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Final thesis

Optimizing Energy Absorption of 3D-Printed Auxetic Cylindrical Structures

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Auxetic materials have an unusual property: when they contract, they shrink perpendicular to the applied force, unlike conventional materials that expand in that direction. This counterintuitive behaviour, which corresponds to a negative Poisson's ratio, is due to their complicated internal structure and offers numerous advantages in various application areas such as protective equipment, biomedical engineering, energy absorption and shock absorption. This work will develop optimised auxetic structures that have high impact absorption and low mass. Cylindrical beam structures will be investigated, designed and manufactured by 3D printing.

For this purpose, the following steps have to be carried out:

- Research existing investigations on auxetic materials for impact absorption.
- Develop and implement a design approach to create optimized auxetic microstructures for cylindrical beam structures.
- Utilize 3D printing technology to manufacture the designed auxetic prototypes.
- Perform experimental testing to analyse the impact absorption.
- Employ simulation software or other analytical techniques to evaluate the impact absorption capabilities of the designed auxetic structures.
- Compare and analyze the performance of different designs to identify the most effective ones.

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