**Nazwa przedmiotu:**

Advanced Geometry Modelling

**Koordynator przedmiotu:**

Przemysław Siemiński, PhD

**Status przedmiotu:**

Obowiązkowy

**Poziom kształcenia:**

Studia I stopnia

**Program:**

Electric and Hybrid Vehicles Engineering

**Grupa przedmiotów:**

Obowiązkowe

**Kod przedmiotu:**

1150-PE000-ISA-0210

**Semestr nominalny:**

3 / rok ak. 2022/2023

**Liczba punktów ECTS:**

1

**Liczba godzin pracy studenta związanych z osiągnięciem efektów uczenia się:**

1) Number of contact hours - 16 hours including:
a) laboratory - 15 hours;
b) consultations - 1 hour;
2) Student's own work - 14 hours including:
a) ongoing preparation of the student for laboratories - 5 hours,
b) literature studies - 9 hours;
3) TOTAL - 30 hours

**Liczba punktów ECTS na zajęciach wymagających bezpośredniego udziału nauczycieli akademickich:**

0.5 ECTS point - number of contact hours - 16, including:
a) laboratory - 15 hours;
b) consultations - 1 hour;

**Język prowadzenia zajęć:**

angielski

**Liczba punktów ECTS, którą student uzyskuje w ramach zajęć o charakterze praktycznym:**

1 ECTS point - 29 hours, including:
a) laboratory exercises - 15 hours;
b) preparing for laboratory exercises - 14 hours;

**Formy zajęć i ich wymiar w semestrze:**

|  |  |
| --- | --- |
| Wykład:  | 0h |
| Ćwiczenia:  | 0h |
| Laboratorium:  | 15h |
| Projekt:  | 0h |
| Lekcje komputerowe:  | 0h |

**Wymagania wstępne:**

Students must have completed:
• Basics of Engineering Drawing and Descriptive Geometry ;
• Manufacturing Technology;
• Geometry Modeling;
• Computer Techniques I.

**Limit liczby studentów:**

29

**Cel przedmiotu:**

Study of the selected methods of parametric 3D modeling systems 3D CAD (meshes from point clouds, surface modeling, modeling of mold or die, sheet metal modeling). Analysis of manufacturability in 3D CAD and CAM systems, programming CNC machines (generating tool paths on free form surfaces for rough and finish milling, virtual machining simulation and analysis of collision).

**Treści kształcenia:**

1. Modeling parts in the context of an assembly (model of mold or die) and generation of the 2D documentation like 3D PDF and 2D files in high quality (300 dpi);
2. Basic techniques of sheet metal modeling in 3D CAD system: creating a base flange, adding a miter flange, adding an edge flange and editing its sketch profile, mirroring a feature, adding and bending a tab, adding a cut across a bend, folding and unfolding bends, creating a closed corner, creating a sheet metal drawing, adding bend line notes. Generating DXF files for workshops and testing their scale in other 2D CAD systems (for example DraftSight).
3. Introduction to surface modeling in 3D CAD system (presentation, examples, explanation of the terms: NURBS, Bezier, Class A surface). Study of surface modeling - lofted surface, extending and trimming, combining with preset tolerance), analysis of surface quality (curvature, zebra stripes, texture mapping) and of connection surface according to: continuity geometry (G0), continuity of tangency (G1) continuity in curvature (G2); demonstration of the continuity of the gradient changes of curvature (G3), information on exporting surface objects by neutral file formats: IGES and STEP, creating solids form surfaces;
4. The analysis of manufacturability shape of the virtual body in 3D CAD systems: generating of milling with solid elements, generating pathways for 3-axis CNC milling (roughing, surface treatments - line printing and profiling), the virtual simulation of manufacturing, collision analysis, surface quality, G-code generation;
5. Introduction to reverse engineering and 3D scanning - examples of application. 3D Scanning of the car body using the measuring system (for example Smarttech ScanBright). Combining and processing of point clouds, generating triangle meshes in 3D CAD systems (Mesh3D, ScanTo3D in SolidWorks). Creating NURBS surface on meshes and analysis of the accuracy of the mapping geometry (eg. SolidWorks ScanTo3D).

**Metody oceny:**

Each of the 5 exercises is assessed separately on the basis of the individual assignments completed at the end of a class.

**Egzamin:**

nie

**Literatura:**

• Paul Tran: Solidworks 2015 Part II - Advanced Techniques, SDC Publications, 2014
• Sham Tickoo: EdgeCAM 10.0 for Manufacturers, CADCIM Technologies (July 12, 2006)

**Witryna www przedmiotu:**

None.

**Uwagi:**

Brak

## Efekty przedmiotowe

### Profil ogólnoakademicki - wiedza

**Efekt 1150-PE000-ISP-0210\_W1:**

Student has basic techniques of sheet metal modeling in 3D CAD system.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_W06, K\_W10, K\_W11

**Powiązane efekty obszarowe:** T1A\_W03, T1A\_W09, T1A\_W02, T1A\_W03

**Efekt 1150-PE000-ISP-0210\_W2:**

The student has knowledge about modeling and combining surfaces (G0, G1, G2) in 3D CAD system.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_W06, K\_W10

**Powiązane efekty obszarowe:** T1A\_W03, T1A\_W09

**Efekt 1150-PE000-ISP-0210\_W3:**

The student has knowledge about the analysis of the technology shape using the tools of the 3D CAD and 3D CAM system and what are the principles of programming roughing (volumetric) milling on CNC machine with end milling tools.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_W06, K\_W10, K\_W11

**Powiązane efekty obszarowe:** T1A\_W03, T1A\_W09, T1A\_W02, T1A\_W03

**Efekt 1150-PE000-ISP-0210\_W4:**

The student has a basic knowledge of the principles of using optical 3D scanners and methods of obtaining triangles meshes from point clouds, and then obtaining them from the NURBS surface in a given 3D CAD system

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_W06, K\_W10

**Powiązane efekty obszarowe:** T1A\_W03, T1A\_W09

**Efekt 1150-PE000-ISP-0210\_W5:**

The student has a basic knowledge of incremental techniques (especially about FDM), knows what it is and how the STL file format is built; knows how the parameters of linear and angular deviation affect the generated triangle mesh from solids; knows what is the influence of inclination of geometry walls on generating support structures in a given 3D CAM system.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_W10, K\_W11

**Powiązane efekty obszarowe:** T1A\_W09, T1A\_W02, T1A\_W03

### Profil ogólnoakademicki - umiejętności

**Efekt 1150-PE000-ISP-0210\_U1:**

The student is able to do a flatten sheet in 3D CAD system.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_U01, K\_U03, K\_U04, K\_U09

**Powiązane efekty obszarowe:** T1A\_U01, T1A\_U03, T1A\_U03, T1A\_U04, T1A\_U09, T1A\_U12

**Efekt 1150-PE000-ISP-0210\_U2:**

Student is able to model (in the 3D CAD system) NURBS surfaces connection with G0, G1, G2 continuity.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_U01, K\_U04, K\_U09

**Powiązane efekty obszarowe:** T1A\_U01, T1A\_U03, T1A\_U04, T1A\_U09, T1A\_U12

**Efekt 1150-PE000-ISP-0210\_U3:**

The student is able to carry out the analysis of the technology shape using the tools of the 3D CAD and 3D CAM system and can programm roughing (volumetric) milling on CNC machine with end milling tools.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_U01, K\_U03, K\_U04, K\_U09

**Powiązane efekty obszarowe:** T1A\_U01, T1A\_U03, T1A\_U03, T1A\_U04, T1A\_U09, T1A\_U12

**Efekt 1150-PE000-ISP-021\_U4:**

Student is able to model (in a given 3D CAD system) a triangles mesh from a point cloud and then get a parametric NURBS surface from them.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_U01, K\_U03, K\_U04

**Powiązane efekty obszarowe:** T1A\_U01, T1A\_U03, T1A\_U03, T1A\_U04

**Efekt 1150-PE000-ISP-0210\_U4:**

Student can generate (in a given 3D CAD system) from the solid model a valid STL file for 3D printing and can check (in a given 3D CAM system) to orient it to minimize of support material.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_U01, K\_U02, K\_U03, K\_U04, K\_U09

**Powiązane efekty obszarowe:** T1A\_U01, T1A\_U02, T1A\_U03, T1A\_U03, T1A\_U04, T1A\_U09, T1A\_U12

### Profil ogólnoakademicki - kompetencje społeczne

**Efekt 1150-PE000-ISP-0210\_K1:**

The student can develop the indicated task and present its result to the lecturer in order to issue the final mark of the given exercise.

Weryfikacja:

The individual assignments completed at the end of a class.

**Powiązane efekty kierunkowe:** K\_K02, K\_K05

**Powiązane efekty obszarowe:** T1A\_K02, T1A\_K06