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Optimizing Hybrid Fiber-Reinforced Composites With More Than Two Fibers For Pseudo-Ductile Behavior

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Abstract: Unexplored techniques in the field of composites, in this case bringing together meta-heuristics and hybridization, provide a unique opportunity to achieve new optimal composite materials. Work on hybrid fibrous composites with more than two fibers is scarce, due to the complexity of micro-mechanical hybrid composites' models. Therefore, it is of paramount importance to explore solutions with new techniques if a new type of results is to be found. The scope of this work is to produce an adaptation of a model that reciprocates the failure mechanisms of composites, using known properties of fibers ([1]). It is intended to explore the potential of this level of hybridization adopting meta-heuristics, that open up a wider range of possible solutions. This problem reveals itself as multi-objective, considering not only pseudo-ductility as a parameter but also specifications such as how high is the baseline achieved by the material, on a stress-strain curve, and an additional criteria known as pseudo-plastic work . A computational model using genetic algorithms was developed to solve the optimization problem using either a weighted function approach or a multi-objective function with the purpose of identifying the Pareto Front. The obtained results point to a significant improvement on the project specifications when compared to the previous research on this particular subject ([2]). Both in house and commercial algorithms were tested and compared, yielding valuable results.

References

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