

## MODULAR CLAMPING FIXTURES DESIGN FOR UNROTARY WORKPIECES

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**ABSTRACT:** Design of element choice algorithm is based on standard fixing and clamping methods. This algorithm permits maximal flexibility of function unit clamping design. Element database support design complexity, because provides real used elements view. This view simplify selection clamping element illustrated their applicability for specific situation. Elements database can be operated without education training. Showing formulas sequence take over designer via all database and individual elements can be selected to clamping combination. Also a new component can be added to existing database.

**KEYWORDS:** clamping fixture, database, modular clamping fixtures, CAM systems

### 1. MODULAR CLAMPING SYSTEM

All degrees of freedom are removed without clamping forces on ideal fixture. This is impossible in real fixture; therefore it is tendency used minimal clamping forces. Safety clamping is available ensuring positive reactions in each support point. During technological operation workpiece are pressed on supports, but cutting force in this time changing size, direction and theirs point of applications. Therefore is very important correct locate support points and define clamping forces vectors.

It is also very important to achieve repeability of clamping by manufacturing new product butch. Uncertain form workpiece is impossible repeat the same location constitution. Body has 6 degree of freedom on coordinate system. If workpiece mobility is delimited by geometric joints determining function of degree of freedom is following in (1):

$$i_p = 6_n - 6 - \sum k - \sum r \quad (1)$$

$n$  - number of items

$\sum k$  = number of contact point in body

$\sum r$  =number items where are rotating in itself (Fig.1)

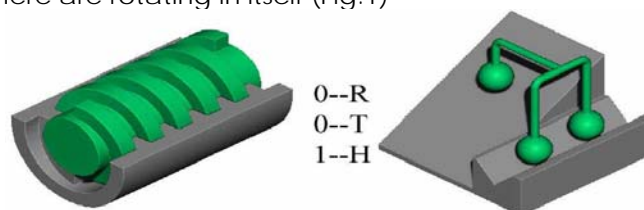


FIG.1 SCREW JOINT (COMBINATION OF ROTATION AND TRANSLATION)

Modular clamping system has high degree of unification and standardization, and represents manufacturing increasing effects itself. This modular clamping system has secondary contributions. There are signified in work organization, storage, maintenance and technical preparing of manufacturing spheres. There contributions permit production cost and manufacturing reaction time decreasing. Workpiece clamping must permit correct workpiece position toward cutting tools during machining operations. This position not allowed changing by cutting forces. The same clamping is used by hand machining. The simple clamping device is hand jaw. Clamping devices are used at assembly process also. In this case, clamping device instrumental achieve perfect joint between two assembly parts. Sometimes clamping device include guide bush.

## 2. CLAMPING FIXTURES DATABASE

Scale of modular clamping systems components is very widely. Many of them consist of 300 items. This number of components cause non-temporary of all items in system. The goal parameters at fixture building are clamping function and speed. It is tendency, which aim is summary and classification process of clamping system elements. Like that, elements choose from modular system are simplified. Different ways of many modular systems parameters tasks are designed. This systems are known as computer aided system – CAD, in which processing with many of dates is easy. Globally there are database systems, Fig.1.

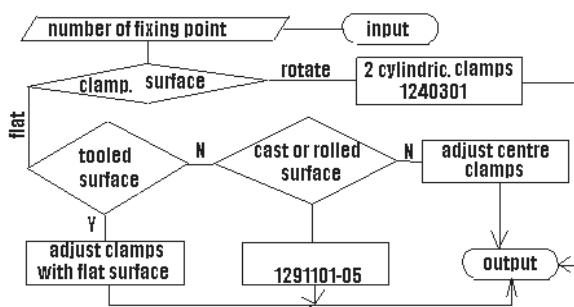


FIG.2 ALGORITHM FOR CLAMPING CHEEK CHOICE FROM DATABASE

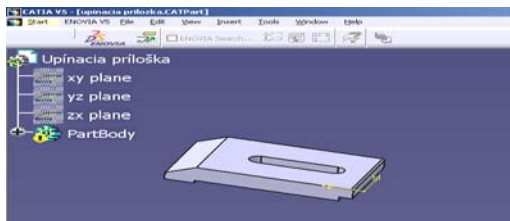


FIG.3 FIXTURE COMPONENT CHOICE IN CATIA V5R15

component at this moment. Flexibility increasing of clamping fixture design is effected parametric designing of fixture component, Fig.3

## 4. WORKPIECE AND THEIR FIXTURING

Clamping fixture design is influenced by several factors. Largely there are factors, which are included in technological production sequence.

- Workpiece design (Fig.4)
- Class and type of tool machine
- Choice of clamping and fixturing surface
- Fixing force design and computing
- Design clamping fixture
- Number of workpieces

There are designed several alternatives, and we can choice one of them, which is most advantageous. This chosen alternative permits to increase productivity. Alternative choice is realized at CATIA workbench. Fig.5

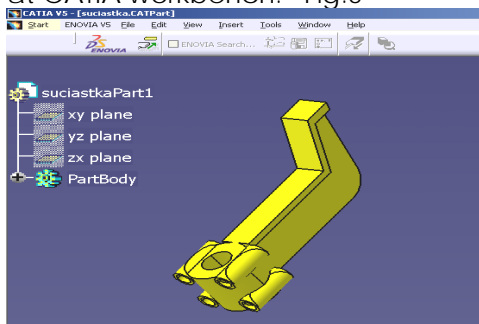


FIG. 4 WORKPIECE

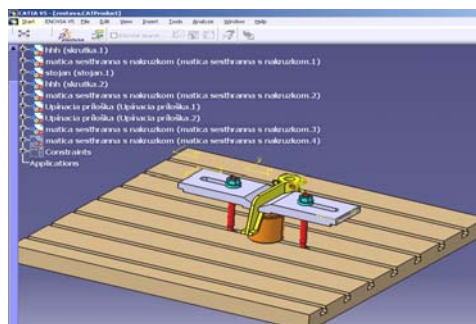


FIG. 5 DESIGN FIXTURE SYSTEM

CAD/CAM/CAE systems, e.g. CATIA Solutions, Unigraphics, Euclid Quantum, Pro/Engineer, I-DEAS Master Series, and complex CAD/CAM systems of middle class permit trouble free transfer data between individual modules.

## 5. CONCLUSION

Design CAD models of clamping fixtures components permit effective and flexible choice and using designed clamping fixtures. Permit decreasing costs for repeat design the same or similar clamping fixtures also.

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