

Preliminary Sizing and Optimization of Propeller Aircraft (Part 25)

Purpose – This project incorporates methods for propeller efficiency estimation into a preliminary sizing tool for large aircraft certified for CS-25 respectively FAR Part 25.

Methodology – Variable pitch propellers are considered. For them, previously collected methods for propeller efficiency estimation are evaluated and used. The resulting preliminary aircraft sizing tool is evaluated with a redesign of the ATR 72-600.

Findings – Propeller efficiency estimation methods are based on experience or theory and are defined in diagrams or equations. The main parameters with an influence on propeller efficiency are cruise speed, air density and propeller disc diameter. Furthermore, friction and shock waves (occurring at high Mach numbers) have a large influence on the propeller efficiency. When aerodynamic effects at high Mach numbers are not considered, estimation methods yield maximum propeller efficiency at maximum speed.

Research Limitations – The influence of high Mach number on propeller efficiency needs to be evaluated further. Propeller efficiency methods are referenced and explained, but not derived.

Practical Implications – Aircraft preliminary sizing works with automatic calculation of propeller efficiencies. User look-up of efficiencies from diagrams is not required anymore.

Social Implications – The preliminary sizing tool for large propeller driven aircraft is openly available. Therefore, the potential of future propeller driven aircraft can be discussed by the public.

Originality – A didactically enhanced design, redesign, and optimization tool (on preliminary sizing level) for large propeller driven aircraft is made openly available. It is especially suited for students and fills a perceived gap.

This informative poster is based on a student project with (almost) the same title. Details here: <https://nbn-resolving.org/urn:nbn:de:gbv:18302-aero2022-04-29.012>

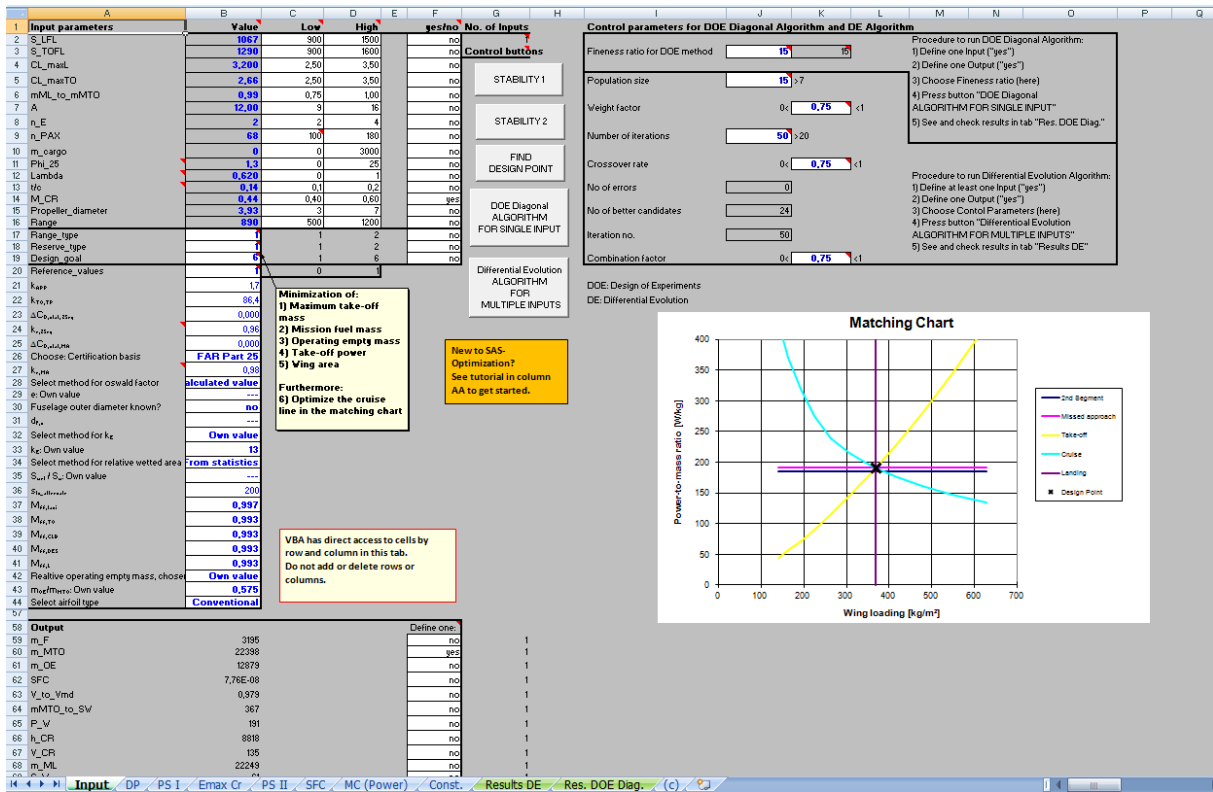


Figure 1: Graphical User Interface (GUI) of the optimization tool "Simple Aircraft Sizing and Optimization", in short: SAS-Part25-Prop.

This is an abstract answering the Call for Papers of the German Aerospace Conference 2024 for an informative poster at the conference.

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