EFFECT OF CENTRIFUGAL FORCE AND GEOMETRY UPON DYNAMICAL BEHAVIOUR OF ROTATING CAMS

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Abstract: *The paper studies the effect of geometry and centrifugal force upon the stress state and strain state in a circular rotating cam. There are considered two cams of different thicknesses. For an uniform rotation velocity of the cam, the equivalent von Mises stress is much lower than the yield stress and thus the risk of plastic deformation occurrence is avoided. Concerning the strains, they are grater for the thicker cam and there is the possibility that the deformations exceed the limit allowed by the deviation from the nominal profile. For the same supports scheme, the vibration modes are found. For the first vibration mode, the von Mises stress values exceed substantially the yield stress of the cam's material. Complementary, for the fundamental vibration mode, the displacements of the points from the cam's periphery are parallel to the shaft axis and thus the profile of the cam is unaltered.*

Keywords: *rotating cam, centrifugal force effect, vibration*

1. Introduction

Cam mechanisms are broadly met in technical applications, this extended employ owing to constructive minimalism. As a fact, having two mobile parts, the cam and the follower, any law of motion can be achieved when the mechanism is accurately designed. The design of cam mechanisms is well founded and the literature presents numerous monographs and papers dedicated to the subject, [1]-[8]. During the operating cycle of a cam mechanism, four phases are recognized:

- the rise phase, when the follower departs from the cam's centre;
- the upper dwell phase, when the follower is immobile in the highest position;
- the fall phase, when the follower approaches the centre of the cam and finally,
- the inferior dwell phase, when the follower is stationary in the lowest position.

Sometimes, one or both of the stationary phases may be absent.

Regardless of the situation, for rotating cam mechanisms, the follower has a periodic motion, specifically the follower moves periodically between two extreme positions, fact that confirms the presence of accelerations and implicitly of considerable inertial forces. Obviously, with increasing rotation velocity of the cam, the time intervals during which the follower moves between the extreme positions decrease and as a result the inertial forces increase correspondingly.

Another extremely important aspect concerns the machining accuracy of cam's profile. The cam is a profiled part that, with a few exceptions (circular cams), must be obtained on machines with numerical command. To ensure the prescribed law of motion for the follower, the shape of the cam's profile should respect prescribed tolerances rigorously.

Any deviation form the profile of the cam possibly will be understood as a perturbation signal, whose effect can be simply studied by Fourier expanding of perturbation signal with respect to the harmonics of cam's rotation.

During running, the centrifugal force produces a displacement field that possibly