EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1087

MULTIOBJECTIVE OPTIMIZATION OF COMPOSITE MATERIALS FOR CONTINUOUS FIBER ORIENTATION

Pedro Bührer Santana[(1)], Ewerton Grotti[(1)], Marcos Awruch[(2)], Herbert Gomes[(3)]

[(1)]UFRGS, Brazil
pedrobs66@gmail.com, ewerton.grotti@ufrgs.br

[(2)]UFSM, Brazil
marcos.dfa@gmail.com

[(3)]Federal university of Rio Grande do Sul, Brazil
herbert@mecanica.ufrgs.br

Keywords: multiobjective optimization,composite material,natural frequencies,QPSO,continuous fiber orientation.

Abstract: Composite materials have gained prominence as an intensively used material in the aerospace and mechanical industry due to their characteristics of stiffness and low weight. The possibility of designing composite material specimens with continuous orientation of the fibers at the ply level, following smooth contours, makes this material even more attractive, as it assess, in a more rational way, the whole reserve of fiber stiffness in the directions of main loadings. This work presents a methodology for the optimization of the dynamic behavior of composite materials by the definition of a continuous fiber orientation. Parameterized curves are used to define the continuous orientation of the fibers and the control points are assumed as design parameters during optimization. A Multi-Objective Quantum Particle Swarm Optimization (MOQPSO) algorithm is used as an optimizer due to desirable characteristics of good convergence and lower likelihood of being stuck in local minima. An example of a composite plate is used to maximize the relationship between the first two natural frequencies (mode veering) and the results compared to solutions assumed optimal. Another example of multi-objective optimization of the composite plate material is presented and compared with literature solutions (which uses an improved NSGA-II algorithm) taking into account the Tsai-Wu index and the Practicality index (a value that defines the ease of execution of the continuous orientations of the fibers). In the end, the results of the orientation of the fibers found in the composite material were very similar to those reported in the literature, confirming the validity of the proposed methodology.