Kinematics and durability of a circular saw of a robotic unit for woodworking

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Effective development and subsequent use of robotic systems are inextricably linked with the study of the dynamics of their elements. The necessity of the study when designing such systems is due to the difficulties in justifying the choice of permissible parameters that ensure a given working capacity and the operating conditions of the components of these systems. For woodworking machines equipped with robotic units, a crucial task is to determine the allowable kinematic modes of using circular saws that perform complex rotational movements during operation. It is important to take into account the analysis of the stress-strain state arising in them. The solution of this problem was carried out on the basis of the developed mathematical model of a thin disk (thin plate), whose relative and transportable rotation occurs around intersecting axes. The formulated boundary value problem was calculated using numerical methods. The stresses in the disk and its deformation were determined according to the kinematic characteristics of its movement. The calculation of the allowable frequencies of rotation of the saw blade was carried out through the example of a circular saw from the Uniteam Ultra robotic machining center (Italy). In order to obtain the necessary initial data for strength analysis, experiments were conducted to determine the strength characteristics of the steel from which the saws of this machining center are made. The results of the calculations make it possible to impose restrictions on the rotational speeds of a circular saw when the machining center operates taking into account its geometrical parameters and the mechanical characteristics of the material. The proposed method for studying the spatial movement and behavior of a cutting disk tool is necessary for the selection of technological modes of operation of modern woodworking equipment.

Keywords: *circular saw, disc, rotational speed, deformation, Coriolis acceleration*

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