DYNAMIC ANALYSIS WITH MSC ADAMS OF THE CONDUCTIVE BLADES CONTOUR CUTTING DEVICE FOR PYROTECHNICAL ELECTRIC INFLAMMATORY

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ABSTRACT: The author presents, by this paper, the result of dynamic analysis with MSCAdams of the mechanism of conductive blades contour cutting device, used in the exercise technological process of the pyrotechnic electric inflammatory. In this sense, the mechanism of this device is considered a mechanic system and is treated as an assembly of rigid bodies connected by mechanical connections and elastic elements.

By shaping, simulation and dynamic analysis of the mechanism of conductive blades contour cutting device with ADAMS program, the author has covered the following stage: model construction, test-simulation, validation, finishing, parameterization, optimization.

KEY WORDS: Modelling, simulation, connection, spiral spring, contact forces, parameterization, kinetic energy, rigid body.

In order to realize the technological operation of conductive

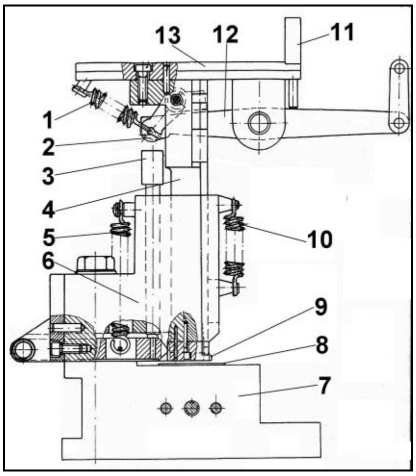

Figure 1. Device for cutting blades contour.

blades contour cutting for the pyrotechnic electric inflammatory, the device from figure 1 executes a series of movements which ensures the movement, correct seating, positioning and lock of the unfinished goods (brass tape) in front of working mandrels. This movement assembly is known under the name of manipulation-positioning.

Passing from manipulation and positioning made with the human operator's help, to automation of these operations, represents one of the most important problems of industrial production automation.

That is why, the problem of ***creating standardized equipment systems for automatic manipulation and positioning*** of thin tapes in order to make stamp-cupping operations, has become a primary concern for building technological systems companies.

A special accent was put in the reduction number of free grades, simultaneously with the diminution of action numbers in order to fulfill this desiderate. This approach from the paper [2], known under the name of ***sub-driving***, uses key type passive elements or mechanical limiters which lead to bring in initial position the post-mandrel and the elements which collaborate for the positioning or lock of the tape in the stamp process. Starting from these considerations, in the present paper it is presented the dynamic analysis result with MSC ADAMS of device 1 mechanism, which executes conductive blades cutting and competes together with 10 other devices in the realization of the pyrotechnical electric inflammatory.

For the modeling of forces which operates over the post-mandrel and over the elements that compete to the positioning and lock of tape during the stamp operation execution, I have started from the hypothesis that in the use process of contour cutting device most part from the received energy was used to make the stamp operation.

It is obvious that the mechanical output of this device depends on the resistance types that appear during its running, on the conditions in which it works, on the element construction and kinematic couplings of the component mechanism, on the lubrication and maintenance mode of the mechanism, etc. That is why, it cannot be determined the exact value of the mechanical output [2] for the contour cutting device mechanism. It is necessary to be made an experimental analysis over some dynamic parameters in mechanism, using the MSC ADAMS program package in order to realize an energetic study and to calculate the mechanical output.

2. STRUCTURAL MODELLING OF THE CONTOUR CUTTING DEVICE MECHANISM

According to the kinematic scheme from figure 2, in the moment when the pile driver of the presser operates over the upper board ***1***, ***Q*** force presses on port-mandrel ***1*** on which are set on step stamp mandrel, the seeking mandrel, profile I cutting mandrel and mandrel for profile II cutting. In the same time, by pressing jack *4*, jack ***3*** is being operated which directly operates on the pressing mandrel ***2***. At its turn, the pressing mandrel ***2*** obliges fluid pad ***5*** to enter in contact with the tape, to position it and then to lock it on the cutting matrix for an interval in which the stamping is produced. In the next phase the mandrels nested in the port-mandrel ***1*** execute the contour cutting operation.

After contour cutting operation is finalized, in the reverse stroke of the pile driver presser, for a tape to allow the extraction of the 4 mandrels, spring ***8*** enters in function to make a reverse tension state in jack ***4*** and ***3***. The tension state is transmitted to jack ***3***, mandrel ***2***, jack ***5*** and stamping tape.

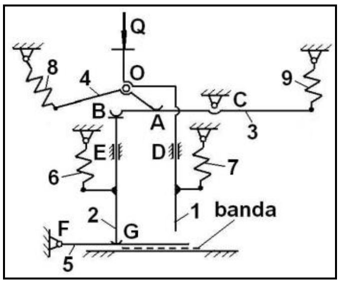

Figure 2. Cinematic scheme of the cutting contour device.

When raising the pile driver of the presser and action force termination over the mechanism, springs, ***6, 7, 8, 9***, ensures the kinematic constraint of the mechanism and has a role to bring back the elements on which it operates in the initial position.

The contour cutting device mechanism was considered a mechanic system and treated in ADAMS as a rigid bodies assembly (denominated pieces), connected by mechanical bonds (named coupling) and elastic elements [1]. The kinematic model of this device made with Adams/ View module is presented in figure 3.

Initial positioning-orientation conditions were imposed over bodies frommechanical system of the device mechanism, which were taken into consideration in its assembly process [2].

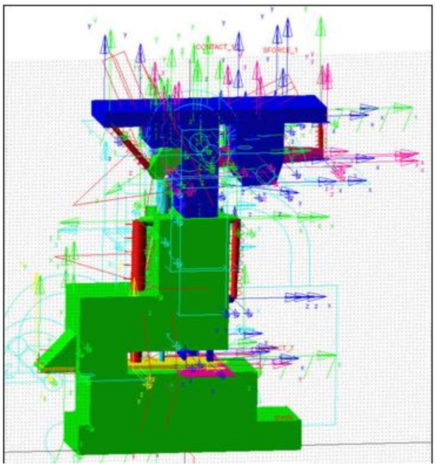

Figure 3. Model in Adams/ View of the cutting blades contour device.

I have taken in study the mechanism from figure 1 for the modelling and stimulation of the device mechanism with ADAMS program. The geometrical dimensions of elements that enter in the structure of the mechanism, as well its assembled configuration are known at this model.

I have left from the hypothesis that in the operating process the biggest energy received by the device is being used to make stamping operation for the modelling of contact forces.

The modelling based on MSC ADAMS soft, Adams/View model has at base the solid modelling principle [1]; in this sense, the mass, initial tensor and position of the mass center of molded elements are automatically determined.

The couplings of the mechanism are implemented, using the coupling library of the soft, by indicating the binds between different component elements of the realized model or between the elements and fixed part of base type. There have molded the contacts between the operating chain elements and the tape, pressing fluid pad and matrix in the next stage. In the end, the 1000 N operation force was molded. The connections between different elements of model and exterior loads are briefly presented in figure 4.

The entrance parameters used for the stimulation realization are: geometrical dimensions and the assembled configuration of the device mechanism, the movement distance of port-mandrel, the operating force and realization duration of the active stroke, the operating force and the rigidity coefficient of spring ***8***.

Taking into account the variable character of some entrance parameters (presented above), the operating force and linear movement speed of port-mandrel are imposed to be constant.

The verification of the created model was made before starting the stimulation. The soft automatically displayed the results presented I figure 5 by verification.

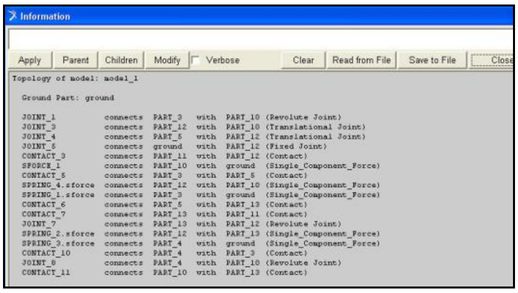

Figure 4. The connections between different elements of the model and exterior loads.

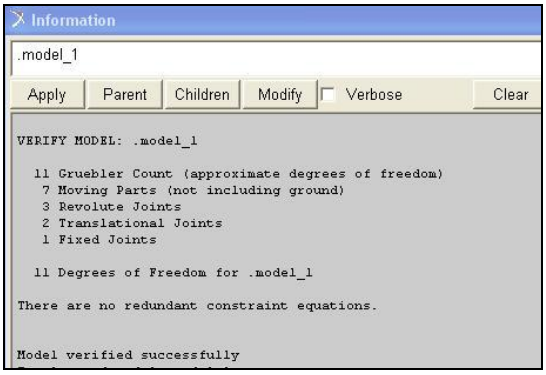

Figure 5. The verification result of the created model

3. THE RESULT OF THE SIMULATION

By simulation with MSC ADAMS of the model from figure 3, it was followed mandrel, on the active stoke of the pile driver presser [3].

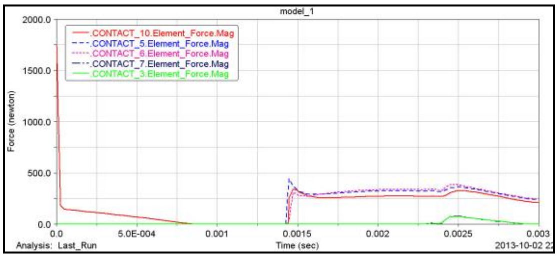

Figure 6. Variation of the contact forces from pressing chain couplings over the brass tape

The variation of the contact forces from the pressing chain couplings on the brass tape and matrix are represented in figure 6. According to this figure, a contact between the element ***4*** and mandrel ***2*** is observed before this element operates on element ***3***.

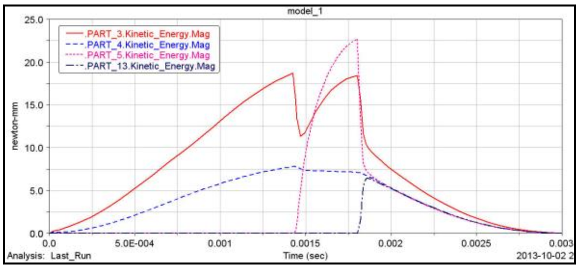

Figure 7. Kinetic energy of the pressing chain elements over the brass tape.

In order for this phenomenon to be eliminated, the device was endowed with a stroke limiter of element ***3***, regulated so that the contact between element ***3*** and ***4*** to be made before the contact with mandrel ***2***.

Its elements are permanently moving, fact proved by the kinetic energy of each element and exemplified by figure 7, due to the fact that the pressing chain is part of the contour cutting device structure.

the identification of random dynamic stresses at which are submitted the kinematic elements that enter in the pressing chain on the brass tape, matrix and guidance of the port-

Indications regarding the ***K*** rigidity coefficient influence of spring ***8***, which ensures the contact between kinematic elements 4 and 3, as well as on its deformation, have been also obtained by simulation with MSC ADAMS.

According to figure 8, there is observed that larger the spring rigidity coefficient is, larger its reaction force is and smaller the deformation.

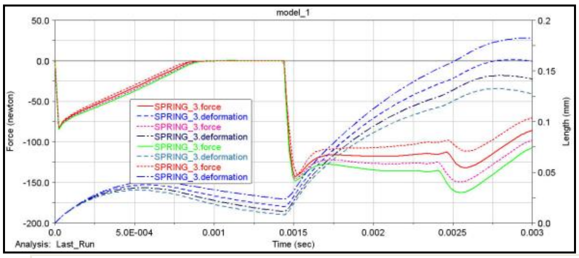

Figure 8. Variation of the reaction force and deformation of spring 8 for different values of the K stiffness coefficient.

This thing presents importance in the reverse stroke of the pile driver presser, when the pressing mandrel should rise on element 5 with a certain delay. This delay should facilitate keeping the contract between matrix and element 5, until the extraction of the cutting mandrels from the tape is made.

5. CONCLUSIONS

The following conditions can be drawn after the interpretation of the simulation results with MSC ADAMS:

- The conductive blades contour cutting operation must start only after the elements from the pressing chain positions and locks the brass clip.

- The pressing force practiced by element ***5*** over the tape, must be smaller than 500 N, in order to produce deformations of this and fissures (prints).
- The pressing force practiced by element ***5*** over the tape, must stop after the extraction of the mandrels and before starting its advance.
- Spring 3 must have a K rigidity coefficient > 800 to ensure a contact force with mandrel ***2*** during the extraction of the mandrels from the tape.
- It is imposed the mounting of a stroke limiter to attend element ***3*** for the realization of a rapid contact between element ***4*** and *3* before the contact stabilization with the mandrel ***2***.

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