Static study of the Driving mechanism of the Saw Mechanics

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Summary:
To carry out fast and precise sawings on limited dimensions, profiled, tubes, billets, bars, etc. , of steel, of aluminium, copper, one uses the mechanical saws of forms and various dimensions. All these saws are based on the same principle: They cut out the matter by removal of chips using tools with multiple sizes   (web).

These machines are distinguished mainly from/to each other by the type of used saw. One finds alternate saws with blade, covered disc saws and saws with flexible band mechanical saw saws has mechanical   bow,   object   of   our   study.

A   bow   saw   mechanical   is   used   to   saw   stems,   tubes   and   different   forms especially out of steel, iron or non-ferrous metals. cutting can be carried out in the plan perpendicular   of   thecut   object.

One proposes to make the design of the driving mechanism of the mechanical saw in draft of all components, after making the assembly until the final model and checking with simulation of   animation   of   the   part   activatesmoving.

To lead to a static study of the driving mechanism of the mechanical saw one passes to one modeling by software SOLID WORKS (CAO/DAO); then one applies to the blade the force of cut   to   see   the   influence   of   this   last   on   the   unit. Keywords: design; modeling, static study.

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I. Introduction:

In the Seventies. The software of CAO (Computer assisted design) was only software of CAD (Drawing Computer-assisted). They evolved gradually grace, on the one hand with increase in the performances of the computer material and in addition to research in field of the logicie1. But, today, they   are   not   yet   truly   assistance   systems   with   design. This work tries to put in prospect 1 ' use of the constraints in the process of design and in particular in the process of the preliminary design so that finally this software is tools of assistance to 1a design and creation, are or will be used in the software of CAO for geometrical modeling of the physical object to conceive.

II.The process of design of a   product:

A product (or produced object) is manufactured by the man in opposition to a natural object. This object artificial can be very diverse but we will limit ourselves here within the framework of the CAO to an object real 3D (produced mechanical: machine element, automobile. plane, furniture, product of industrial   design:

body   of   car,   cap   of   an   electronic   product   telephones   computer…). In short. Any object 3D which requires or required in the past before the CAO a plan in 2L) (drawing technique) for its realization. In the systems of CAO, which were at the beginning of the software of CAD,   the   model   2D   or   3D   is   central.

The process of design/realization is the passage of the idea to the object. More the object to be manufactured   is   complex.

The more necessary one methodology is and the more the intermediate objects of design. In particular them plans. Are essential. One thus witnesses a rationalization of the production which makes it possible to   make   to   lower   the   time   and   the   cost   of   the   construction   of   the   product.

4   stapes   of   the   process of   design:

♣ the stage of the specifications or specifications. For a mechanical product, it is the book of loads   functional   (CDCF).

♣ the stage of the conceptual design. Development of this phase can allow one more global solution process of design. This stage becomes today. With our opinion, important   object of   study.

♣ the stage of the preliminary design which leads to a Summary Preliminary draft (NOT) with plans with small scale.

♣ the   stage   of   the   design   detailed   which   is,   it,   covered   well   by
♣ software of CAO current and which ends in plans on a large scale.
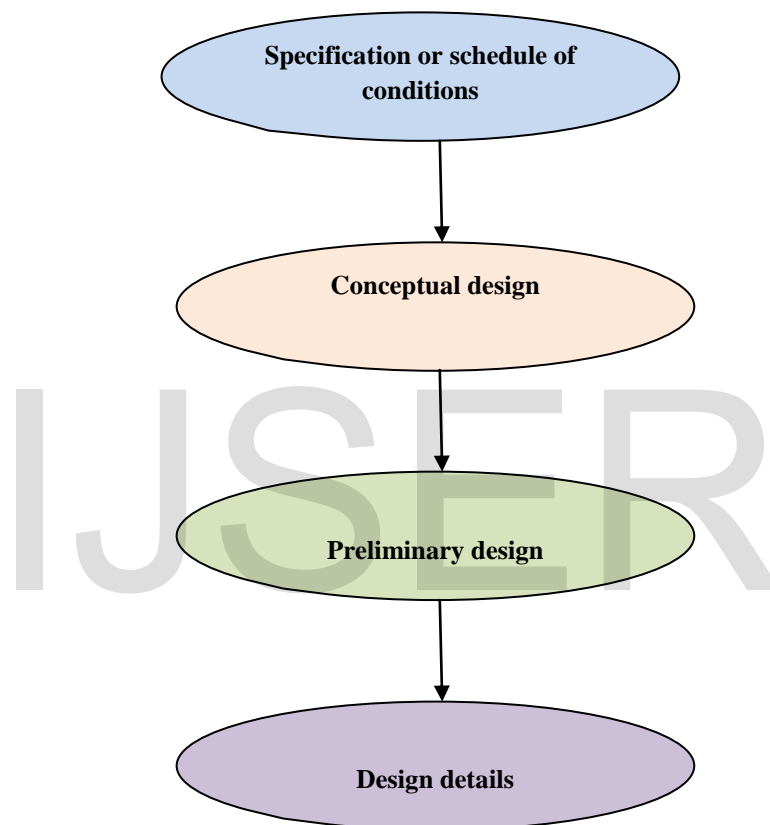
Figure.1:   Stages   of   the   process of   design

III. Use of Solid software Works for the design of the part port blade (tool saws):
The Solid software Works is a mechanical application of design which benefits from the graphic user interface of Microsoft Windows. Thanks to this software, the originators can quickly outline an idea, tested with functions and coasts and produce models and settings in precise plan. As it can pre-empt the possible requirements to reduce to the minimum the efforts de re design when one wants to modify the model. IV. : Performances major of the Solid Solid Works Works adopts driving mechanism of modeling 3D. When the design of a part is made, an entity 3D is shouted. Initial draft and after assembly until the final model. With part of this entity 3D, we can create setting in 2D plan or force various components to create assemblies 3D. We can thus create settings in 2D plan of assembly 3D. The intention of design is a property of Solid Works, it describes the way in which one wishes to make react the model to any loading that one wishes to bring there. The intention of design is before a a whole question of planning. Driving mechanism adopted to create the model determines how the changes will be reflected there. Rained the execution of the design respects the intention of design, plus

the model will be optimized. The process of design passes by the following stages:

- ♣ Pegging.
- ♣ Conceptualization of the model on the basis of identified need.
- ♣ Development of the model on the basis of elaborate concept.
- ♣ Analysis of the results of the development of the model.
- ♣ Prototyping of the model.
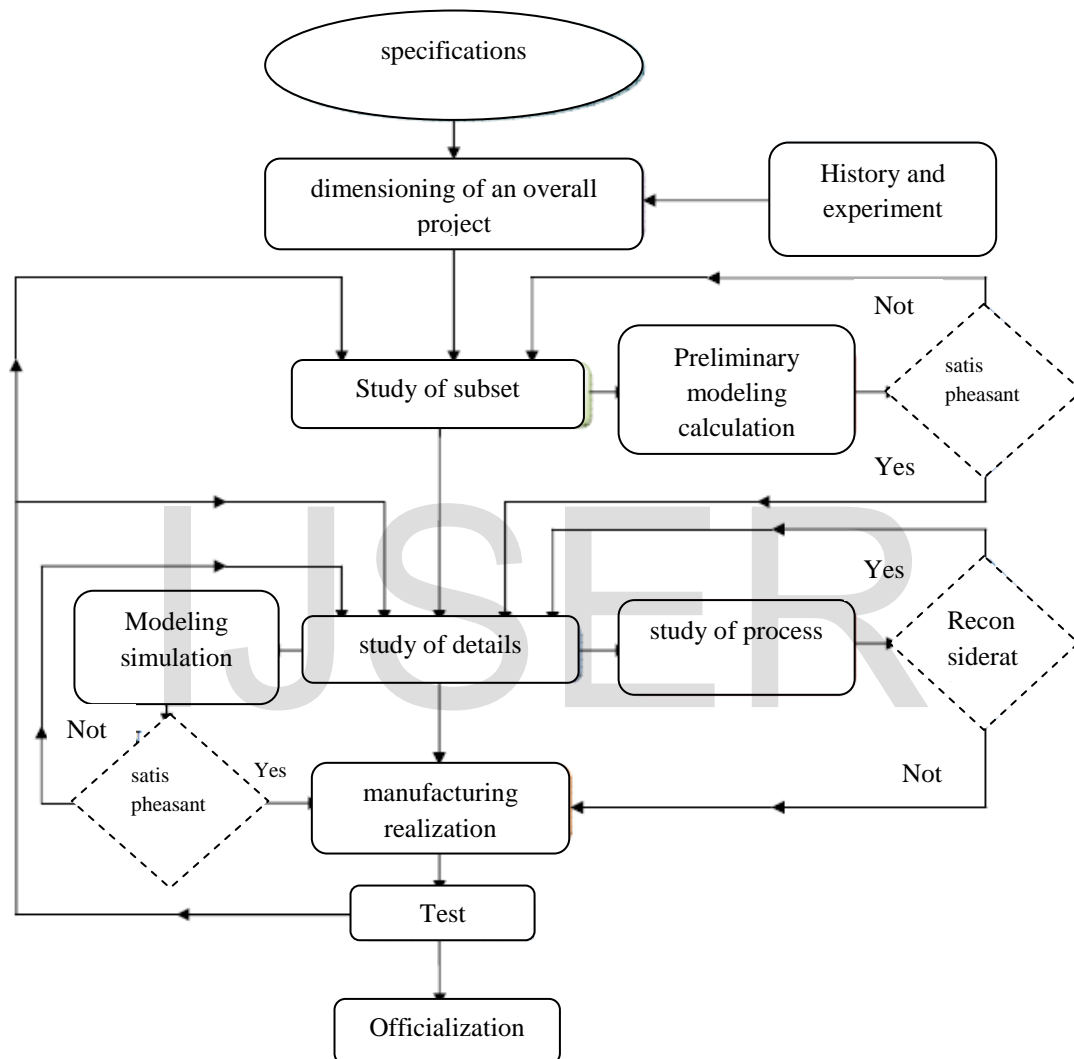- ♣ Construction of the model.
- ♣ Edition of the model so necessary.

Figure 2:   General process of   design

V. Application: Static study of the driving mechanism of the mechanical saw:
One proposes to make the design of the driving mechanism of the mechanical saw in draft of all the components, after making the assembly until the final model and checking and simulation of animation of the active part moving. The following figures illustrate this idea.

VI.   Functions:
Once the supplemented draft, one can create a model 3D by using functions such as the extrusion and the revolution of the parts.
Certain functions based on drafts present particular forms (embossing, removal of matter, drillings, etc). Of other, such as smoothings and sweepings, use a profile along a trajectory. Others still are functions applied such as the vacation, the chamfers and the hulls. All the parts

understand functions based on drafts and the majority understand functions applied.
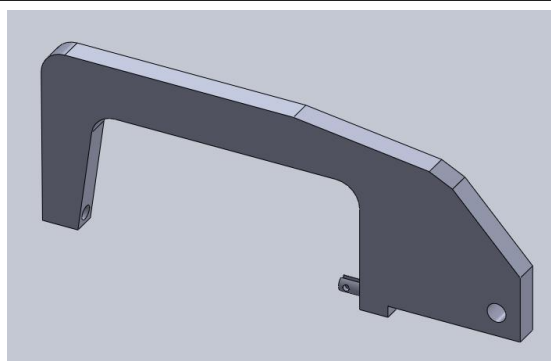• Design:

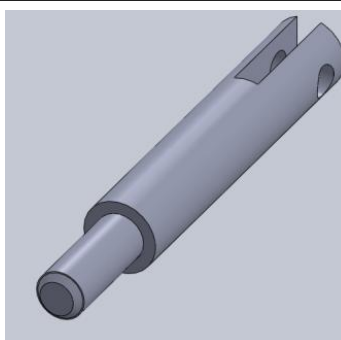Figure3a: driving mechanism of the mechanical saw.
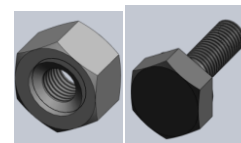

Figure.3b: axis of tightening of the blade
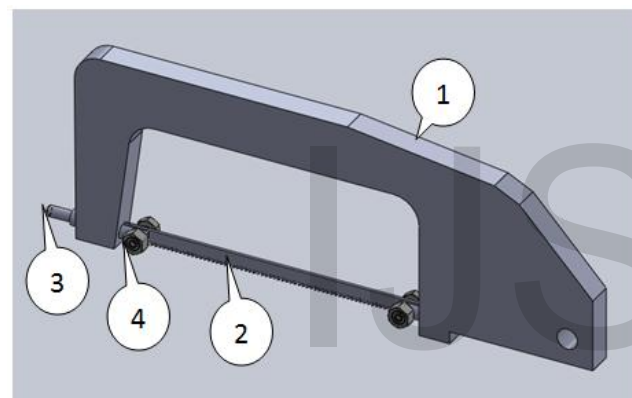

Figure3d: Screw and nut H

Figure.3c: tool blade

Figure.4: design of the driving mechanism of the mechanical saw

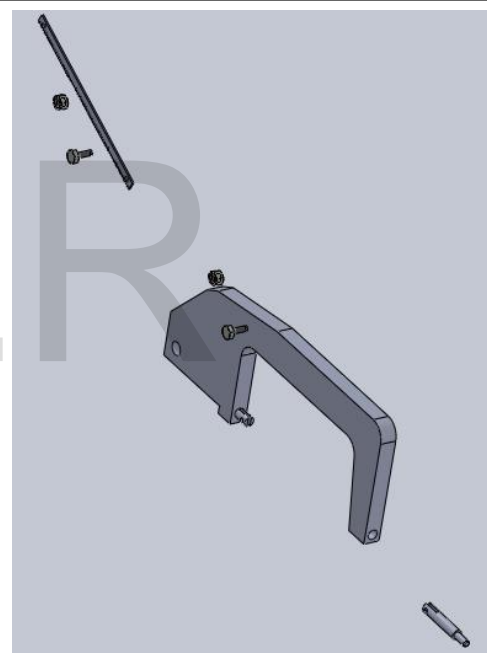| 1	Body
2	Tool blade
3	Thumb screw
4	Connecting holding bolt

Figure.5: sight burst of the unit

VI.3 Modélisation:
To lead to a study statiquedu driving mechanism of the mechanical saw one passes to a modeling by software OLID WORKS (CAO/DAO); then one applies to the blade of the cutting forces to see the influence of this last on the unit.

VII. Calculation of the driving mechanism by the finite element method:
The finite element method (MEF) is a reliable technique for analysis the problems of engineering. It replaces an extremely complex problem by a large number of problems simple. It consists in dividing the complex geometry of the model into small entities called elements. Generally, the great phases of a calculation are the following ones:

❖   Definition   3D   of   the   geometry   of   the   assembly   studied.

❖   Introduction   of   the   forces   applied   to   the   driving   mechanism.

❖ Operation of ‹‹grid›› of the assembly, while being based on the geometry of, the assembly realized before. It is the operation which consists in dividing a complex structure into multiple simple parts: elements.

❖ Application of the boundary conditions and loadings: external efforts, imposed pressures, displacements.

❖ Phase of calculation itself; Analysis of computation results, leading to the qualification of the driving mechanism of the mechanical saw from the theoretical point of view or to a resumption of the geometry of the driving mechanism of the mechanical saw for new calculations.

VII .1. Why do calculations?

After having crééle driving mechanism of the mechanical saw with the help of the software of D.A.O and C.A.O. "Solid Works", it will be necessary to answer certain questions, such as:

❖   will   Mondispositif of training of the   mechanical   saw break?

❖   will   it   much   become deformed?

❖   can   I   use   less   matter without to   decrease the   performance?

Without computational tool, these questions cannot find answers that by carrying out cycles of develop long and expensive. A development cycle of product generally understands:

❖   the   creation   of   the   model   in   the   system   of. CAO   Solide   Works

❖   the   manufacturing   of   a   prototype.

❖   the   test   of the prototype under the conditions of use.

❖   modification   of   the   design   on   the   basis   of   lesson   of   tests. This process continuous until an acceptable solution is found. Calculation can thus help with:

❖ To rather reduce the costs by testing the products on computer than during real tests long and expensive.

❖ To reduce the time of development by reducing the number of development cycles.

❖ To optimize the products by quickly simulating many designs and scenarios before making a final decision, which enables us to explore more potential solutions.

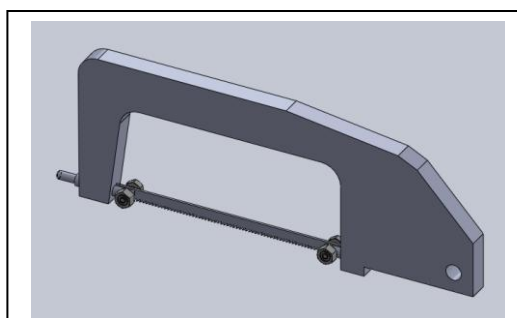## VII .2 Définition 3D of the geometry of the assembly studied:

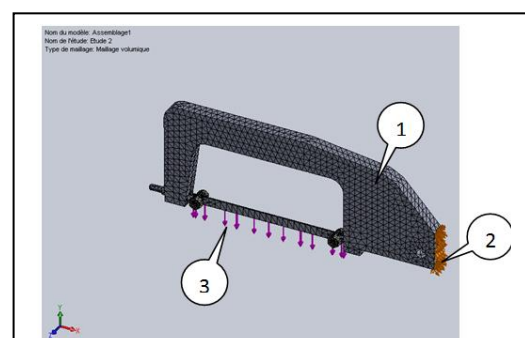Figure.6: Definition 3D of the geometry del' assembly studied

Figure.7: Operation of ‹‹grid›› of the assembly and Application of the boundary conditions and of loadings.

VII.3. Opération of   ‹‹grid›› of

Information   for   the   grid:

·   Number   of   the   nodes   =   2959   nodes

·   Many   elements   =   10417   elements

·   Many   DDL   =   8877   DDL

1:       Grid   of   the   unit.
2:       Boundary   condition   (fixed   Geometry).
3:       Cutting force   F=   1000N.

VII.4.Analyse Static of the driving mechanism:

The linear static analysis, calculates displacements, the strains and the stresses in The assembly made with materials given for each part, under the action of loading given to the tool and of blocking given on the face of the part, a material yields when the constraints reach a certain level. A tool for simulation of SOLIDWORKS used for the linear static analysis, based on the finite element method to calculate the constraints, deformations and displacements of the nodes of the elements of grid. The static analysis allows moreover the checking the resistance and the rigidity of all the structure or all   the modeled   overall device.

1 Choice of   Materials:

In accordance with the note delivered by manufacturing for the studied model, the materials of the various parts of the device are indexed in the table below.

✓   For part 1:

Table 1: Information on materials

Propriété	Valeur	Unités
Module d'élasticité	6.61781e+010	N/m^2
Coefficient de Poisson	0.27	S.O.
Module de cisaillement	5e+010	N/m^2
Masse volumique	7200	kg/m^3
Limite de traction	151658000	N/m^2
Limite de compression	572165000	N/m^2
Limite d'élasticité		N/m^2
Coefficient de dilatation thermique	1.2e-005	/K

✓   For parts 3 and 4:

Table 3: Information on materials

Propriété	Valeur	Unités
Module d'élasticité	2.1e+011	N/m^2
Coefficient de Poisson	0.28	S.O.
Module de cisaillement	7.9e+010	N/m^2
Masse volumique	7700	kg/m^3
Limite de traction	723825600	N/m^2
Limite de compression suivant X		N/m^2
Limite d'élasticité	620422000	N/m^2
Coefficient de dilatation thermique	1.3e-005	/K
Conductivité thermique	50	W/(m·K)

-   Displacement -X:

Figure9: following displacement – X

-   Displacement -Y:

✓   For part 2:

Table 2: Information on materials

Propriété	Valeur	Unités
Module d'élasticité	1.9e+011	N/m^2
Coefficient de Poisson	0.29	S.O.
Module de cisaillement	7.5e+010	N/m^2
Masse volumique	8000	kg/m^3
Limite de traction	517017000	N/m^2
Limite de compression suivant X		N/m^2
Limite d'élasticité	206807000	N/m^2
Coefficient de dilatation thermique	1.8e-005	/K
Conductivité thermique	16	W/(m·K)

2 - Results of the static study:

·   Results in displacements:

-      Resulting displacement:

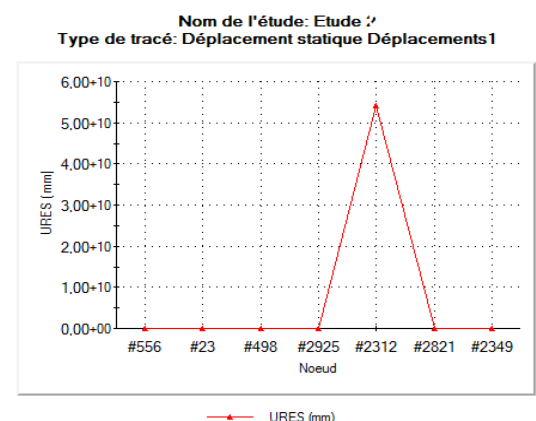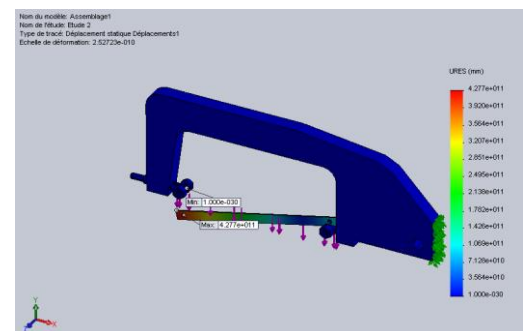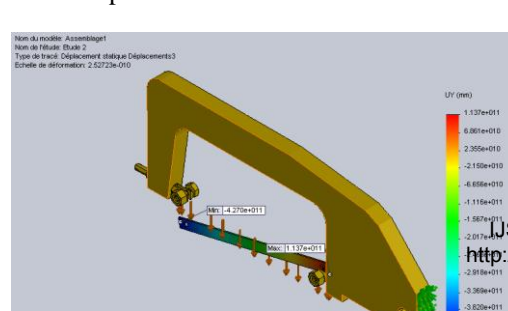
Figure8: resulting displacement.

- Displacement -Z:

Figure11: following displacement –Z

- Constraint of Von Mises:
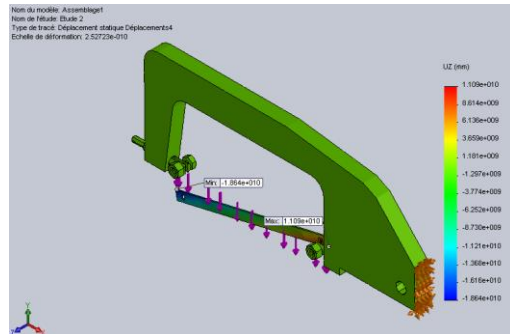

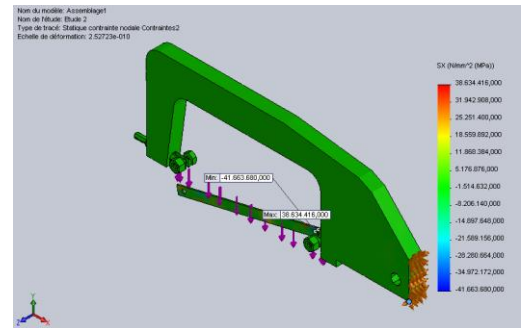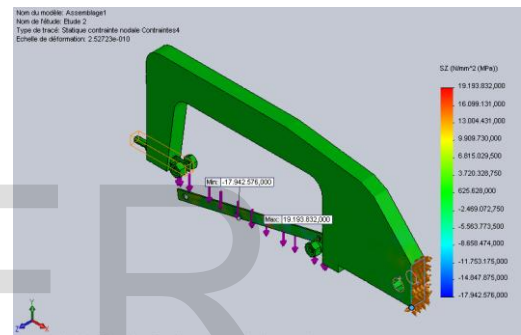Figure15: Constraint of Von Mises with the curve of the constraint Von Mises.

- Results in Constraints:

Figure12: Static stress according to X

Figure13: Static stress according to Y
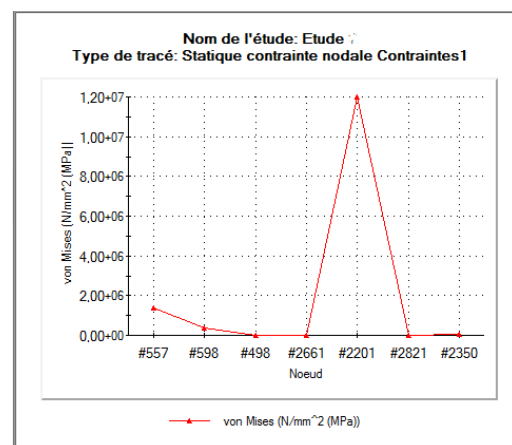

Figure14: Static stress according to Z

- Static deformation:
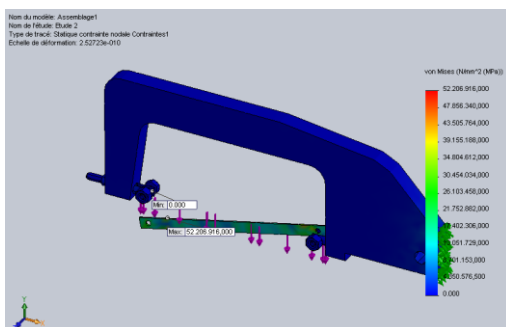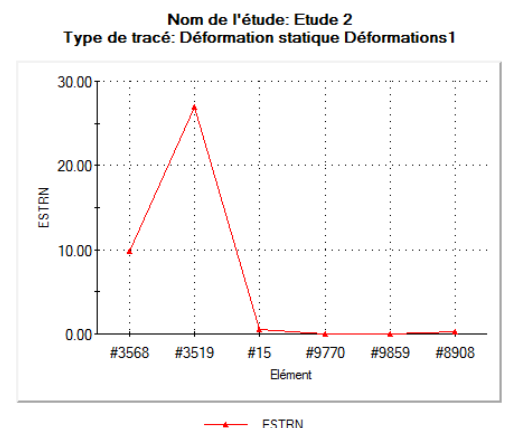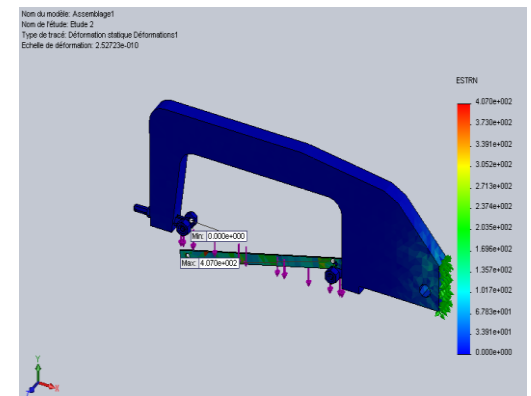

Figure16: Static deformation and the curve of deformation.
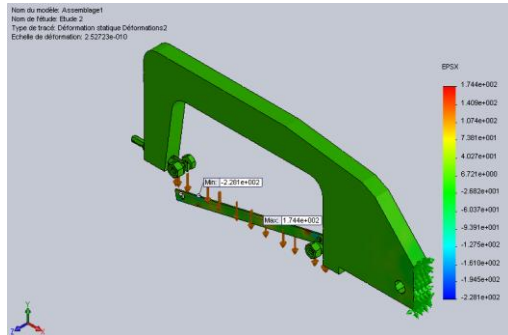
- Deformation according to – X

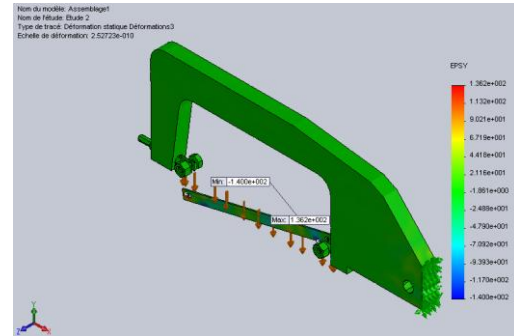Figure17: Deformation according to – X

- Deformation according to – Y

Figure18: Deformation according to – Y

- Deformation according to – Z

Figure19: Deformation according to – Z

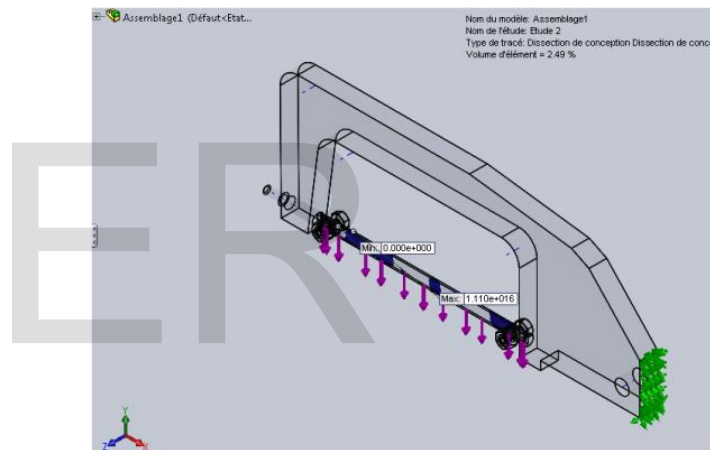- Description of design and discussion of design:

Figure20: Description of design and discussion of design

3-Description and discussion:

Adjust the cursor to trace a continuous trajectory between the external actions. The transparent parts of the layout of dissection take part less in the behaviour of the loading applied than the opaque portions. These transparent zones can be removed with an aim of reducing the weight of the design. It is recommended to check a new design by carrying out a new study.

4-Conclusion:

The results obtained at the time of the static study has show to us that for a thickness of 3mm of the blade tool saws with was moved and a deformation according to X, Y and Z, with constraints along the three axes as indicates the figures.

5-Referenc bibliography:

[1]   C. Souchon, S. Martinez, Sawing, DEST of mechanics of the national Academy of arts and trades, bet   6,

[2]   Working instructions National company of Production of the machine tools unit U.T.F Constantine –   Wadi-Hamimime,   Machine models N°: SMA 3.

[3]   Instruction manual, Construction of saw ribbon COTTON FLANNELS, model Machine: ARG 110.

[4]   Daniel Marc, Nightingale Vincent, declaratory approach of the modeling of the curves, Review of CFAO and graphic data processing, vol. 12, n° 5.1997, pp.497.512.

[5]   Jean Louis Fanchon, Guide of Sciences Technologies Industrial, Technical of the Engineer.

[6]   A.G. Ulsoy, C.D. Mote Jr., Analysis of bandsaw vibration, Wood Science 13 (1980).

[7]   A.G. Ulsoy, C.D. Mote Jr., Vibration of wide band saw blades, Newspaper of Engineering for Industry 104   (1982).

[8]   T.J. KB, H.S. Kim, Mechanistic cutting force model in band sawing, International Newspaper of Machine   Tools   &   Manufacture   39   (1999).

[9]   K.W. Wang, C.D. Mote Jr., Vibration coupling analysis of band/wheel mechanical systems, Newspaper   of   Sound   and   Vibration   109   (1986).

[10]   K.W. Wang, C.D. Mote Jr., Band/Wheel system impulsive vibration under boundary excitation, Newspaper   of   Sound and   Vibration   115   (1987).

[11]   J. Wojnarowski, S. Wojciech, Dynamic analysis of bandsaws by the method of rigid finite elements,   Machine Vibration   2   (1993).

[12]   Y. Altinas, Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC   Design, Cambridge   University   Near,   2000.

[13]   Kruszewski and al., Rigid Finite Method Element, Arkady, Warsaw, 1975 (in Polish).

[14]   I. Adamiec, Interactions between vibrations of flexible links and bases motion of manipulators, Newspaper of   Theoretical   and   Applied Mechanics   2   (2002)   40.

[15]   J. Wojnarowski and al., Computer model of the endless band saw blade during investigation of dynamic phenomena in cutting process, Silesian Technical University, Gliwice, 2002 (in Polish).

[16]   I. Adamiec, A. Go' ral, K. Kubas, J. Plosa, S. Wojciech, J. Wojnarowski, Department of Materials, 2001.

[17]   A.L. Thurman, and C.D. Mote, Jr. 1969 Transaction of the ASME, Newspaper of Applied Mechanics 36 83-91. Free, periodic, nonlinear oscillation of year axially Moving striptease.

[18]   J.A. Wickert 1992 International Newspaper of Non-Linear Mechanics 27 (3) 503-517. Non-linear vibration of   has   dolly   tensioned   beam.

[19]   F. Pellicano and F. Vestroni 2000 Newspaper of Vibration and Acoustics 122 21-30. Nonlinear dynamics   and   junctions   of   year   axially   moving beam.

[20]   R.A. Sack 1954 British Applied Physics 5.224-226.Transverse oscillations in dolly G-strings.

[21]   F.R. Archibald and A.G. Emslie 1958 Applied Mechanics 25.347-348. The vibrations of has G-string having   has   uniform motion   along   its   length.

[22]   C.D. Mote Jr. 1975 Transaction of The American Society of Mechanical Engineers, Newspaper of Dynamic System, Measurements and Control 97 96-98. Stability of systems transporting accelerating axially   moving materials.

[23]   S. Mahalingam 1957 British Newspaper of Applied Physics 8.145-148. Transverse Vibrations of power   transmission   chains.

[24]   W.T van Horssen 2002 Applied Mathematical Analysis side Carryforward One the inuence of vibrations of supports for year axially moving G-string. Delft: Technische Universiteit Delft.

[25]   W.L. Miranker 1960 IBM Newspaper Research and Development 4 36-42. The wave equation in has   medium in   motion.

[26]   H.R. OZ and Mr. Pakdemirli 1999 Newspaper of Sound and Vibration 227(2) 239-257. Vibrations of   year   axially moving beam   with   time-depend   velocity.

[27]   R.G. Parker and Y. Lin 2001 Newspaper of Applied Mechanics 68,49-57. Parametric Instability of Axially Moving Media Subjected to Multifrequency Tension and Speed Fluctuations.

[28]   H.R. OZ, Mr. Pakdemirli and H. Boyaci 2001 International Newspaper of Non-linear Mechanics 36.107-115. Non-linear vibration and stability of year axially moving Beam with time-depend velocity.

[29]   Paul PAINTER, Finite element method, Award-winning of the Institute, Techniques of the Engineer.