

外齿轮式高压油泵全齿面润滑的理论分析

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关键词: 油泵 齿面润滑 油膜厚度 困油压力

摘要: 为探究困油压力和异齿数对外齿轮式高压油泵全齿面润滑的影响, 基于齿轮传动的几何关系, 将全啮合齿面分成3个啮合区、8个位置点和7个过程, 并以主动齿轮的啮合曲率半径为变量, 建立了全齿面的啮合力公式和基于弹流润滑理论的膜厚公式, 并对最小膜厚和最大啮合力发生的位置作出准确的判断。实例的研究表明: 啮合力的变动很大, 全齿面润滑总体上属于刚性-变粘度的边界润滑; 不同啮合点可能会采用不同的膜厚公式; 异齿数能缓解啮合力的波动和改善齿面润滑状态, 但效果不明显。由此得出外齿轮式高压油泵的齿面润滑确实有别于常规的齿轮传动, 因而不能直接应用现有的计算公式。In order to understand trapped oil pressure and the different numbers of teeth effect on lubricating state on all tooth profile of external spur-gear high pressure oil pump, based on the geometrical relationship of gear transmission, with radius of curvature of driving gear in mesh-point engaged as a variable in a tooth period, all tooth profile was divided into three mating sections and eight especial points and seven courses, the corresponding transient formula of both oil film thickness based on elastohydrodynamic lubrication theory and tooth force were derived, hereby, the accurate position of minimum oil film thickness and maximum tooth force were estimated. Research and all results of an example indicated transient tooth force had a high change in a tooth period, the lubricating state on all tooth profile of external spur-gear high pressure oil pump is boundary lubrication of stiffness with a variable viscosity on the whole, different formula of oil film thickness should be used for different position of all tooth profile, different numbers of teeth have a positive unapparent effect on lubricating state on all tooth. Finally, a conclusion was educed that the gear transmission of external spur-gear high pressure oil pump was indeed different from conventional gear transmission in lubricating state on meshing surface, and the calculation of oil film thickness in external spur-gear pump couldn't directly use the conventional formula for conventional gear transmission.

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