

Master's Degree Thesis in Automotive Engineering

Tools For Optimisation Strategies in Mechanical Applications

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For research, writers delve into philosophy to create dimensions to questions that have not been asked, in an attempt to simplify a concept by complicating it first. In this paper, I tend to question the existence of optimality. What is optimization and is optimization unique? Theoretically, in some very unique cases, it might be so. However, the human capability is limited, and the computation algorithms are blind and straightforward. They can not deviate from the path laid ahead of them, the path they were programmed to follow.

In the study of the `fmincon` function used in the creation of the Optimisation Panel, it became evident in many cases how disappointing this tool really is. In the presence of multiple feasible solutions, `fmincon` will only point towards one fooling the user to believe that it is the only optimal solution. Even if the solution satisfies all the constraints and boundaries, a better one might exist that satisfies other unwritten constraints or ambitions. Perhaps, the most common way to turn the direction of optimization is through the choice of the initial point. However, that might require the user to have a vague idea on the location of the optimum.

In the case study of the thesis, a reduction approach was implemented to change the form of the variables without altering the objective function or the optimization algorithm, in an attempt to discover other feasible solutions.

The overall summary presented here is quite simple. First, a quick but sufficient introduction to the components of an optimization problem from the decision variables to the objective function to optimize and the constraints that limit or trap the solution and the different types of optimization were represented with examples. Second, some common optimization algorithms were broken down algebraically, logically and/or graphically. Third, the optimization tool which was developed during this thesis was explained and a user guide was written. The functionality and versatility of the tool was tested and validated. Finally, a case study was evaluated given the knowledge that was acquired along the way.