World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:9, No:07, 2015

Singular Value Decomposition Based Optimisation of Design Parameters of a Gearbox

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Abstract : Singular value decomposition based optimisation of geometric design parameters of a 5-speed gearbox is studied. During the optimisation, a four-degree-of freedom torsional vibration model of the pinion gear-wheel gear system is obtained and the minimum singular value of the transfer matrix is considered as the objective functions. The computational cost of the associated singular value problems is quite low for the objective function, because it is only necessary to compute the largest and smallest singular values (μmax and μmin) that can be achieved by using selective eigenvalue solvers; the other singular values are not needed. The design parameters are optimised under several constraints that include bending stress, contact stress and constant distance between gear centres. Thus, by optimising the geometric parameters of the gearbox such as, the module, number of teeth and face width it is possible to obtain a light-weight-gearbox structure. It is concluded that the all optimised geometric design parameters also satisfy all constraints.

Keywords : Singular value, optimisation, gearbox, torsional vibration
Conference Title : ICMSE 2015 : International Conference on Mechanical Sciences and Engineering
Conference Location : Zurich, Switzerland
Conference Dates : July 29-30, 2015