

سامية محمد مصطفى



شبكة المعلومات الجامعية

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سامية محمد مصطفى



شبكة المعلومات الجامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

جامعة عين شمس

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DEVELOPMENT OF A CAD/CAM PROGRAM FOR SELECTION
OF FITS AND TOLERANCES WITH AN APPLICATION
TO LIMIT GAUGES

by

MOHAMED ELSAYED HOSSNY ELTAIB

B. Sc., Machine design and production engineering
El- Mansoura University, 1986.

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Department of Mechanical Engineering

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Assiut, Egypt.

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Supervised by :

Prof. Dr. Mohamed M. Sallam
Dr. Saied M. H. Darwish

Examined by :

Prof. Dr. Monier M. Koura
Prof. Dr. Refat M. El-Zahary
Prof. Dr. Mohamed M. Sallam

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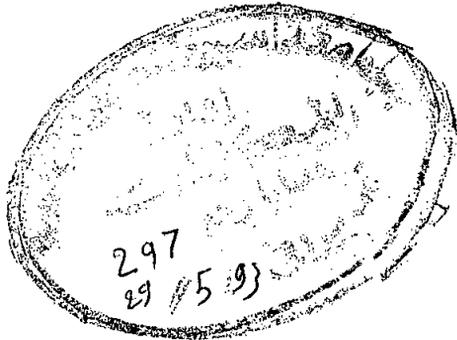
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ABSTRACT

In the present work a computer package has been developed to select fits and tolerances, to be used for the design of limit gauges, and to generate a part program for execution on a CNC vertical milling machine.

This package contains three main parts:

The first part contains the logic and information as summarized in ISO standards for fits and tolerances. It can be used as a guide for fits and tolerances selection in general.

In the second part plain and threaded limit gauges have been designed as examples using the information and data developed in the first part.

The third part contains the logic for generating a CNC part program from 2-D drawing created using Auto-CAD (microcomputer-based CAD system). The tool path is extracted and a file created to contain a complete set of data and instructions for the purpose of manufacturing a part on a STARMILL training vertical milling machine controlled by a personal computer.

The package has been developed using AutoLISP (an implementation of the LISP programming language) and runs through AutoCAD. It can run on an IBM PC or IBM compatible.

The developed package has many advantages. It was designed as menu driven programs to be flexible and easy for use. It makes it easier for the designer to select the appropriate fits and tolerances according to the particular engineering application. It fills the gap of most CAD systems in specifying

fits and tolerances . A significant amount of time and effort which would be spent in consulting text books and standard systems can be saved. Accuracy as well as consistency can always be achieved when using this package for design purposes. It also provides the link between CAD and CAM, by creating a part program from CAD information to be executed on a CNC vertical milling machine.

NOMENCLATURE

ALPHABETICAL SYMBOLS:

(see Fig. 7,10,11,12,13)

- D Basic major diameter of internal thread (mm).
- d Basic major diameter of external thread (mm).
- D_H Hub outside diameter (mm).
- D_o Shaft outside diameter (mm).
- D_s Shaft inside diameter (mm).
- D_1 Basic minor diameter of internal thread (mm).
- d_1 Basic minor diameter of external thread (mm).
- D_2 Basic pitch diameter of internal thread (mm).
- d_2 Basic pitch diameter of external thread (mm).
- E_H Young's modulus of elasticity for hub material (N/mm^2).
- E_S Young's modulus of elasticity for shaft material (N/mm^2).
- ei Lower deviation of the internal feature (μm).
- ei Lower deviation of external feature (μm).
- ES Upper deviation of internal feature (μm).
- es Upper deviation of the external feature (μm).
- F Force required to separate or assemble mating parts (N).
- H Main deviation of hole for hole basis system.
- h Main deviation of shaft for shaft basis system.
- H_1 Tolerance for plain plug gauges (μm).
- H_2 Tolerance for plain caliper and plain ring gauges (μm).
- H_p Tolerance for reference gauges for plain caliper gauges (μm).
- IT Tolerance grade.
- i Amount of interference (mm).
- L Mating Length in the case of interference fit (mm).
- p Thread pitch (mm).
- P_a Allowable pressure at shaft hub interface (N/mm^2).
- T Torque which can be transmitted by a pressure fit (N.m).
- T_{cp} Tolerance for the pitch diameter of GO and NOT GO screw check plugs, wear check plug and setting plugs (μm).
- Td Tolerance for the major diameter of the W.P. external thread (μm).

- T_{d2} Tolerance for the pitch diameter of the W.P. external thread (μm).
- T_{d1} Tolerance for the minor diameter of the W.P. internal thread (μm).
- T_{D2} Tolerance for the pitch diameter of the W.P. internal thread (μm).
- $T_{\alpha 1/2}$ Tolerance for the flank angle of profiles with complete flanks (second).
- $T_{\alpha 2/2}$ Tolerance for the flank angle of profiles with truncated flanks (second).
- T_p Tolerance for the pitch of the gauge thread (μm).
- T_{pL} Tolerance for the pitch diameter of GO and NOT GO screw plug gauges (μm).
- T_R Tolerance for the pitch diameter of GO and NOT GO screw ring gauges (μm).
- W_{GO} Average of the permissible wear of GO screw plug gauges and GO screw ring gauge (μm).
- W_{NG} Average of the permissible wear of the NOT GO screw plug gauge and NOT GO screw ring gauge (μm).
- y Margin, outside the GO workpiece limit, of the wear limit of gauges for holes (μm).
- y_1 Margin, outside the GO workpiece limit, of the wear limit of gauges for shafts (μm).
- y Difference in absolute value between y and α (μm).
- y_1 Difference in absolute value between y_1 and α_1 (μm).
- z Distance between center of tolerance zone of new GO gauges for holes and GO workpiece limit (μm).
- z_1 Distance between center of tolerance zone of new GO gauges for shafts and GO workpiece limit (μm).
- z_{pL} Distance between the middle of the tolerance zone T_{pL} of the GO screw plug gauge and the lower limit of the WP thread
- z_R Distance between the middle of the tolerance zone T_R of the GO screw ring gauge and the upper limit of the W.P. thread

GREEK SYMBOLS

- α Safety zone provided for compensating measuring uncertainties of gauges for holes of nominal diameter over 180 mm (μm), (see Fig. 7).
- α_s Safety zone provided for compensating measuring uncertainties of gauges for shafts of nominal diameter over 180 mm (μm), (see Fig. 7).
- ΔT Temperature difference in degree K.
- Δs Change of diameter at bearing bore (mm).
- μ Coefficient of friction .
- ν_H Poisson's ratio of hub material.
- ν_S Poisson's ratio of shaft material.

SYMBOLIC NOTATIONS

(see Fig. 5,6)



Full form cylindrical plug gauge.



Segmental cylindrical bar gauge.



Rod gauge with spherical ends.



Full form spherical plug or disk gauge.



Segmental spherical plug gauge.



Segmental cylindrical bar gauge with reduced measuring faces.



Full form cylindrical ring gauge.



Gap gauge.

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