsheet in this dataset.

- Software versions that were used for this dataset:
 - Operating system: Microsoft Windows 10 Pro
 - COMSOL Multiphysics 6.0.0.405
 - Microsoft Office Professional 2019
 - Autodesk Inventor Professional 2024.3.2
 - nTop 5.7.2
- Additionally, relevant figures and tables are provided in the dataset.

The dataset is provided as a PDF-Readme-file and a single zip-file:

- 0_Readme.pdf
- 1_Biom_design_files.zip

The contents of the zip-file are depicted below:



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