
Investigation of dominant modes of heat transfer and thermal stability of the classic cycloid reducers concept

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Abstract

High-precision reducers are increasingly used in modern industrial systems, especially in industrial robots, navigation systems and CNC machine tools. That is why the number of installed cycloidal reducers is constantly growing year after year. One of the least researched aspects of cycloidal reducers is certainly their thermal stability, which can only be ensured if the amount of heat dissipated should equal the amount of heat generated, that is, if the operating temperature is lower than the permitted one. This paper presents a mathematical model for determining the stationary operating temperature of a lubricant, one of the most important parameters of thermal stability. This research is very important, because elevated operating temperature affects thermal expansion, change of internal clearances, reduction of the viscosity of the lubricant, i.e. the thickness of the oil film.

For the correct operation and fulfillment of the intended work function of the cycloid reducer, its thermal stability plays an extremely important role, and it largely depends on the temperature of the lubricant. Currently, there is no methodology that systematically studies and checks the thermal stability of cycloid reducers. That is why the presented methodology is of great importance for engineering practice, as it provides the opportunity to obtain relevant data on the influence of operating temperature on the bearing capacity of the reducer in the construction phase and to make the necessary corrections in a timely manner without expensive and time-consuming prototype tests.