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OPTIMAL SYNTHESIS OF THE PLANETARY GEAR TRAIN OF THE TRACKED VEHICLE GEARBOX

The forest environment is characterized by a complex variety of natural-production operating conditions. In it, for the implementation of normal production activities, forestry machines of increased off-road patency are necessary. At present, the achievement of high cross-country ability of modern forest automobile and tractor equipment is unthinkable without the perfect design of their transmission. Transmissions of modern forestry machines are characterized not only by a wide variety of designs, but also by significant differences in their kinematics. Various types of transmissions are installed on the machines. They have a high efficiency, create favorable working conditions for the operator, have a minimal impact on the environment, and also have many other advantages.

Most existing modern transmissions in the mechanical part use a planetary gear train. Under similar operating conditions, planetary gear have a number of advantages as comparing to the standard transmission: light weight, compact size, large speed ratio, high efficiency, long service life and so on. The optimal synthesis of planetary gear is a complex engineering problem and a multi-objective optimization problem because of very complicated calculations, a great number of conditions, geometrical and functional constraints and numerous solution variants.

In the paper, this problem is considered as an example of the synthesis of a planetary gear train of a tracked vehicle. The task of designing and optimizing planetary gear was solved using the differential evolution algorithm. The model obtained during optimization was checked using the conditions of strength, including the fatigue stress of the contact and the fatigue stress of the bending strength of the tooth. Verification shows that the synthesis with differential evolution algorithm is effective and correct. Result of simulation shows that by using differential evolution algorithm, the design quality and efficiency of the planetary gear train can be improved.

Keywords: planetary gear, optimization, differential evolution algorithm, gear-tooth strength

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