Institut für Statik und Dynamik
der Luft- und Raumfahrtkonstruktionen

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Master thesis

Generative Machine Learning for Designing Auxetic Materials Maximizing Poisson's Ratio

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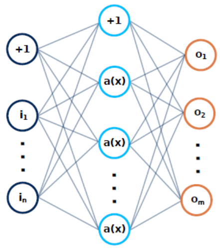

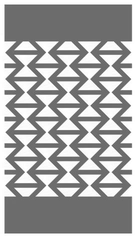

Auxetic materials have an extraordinary property: when stretched, they actually expand perpendicular to the applied force, unlike conventional materials that contract in that direction. This counterintuitive behaviour, which corresponds to a negative Poisson's ratio, is due to their intricate internal structure and offers numerous advantages in various applications including protective equipment, biomedical engineering, energy absorption and impact mitigation. This thesis proposal aims to leverage generative networks to design and fabricate auxetic planar structures with a focus on maximizing the poisson's ratio. The proposed research will involve investigating existing studies, defining appropriate boundary conditions, designing auxetic structures using generative networks, and manufacturing the final prototypes through 3D printing.

- Investigation on auxetic materials and generative networks
- Training of generative networks for designing auxetic reentrant structures
- Utilization of 3D printing technology for manufacturing auxetic prototypes
- Validation of predicted values through mechanical testing on created prototypes
- Comparative analysis between predicted and experimental results
- (Optional) Extension of methodology to 2.5D or 3D structures
- Summary of findings, discussion of implications, and suggestions for future research directions

By exploring the capabilities of generative networks in designing auxetic materials and utilizing 3D printing technology for fabrication, this thesis aims to contribute to the field of materials science and engineering by offering new possibilities for creating advanced materials with enhanced mechanical properties.

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