拖拉机最终传动多目标模糊可靠性优化设计 Multi-objective Fuzzy Reliability Optimization Design of Tractor’s Final Transmission

叶秉良 俞高红 赵匀

浙江理工大学

关键词： 拖拉机 最终传动 模糊可靠性 多目标优化 遗传算法

摘 要： 综合考虑拖拉机单级外啮合直齿圆柱齿轮最终传动的承载能力、结构、齿面磨损和传动效率等问题，应用模糊数学和可靠性理论以及多目标优化技术对该机构进行设计。建立了以机构的体积和两齿轮的最大滑动系数最小、效率最高为目标函数，以模数、小齿轮齿数、齿宽和啮合角为设计变量的多目标模糊可靠性优化设计数学模型，应用多目标优化的模糊解法和遗传算法对其进行求解。在保证最大滑动系数不超限的前提下，模糊可靠性优化设计方案比常规可靠性优化设计和原设计方案体积分别减小1.55%和6.74%，且传动效率得以提高。Fuzzy mathematics, reliability theory and multi-objective optimization technology were applied to design tractor’s final transmission with external single-stage spur gear based on comprehensive consideration on its loading capacity, structure, tooth face wear and transmission efficiency. The mathematical model for the multi-objective reliability optimization design was set up under the objective of the minimal volume and gears’ maximal sliding coefficients, and the maximal efficiency of the mechanism, with the design variable of module, teeth number of the pinion, teeth width and meshing angle. Then, the fuzzy solution of multi-objective optimization and genetic algorithm were used to solve this model. On the premise of ensuring the maximal sliding coefficient below the allowable value, the final transmission’s volume reduces by 1.55% and 6.74% of the common reliability optimization and original design scheme respectively, and the efficiency improves.

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