Turbofan Specific Fuel Consumption, Size, and Mass from Correlated Engine Parameters

Task for a Master Thesis

Background

The specific fuel consumption (SFC) characterizes the efficiency of an aircraft's engine. For a jet engine, the thrust specific fuel consumption is defined as the fuel mass consumed per unit thrust and per unit time. SFC changes with aircraft speed (V) and altitude (h). The knowledge of SFC is fundamental for calculations in flight mechanics and aircraft design. In aircraft design also engine mass is important, because it adds to the aircraft overall mass. Engine size is important for engine integration. Simple but reliable engine black box models are needed in aircraft analysis and design. SFC (c) can be represented by a linear function $c = c_a V + c_b$ as explained in a memo (https://purl.org/aero/M2017-07-15). The table "Civil Turbojet/Turbofan Specifications" (http://www.jet-engine.net/civtfspec.html) is an open source of input parameters, from which black box engine models can be built. An Excel version is available that also includes the year of entry into service of the engines. Consider also work from Bensel and Schulz (http://library.ProfScholz.de) and Herrmann (http://fm.ProfScholz.de).

Task

Define engine models for engine SFC, size and mass based on given data. Follow these steps:

- Start with a short literature review to appreciate previous results on the topic.
- Extend the given Excel spreadsheet with further engine data as necessary and available.
- Calculate c_a and c_b from the spreadsheet for all engines with sufficient data available.
- Work with linear and non-linear regression to find equations for engine SFC, size and mass. Consider all given engine parameters in your regression one by one and in a useful combination.
- Work with linear and non-linear regression to find equations for c_a and c_b in order to describe SFC based on the equation $c = c_a V + c_b$. This may eliminate the fundamental problem inherent in the definition of SFC based on thrust (instead based on power).
- Find models describing engine SFC, size and mass based on Singular Value Decomposition (SVD) in Excel (and MATLAB).

The report has to be written in English based on German or international standards on report writing.