Weight Estimation

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The goal of this this algorithm is to arrive at a final gross weight of an aircraft after successive iterations by varying certain quantities.

There are essentially two parts in the main code, viz. Parameter Declaration and the Iterative Process.

Parameter Declaration:

The algorithm involves usage of nearly fifty parameters in total. For a detailed elucidation of each parameter, the corresponding README file can be referred. After declaration and initialization of the constants, the variable parameters have to be considered. Since these parameters depend on gross weight (which is varies in the iterative process), they are dealt with in the next section.

Iterative Process:

This process starts off with an initial estimate of gross weight.

Next we deal with the varying quantities viz. weight of fuel in wings (wFw), Wing Surface Area (S), Wingspan (b) Landing weight (Wl), fuselage wetted area (sFus). As stated in the previous section, these parameters depend directly or indirectly on the gross weight (w1) of the aircraft.

$$wFw = 1.06\ w1\ (1 - 0.893)$$

$$S = \frac{w1}{w\_s}$$

$$b = \sqrt{S\ \times AR}$$

$$Wl = w1\ \times w\_s$$

$$sFus = 5.5\ \times S$$

The remaining parameters in this algorithm are constant.

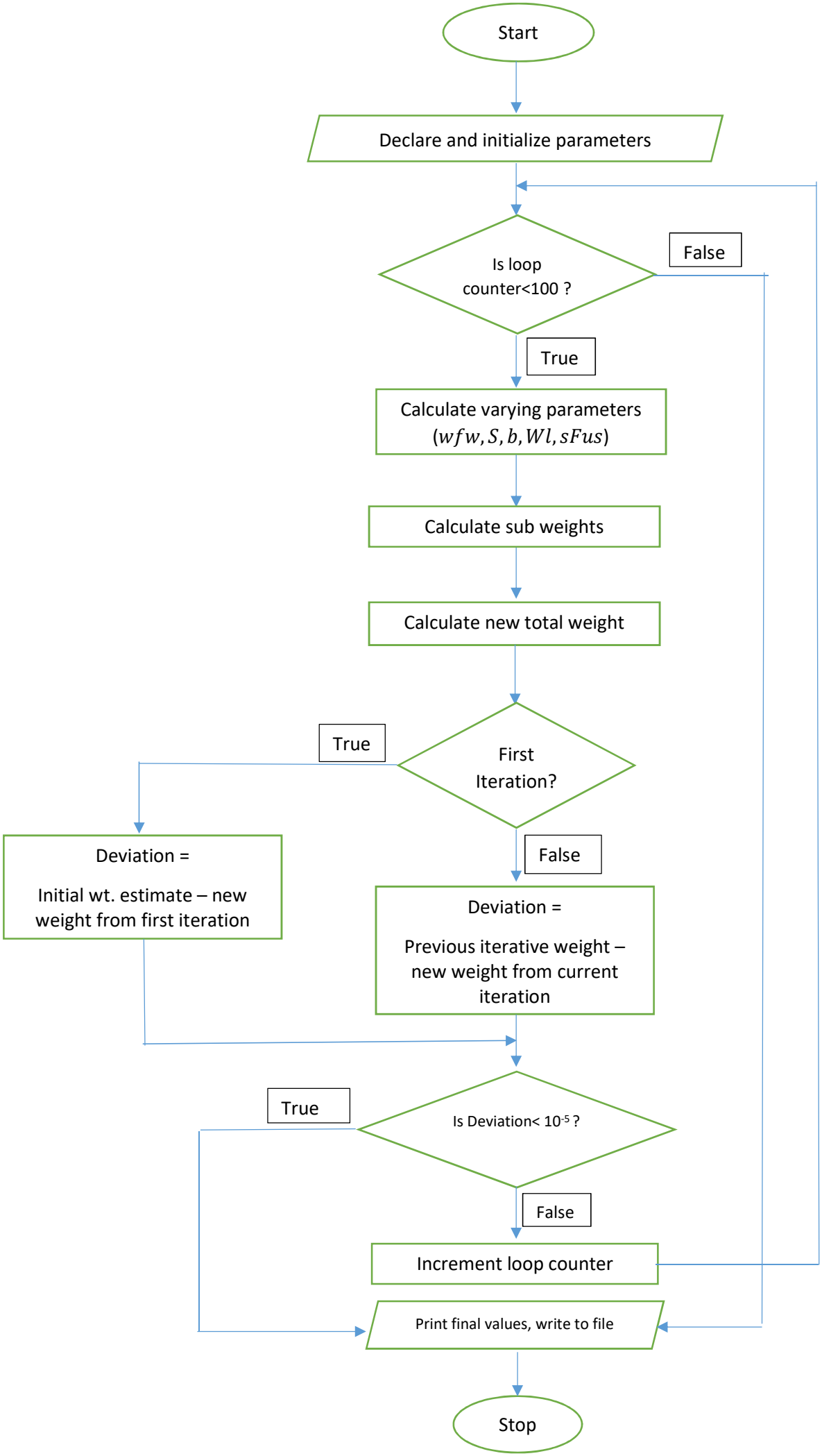
Hence the values of our varying parameters for each iteration are available. These are used to calculate the individual sub weights and ultimately the new gross weight iteratively.

The new gross weight is now replaced as the gross weight for the next iterative cycle, and the new varying parameters are calculated using this. From these newly calculated parameters, the sub weights and new gross weight is calculated. This new weight is again replaced in place of the gross weight for the next iteration and the cycle goes on.

The above process continues until the deviation two consecutive iterations is less than 10^{-5}.

The last value of the gross weight before exiting the loop is the final optimized gross weight of the aircraft.

The flowchart below gives the complete flow of the algorithm:


Start
Declare and initialize parameters
Is loop counter<100 ?
False
True
Calculate varying parameters $(wfw, S, b, Wl, sFus)$
Calculate sub weights
Calculate new total weight
First Iteration?
True
False
Deviation = Initial wt. estimate – new weight from first iteration
Deviation = Previous iterative weight – new weight from current iteration
Is Deviation< 10^{-5} ?
True
False
Increment loop counter
Print final values, write to file
Stop