International Journal of Mechanical and) Production Engineering Research and Development (IJMPERD
ISSN(P): 2249-6890; ISSN(E): 2249-8001
Vol. 9, Issue 4, Aug 2019, 1063-1070

MASS OPTIMIZATION FOR STRUCTURAL MEMBERS IN AN AIRCRAFT WING USING NUMERICAL TECHNIQUES

G. D. VARA PRASAD[1], MURARI VATTIPALLI[2], M. INDIRA RANI[3] & M. MADHAVI[4]

[1]*Assistant Manager, Bharat Forge Limited, Hyderabad, India*

[2]*Senior Executive, Tata Advanced Systems, Hyderabad, India*

[3]*Professor, Jawaharlal Nehru Technological University, Hyderabad, India*

[4]*Professor, M. V. S. R. Engineering College, Hyderabad, India*

ABSTRACT

In an Aerospace industry, reduction of mass is having a greater significance. In this paper the main objective is to reduce the mass of the structure and without getting effected to system parameters like deflections and stresses on the members. Structure is chosen from an existing fighter aircraft and it is generated by a high level of literature study. Modelling is done using a coordinate data of aerofoils and systematic approach of twist angle of structure. The basic model is created in modelling software Pro-E and it is parameterised in analytical software Analytical parametric design language (APDL). Parametric code is developed for optimization study which is an input source code contains all design variables, constraints and objectives. Design variables are number of ribs and Spars and the specific Constraints are considered on the response of the structure such as equivalent stress at the root and deflection of the structure at the tip of the structure.

Load cases are calculated and which is analysed to meet the stiffness criteria and strength requirement of the structure. The initial finite analysis is carried out using FEM tool ANSYS and the results are well within the bounds. In order to satisfy the ultimate objective is minimising the mass of structure, using optimization techniques the initial solution is coupled with optimization software Visual DOC. The model is virtually having several designs in the constructive domain space.

Two methods are used for optimization i. e., Modified method of feasible directions and Broydon-Fletcher-Goldfrab-Shanno (BFGS). These methods work on gradients calculations in Optimization. This optimization method uses forward finite difference calculations to obtain a numerical estimation of required gradients. By this approach objective is achieved, design variables are concluded and the structural constrains are within the threshold.

KEYWORDS: Twist Angle, Design Variables, Constraints, Spars, Ribs, VisualDOC & Optimization

Received: May 18, 2019; **Accepted:** Jun 08, 2019; **Published:** Jul 16, 2019; **Paper Id.:** IJMPERDAUG2019109

Original Article