Applying R-strategies of Circular Economy in Design for Additive Manufacturing

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Introduction

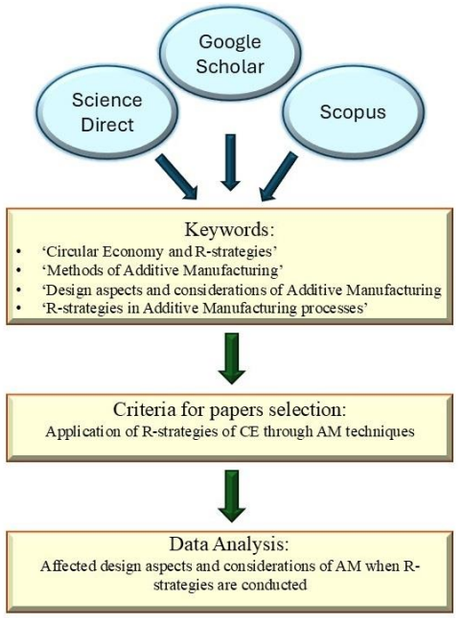
The paper highlights the increasing global waste problem and the overuse of raw materials, prompting action from the European Union through the Green Deal and Circular Economy Action Plan. It discusses how Circular Economy (CE) principles, specifically the 9R strategies, aim to maintain the value of products and services within the economic system. Digital technologies, particularly Additive Manufacturing (AM), are explored as enablers of these CE principles. The paper reviews how AM can support various R-strategies and presents a framework detailing how AM technologies can extend the product life cycle across product phases like research and design, production, use and maintenance, and end-of-life, providing guidance for each phase.

Student Thesis Goals

- Awareness regarding the waste levels and concerning waste management
- Familiarization with terms such as Circular Economy, R-strategies, Additive Manufacturing and Design of Additive Manufacturing
- Literature review and tracking of the state-of-art collaboration between CE and AM - Examples of R-strategies in AM processes
- Examination of how design aspects and considerations of AM are affected when R-strategies of CE are achieved

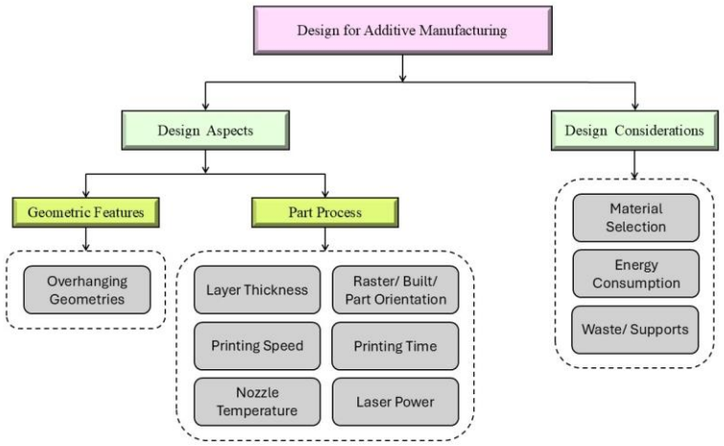
Method

- The method consists of extend research of evidence in existing literature
- Assumptions in evidence according to AM mechanism, materials properties and desired outcome when the references do not deal with

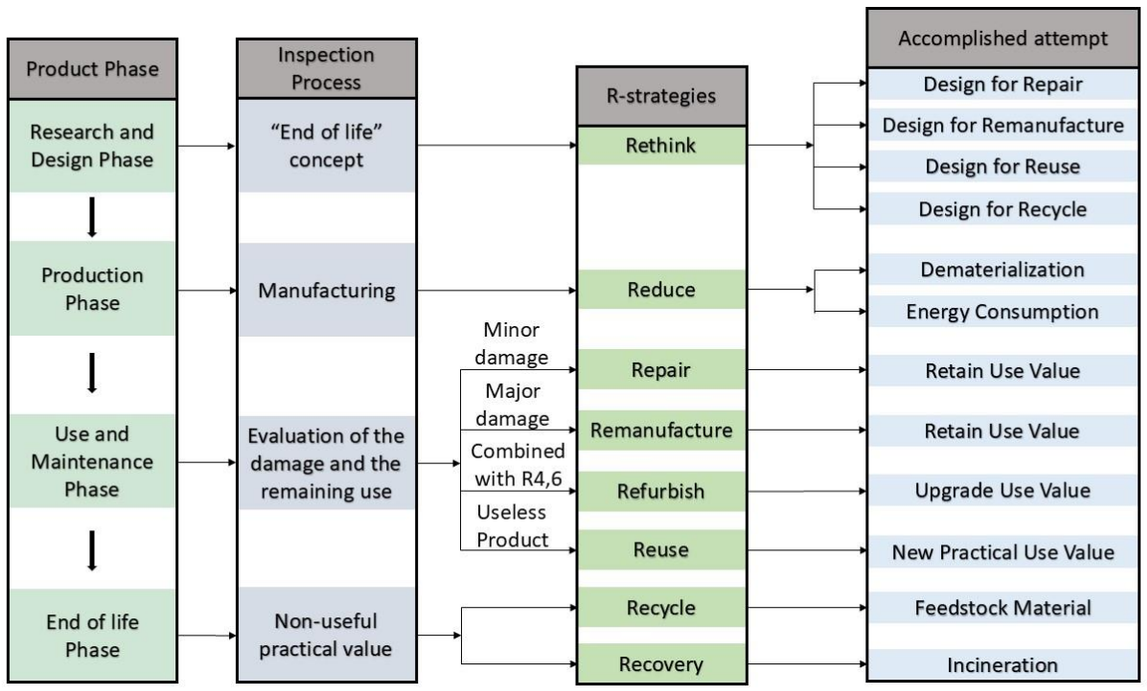


Results

- Proposed Design Aspects and Considerations of AM to help the control to be carried out



- With a view to achieve each R-strategy, focusing on R-strategies that have a direct impact on AM techniques, the affection of all the design aspects and considerations are presented
- Each assumption is confirmed by the literature, if exist
- Creation of a Proposed Framework that provide guidance on how R-strategies of CE support the LCA through AM technologies according to various product phases
- Different R-strategies are implemented in different product phases and are selected after an inspection process
- After the implementation of each R-strategy, the accomplishments are presented



Conclusion

- Further research and investment of how AM could support the R-strategies of CE is on demand, especially due to lack of relevant literature
- Validation of design aspects and consideration assumptions is needed

Future Work

- Application of the proposed framework in real components according to various product phases
- Extraction of Key Performance Indicators to determine the framework's guideline
- Focus on specific AM processes in order to be established as enablers when each R-strategy is conducted