FUNCTION OF CAD/CAM SYSTEM CATIA V5 IN RECREATION OF CNC MACHINING PROCESS

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Abstract

This paper presents improved methodology of the virtual recreation of turning and milling technological process of the select ed components in the graphical interface of CAD/CAM system CATIA V5. Each technology of machining must be supported by selection of the relevant geometry of cutting tools and cutting materials. The technological system CNC machine tool –progressive cutting tool–workpiece–fixture must ensure sufficient stiffness ,which has a direct influence on the quality of the surface finish of the final product. This technological process is important to enter the process of manufacturing of various precision engineering components of complex shape designed for the needs of automotive and aerospace industries. Using the highest level of programming through graphical engineering system is designed for creating the ISO programs using CNC machine tools. All simulations of cutting experiments show that the proposed.

Keywords:CAD/CAMsystem;turning;milling;machiningstrategy;postprocessor;virtual simulation

1. Implementation of CAD/CAM system CATIAV5: Great importance of all new technologies, materials, machinery, progressive methods and information tools that enable more efficient use of starting materials, produces a more cost effective, fast enough to produce reliable and quality products and above all succeed in the market in an increasingly challenging competitive environment.

Nomenrclature:

Depth of cut a
feed motion f
spindle speed n
computer aided design cad
high speed cutting HSC
computeraied manufacturing cam
computer numerical control cnc
CATIA-computer aided three dimensional interactive application

In the field of the new Rapid Technologies,representedtodaymainlythroughvariousAdditiveManufacturingprocesses,theprogressoftheHighSpeedCutting(HSC)technologyisofremarkableandspecificimportance[3].Today'strendcomponentismachininginone setup, with minimal clamping. This is achieved by the time reduction of the final machining, while eliminating accuracies caused by manual switching of the part [10]. The introduction of computer graphics allows a computer to create pieces, handle and examine them. Universal application of computer aided systems brings significant benefits. CAM is most closely associated with functions in manufacturing engineering, such as process planning and numericalcontrol(CNC)partprogramming.[12].ProgrammingofCNCmachinesiscarriedoutatthreelevels:

• DIN ISO programming, which is manually inserted G andM codes. The advantage is accurate programming of each movement. The dis advantage is the error of the human factor[13].

•Higherworkshopprogramming.Applicationwith thesesystemsrequiredminimumknowledge programming. All information about the workpiece are graphically entered which makes operating the machine.The advantage is the possibility of simulation [10].

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CAD/CAMsystems,whichareacomplexp reparationofproductionprocess.CADiscomputer-supporteddesignforpreparationproduction.Capa bledrawingsofa3dimensionalmodeloftheproduct ,creating technical documentation,conversionfrom2Dto3Ddisplay. CAMiscomputeraidedmanufacturing.Itisakindof automation through computerization. CAM brings the possibility of simulation machine cycles. Integration of CAD/CAM offers the possibility to generate CNC codes of design components[7,9].Machining of various components of complex shape using milling, drilling holes and so on, is possible to implement more gripping and carrying out each operation machining on various machine tools. By automating the production process of such components can be performed all the operations to a minimum number of clamping in more axialCNCmachiningcentres.CADSupport/CAM systemmakestheentireproductionprocessfaster,a nd what is particularly important in those parts of complex shape of scale [2, 4]. Moreover CAM systems provide access toalargevarietyofdatasuchastheprogrammedfeed rate,thetoollength,thenumberofflutes,etc.Thesep arameterscanbeofinterestfortheevaluationforwhi chtheprototypicalrealisationoftheassistanceappr oachallowscollectingthisdatawithouttheneedforu serinteraction[1].

2. Recreation of CNC Machining Process

Individualactsnecessaryforthedesignofmachinin gonCNCmachiningcentresintheCAD/CAMsyste mCATIA V5LatheandPrismaticMachiningmodulesareasfo llows:

•DeterminingappropriateandGeometricBODYS ETforpartsandsemi-onworkingtree.Createa3Dmodel.

• Creating a blank (roughstock)with those allowances which will be model.

• Going to the machine mode of CAD/CAM system and set tool parameter,whichwillper form roughing model.

• Defining the strategyof machining operations, which ar edeterminedsemi-alonemodel,themachiningallowance,tolerances, cuttingspeedandfeedmotionof the machine tool path.

•Setting theproperparametersoftheothercuttingtoolswhic hwillperformprofiling.

• Milling and turning machine tools to be stored in the machining centre in preparation for the fabrication andinspectionoftheCAM[4].Runningsimulations outputcontrolmachining(canseeonFig.1,2).

• CNC programinthe ISO format,as appropriate CNC machine tool and CNC controlsystem[7].

After creating atechnological process of production, the choice of an appropriate strategy roughing and finishing ofthefunctionalareasofthedrillingandmillingtool stoselectsuitablematerial,geometryandcuttingins ertholder.Thendeterminetheoptimumcuttingpara metersforeachroughingandfinishinghardmilling(feed,cuttingspeed).Amodelcreatedwiththetool,al ongwithintermediateputintotheenvironmentmod uleofCATIAV5Manufacturing in the work of the tree PRODUCT LIST. Creation of the production process is at the top of the treeunder

the name PROCESS LIST. Process through the menu is listed in NC Manufacturing module design type CNCmachinetool.Thenwedeterminetheworkorig in“W”oftheworkpiececoordinatesystemofthema chine,thetypeof post-processors to generate CNC code. Through the function“Auxiliary Operations” isgenerate do ptimal tool shape and cutting material, tool holders, cutting inserts and determine the strategy (Fig.3)of whole process of production using Machining milling operations. Using the function “Tool Path Replay” simulates of the process of machining. The function “Generating NC code” then generates the CNC program in ISO format (G and M codes),usingamemorycard,transferredtoacontrol systemforCNCmachinetool.Thechoiceofamachi ningstrategy

[11] for machining tool path generation has two main objectives: avoid significant federate loss and reducing aspossiblemachiningtime.To achieve these goals, themachining assistant often associates to a standardof 3-axesHSMtwotypesofmachiningstrategieswidely usedinCAMsoftwareforthemachiningofforgingd ies:parallelplanesstrategy:themachiningfeeddire ctionisdefinedbyparallelplanescontainingthetool axis,levelstrategy:themachiningfeeddirectionisd efinedinparallelplanesperpendiculartothetoolaxi s.Generally in all CAM software, tool paths computation is initially carried out through a selection of the machined surface and the identification or selection of avoidance shapes. When any avoidance shape is selected, tool paths are limited to the boundaries of the machined surface. In the case of a cavity linked to the machined surface (topologicalrelation),tool paths can be extended in order to maintain the set point of thefeedrate[14].

3. Milling SimulationinCATIAV5

The code in CAD/CAM system CATIA is implemented through function Generative CNC code. When activated this icon to formation of the CNC program form the active machining process, which was designed in the previous steps. Before the act of generating the CNC code it is necessary to determine the correct data on the method ofmachining, tool and defining its holder. The generated code can be further edited on a computeror directly to the CNC machining centre, the second option is not desirablein terms of production efficiency.A necessary early step is to delete the generated CNC code, because these data are set in the CNC machining centres and the abolition ofnumberinglines.Itisimportanttochangethefilet oCNCprogramwithoutanextension,tomakeitread ableforCNCmachining centre. The last stages to upload CNC code for portable media and inserted into a machining centre,which operate codes directly from portable media due to lack of internal memory machining centre.

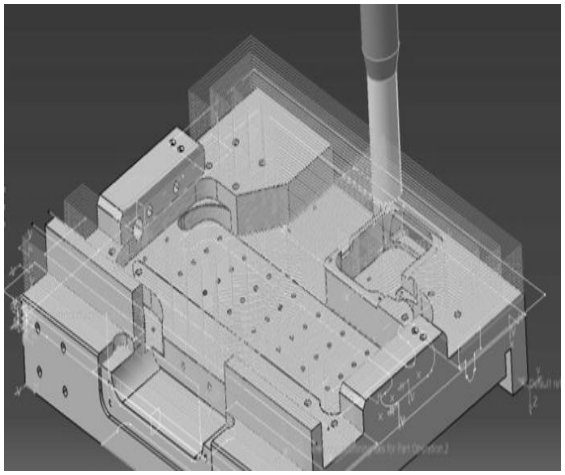


Fig.1.prismaticmillingprocessonselectedCADco mponent[11].

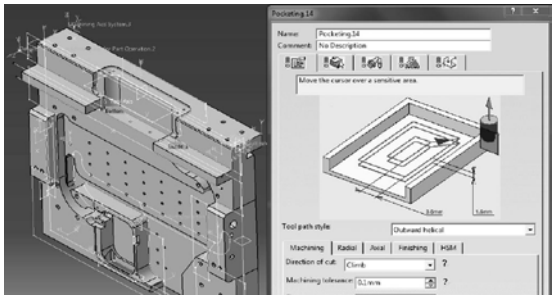
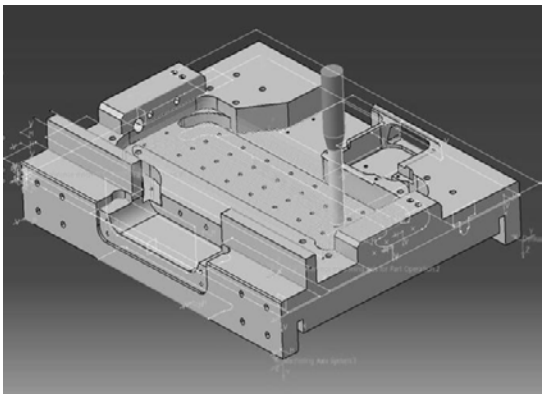


Fig.2.virtualsimulationofprismaticmillingproces sinCATIAV5[11



After clamping the stock it important to set up the plane and other corrections that are needed to start machining.Millingofthemodelweusecylindricalroughingcutterwithadiameterof32mmcarbideinsert,stemdiameterof32mmradiusofcurvatureof2mm.Forprofilingmodelhasbeenimplementedcylindricalcutterwithadiameterof16 mm, 16 mm shank diameter of 2 mm radius. Spherical milling cutter with a diameter of 6 mm was used forre moving the additional material from the grooves.

Pointing milling is the most universal method of the conventional free-form surface manufacturing. The dramaticmerittodesignerandengineeristhatalmostallthecomplexsurfacescanbepointmilledaccurately.However,a disadvantage is that it is inherently time-consuming. Compared to the point milling,the efficiency of the flank milling is higher than that of the point milling. Then, it is the generally conceived that afree-form surface can beflank milled if it can be closely approximated by a ruled surface [15, 16]. Thus, the CAD/CAM system within whichCNC programs are being created, should describe precisely part geometry, have flexibility for the task of relativepositionofthetoolandworkpieceandalsobeabletotakeintoaccountfeaturesofcuttingprocess[5].

4. Turning Simulationin CATIAV5

The CATIA,which is the product of DassaultSystémes Co., are used mostly in medium or large technical companies. Creation of model components using CATIA V5R15 is implemented using the main Start menu, where modules are located, such as SKETCHER, which is creating 2D sketches and shapes, serving as a basis for the subsequent tcreation of3Dmodelsinotherpartsoftheproduct CATIA V5R20(Part Design,GenerativeShapeDesign,SheetMetalDesign,WireframeandSurfaceDesign,WeldDesign).Properwrittenmethodologywascreated,whichwouldbeabletodefinethewaysbetweensingledevicesduringrunningprocess[6].

Inordertoallowcreateaprecisetechnicaldrawings, itisimportanttobeabletodraw3Dmodelsofmachineparts,whichformthebasisforfurtherworkintheCAD/CAMsystems.Theadvantageofmodellingandthecreationoftheunderlyingsketchesliesinthesimplificationofcontrol,i.e.usingalltheassemblyfeaturesandiconsaremostly single-level, creating a much better idea to work, unlike some other CAD systems. After creating a two dimensional sketch,it is possible to get into the interface throughthefunction"ExitWorkbench"inmodules PART DESIGN, SHAPE DESIGN, etc. In 3D interface, then we use the resulting functions which create PART o parts of the Product, which we can join in the module ASSEMBLY DESIGN. Advantage of CATIA is its simplicity.Icons are placed directly on the sides of the active desktop, or you can activate them via the main menu View-Toolbars. This structure of thewhole system is necessary, in view of the scope and job opportunities CATIA.Moreover, CATIA can also do conversion with the documentation created in older CAD systems (e.g.AutoCADDWGformat)directlyinspecialmodule INTERACTIVEDRAFTING).

The creating procedure is clearly stated in so-called working tree, which is always on the left side of the active desktop (see Fig. 5).

ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-4, ISSUE-2, 2017
DOI: 10.21276/ijcesr.2017.4.2.11

Simulation of the machining process includes CATIA V5 Manufacturing module. The menu module is a 2-axis, 2.5-axis, 3-axis, but even 5 axis machining and more.

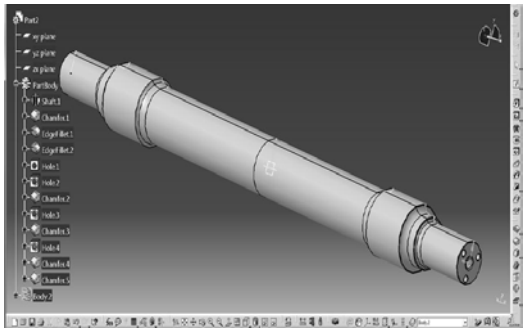
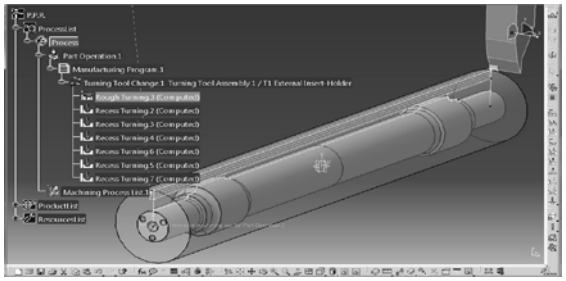


Fig.4.processofmodelcomponentsinCAD/CAMsystem



5. Conclusion

The aim of this paper was realize practical examples of HSC machining technology and programming CNCmachines with CAD/CAM system. CATIA proves the relevance and coherence of the new technologies, materials,machinery,progressivemethodsandinformationtoolsthatenablemoreefficientuseofstartingmaterialstoproduceslowercosts.Oneobjective ofthearticlewastosuggestthepossibilityofcreating CNCprogramproductionprocesscomponentsonarotarychuck,orwithminimalhandling.Thisisachievedbyshorteningthetime of the final machining while eliminating inaccuracies caused by manual switching of the workpiece. This paperpresents a method of connecting High Speed machining technology HSC with the introduction of computer graphicscontained in the CAD/CAM systems. CAM systems are used for preparing data and creating CNC programs formanufacturingcomponents.Thefirststepinthesimulationofthemanufacturingprocessistheselectionofappropriateshapeandsemi-finishedparts.Thechoiceofcomponentswasassociatedwithfindingthematerialcomposition of parts and determining the class of its workability. Based on the findings of machinability suitablecutting tools and cutting conditions for machining were selected. The second step was to determine the productionprocesses. The manufacturing process was designed to model assemblies constructed in CATIA. The manufacturingprocesswasfirstdesignedandsimulatedusingtheCAMsystem.Asignificantreductioninproductiontimecontributed towards lower production costs. Machining process is based on empirical and theoretical relationship between cutting conditions. mechanized operations and instruments were chosen with respect to the geometry and the required precision assembly. The results presented in this paper can be further exploited in the process ofteachingcoursesandprogrammingCNCmachinesandtechnicalpracticeforupgradingoldersolutionsandprocesses of themain and additional times,whilemaintainingthedimensionalaccuracy of machine parts. In ourfuture research plans e.g. comparing to the existing workshop CNC turn-mill machining centers, have the presentedsimulationmethodologyhaveanumberofadvantages.First,withthesameinterpolationsteps,thecontouraccuracyissignificantlyhigher.Second,theprogrammingmoduleiseasiertousemoresimpleGcodelines.Andlast,machiningcostislowerbecauseofthereducedmachiningtime.

Acknowledgements:

Our presented paper was to connection between machining theory, CAD/CAM, CNC machining technology andindustrial practice. The practical functions were conducted in cooperation with the Faculty of Special engineeringtechnology.Theauthorsacknowledgethefinancialsupportprovidedbytheindustrialcom

paniesintheTrencinregion(e.g.TECHNODAT–CAESystemsCo.andMASHIntegrationCo.)

References

[1]Ch.Brecher,W.Lohse,Evaluationoftoolpathquality:User-assistedCAMforcomplexmillingprocesses,in:CIRPJournalofManufacturingScienceand Technology, 2013,vol6, pp.233–245.

[2]J.P.Davim,MachiningofHardMaterials,firsted.,Springer-Verlag-London-Limited,London,2011.

[3]D.Dimitrov,M.Saxer,ProductivityImprovementinToolingManufacturethroughHighSpeed5AxisMachining,in:ProcediaCIRP,2012,vol1,pp.277–282.

[4]R.Dubovska.,ThequalitycontrolofmachiningprocesswithCAD/CAMsystemsupport,in:8thInternationalConferenceofDAAAMBalticIndustrialEngineering, Tallin,Estonia,2012,pp.27–32.

[5] S. N. Grigoriev, A. A. Kutin, V. V. Pirogov, Advanced method of NC programming for 5-axis machining, in: Procedia CIRP, 2012, vol. 1,pp.102–107.