A NOVEL APPROACH FOR SOLVING GEAR TRAIN OPTIMIZATION PROBLEM

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1. INTRODUCTION

From a research and practical aspect, there is a need for constant improvement in theoretical and practical segments in order to justify the use of gear trains. As a basic problem is achieving better working characteristics, performances, in terms of mass, volume costs, etc. Chong et al. [1] presented a general methodology for optimizing gear ratios, sizes and housing volume for multi-stage gear trains in preliminary design phases. Marjanovic et al. [2] developed a practical approach to optimizing gear trains with spur gears based on a selection matrix of optimal materials, gear ratios and shaft axes positions. Golabi et al [3] presented gear train volume/weight minimization optimizing single and multistage gear trains' gear ratios. Mendi et al. [4] aimed to optimize gear train component dimensions to achieve minimal volume comparing GA results to analytic method parameter volume. Savsani et al. [5] described gear train weight optimization comparing various optimization methods to genetic algorithm (GA) result values. Gologlu and Zeyveli [6] performed preliminary design automation through optimization of gear parameters and properties using a GA based approach. Pomrehn and Papalambros, [7] optimized gear train volume varying gear thicknesses, distances between centers, pitch diameters, number of teeth, ratios, etc. for a specific four stage setup. Deb and Jain [8] used similar principles for optimizing multi-speed gearboxes using multi-objective evolutionary algorithm optimizing volume in relation to power.

In order to facilitate improvement in this field, a great deal of experience and use of novel and alternative methods is required. Optimization presents a way of effectively achieving desired characteristics of gear trains. This paper is concentrated only on gear trains with parallel shaft axes. Aside from knowing reducer construction, the processes and method of optimization, it is necessary to develop a mathematical model which can be representative of the problem, and improve performances. Modern approaches of solving this problem represents the use of a heuristic approach, as an alternative to optimization. A heuristic approach allows for achieving adequately optimal solutions with having very little input data.

Motivation for this research is to find a means, and volume optimization method for gear trains using a heuristic approach, where a minimal amount of input data is necessary in order to form a universal method and approach for solving this specific problem for any gear train of this type. Furthermore this method should lead to achieving minimal volume, and with that a lower mass of the construction, smaller dimensions,

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