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MODELING AND ANALYSES PLAN MECHANISMS WITH ADAMS 12

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ABSTRACT

In this paper is presented some aspect about the modeling plan mechanisms, on articulate bar with ADAMS 12 program. For a plan mechanism well-defined is illustrated the simulation, respectively the way it accomplishes the kinematic and kinetostatics analysis, results being presented in the likeness of chart.

CUVINTE CHEIE:
mechanism, modeling, simulation

1. Introduction

It's known that mechanisms plan analysis is in a continuing progress over time. Therefore in plant practice are known many analysis methods of mechanisms plan (condition angle, kinematics, kinetostatics or dynamics), respectively the graphic methods, graphoanalitics and analytics each of one being with own advantage and disadvantage.

Graphics and graphoanalitics methods (vector equations method, projections method, instantaneous centre of revolution method, crude analogy method, respectively polygonal forces method, etc.), have the advantage to be very easy to use, involving a work volume reduced, but results precision is not always right, because of measuring errors from graphic plan.

Analytics methods (polygonal outlines method) consist in outline equations projections writing with successive derivation and equilibrium equations; the result is linear equations systems that need to be solved for as many positions as possible for the main element. This is a very hard work, therefore, is necessary to use software, which solves those equations easily, leading to a higher precision on the results. This method disadvantage is that knowledge in programming language is required.

Along with developing CAD (Computer aided design) applications the software designing companies have developed program packages specific for each engineering field. Therefore modeling and simulating mechanical systems can be done with a important range of software, as for instance: *Mecaplan, Algor, Adams, WorkingModel, Catia, Watt&Roberts,* some of them using finite element method. Next authors present modeling, analyse and simulation plan mechanisms with programs Adams12.

2. ADAMS 12 program description

With ADAMS12 program the users may model and simulate complex mechanic systems, and they obtain kinematics, kinetostatics or dynamics values in graphics variations in time. Modeling mechanic systems, which include plane mechanisms, is solved through modeling component elements, and through kinematics constraint defined (kinematic pair) between them. For the simulation is necessary crank definition, through its input data (revolutions per minute, speed). The ADAMS12 interfaces, with the main toolbars used for mechanism modeling is presented in figure 1.

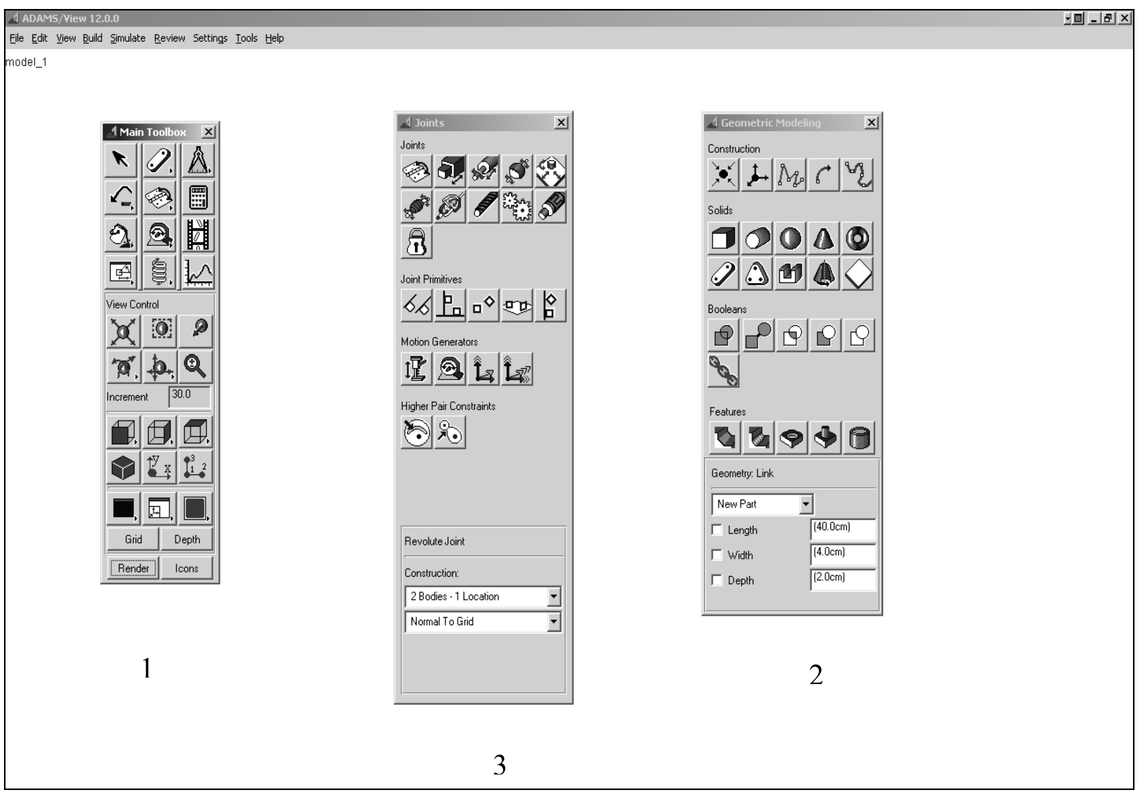

Figure 1

According to figure 1 they are three important toolbars used for plan mechanism modeling:

1. The main toolbar that defines other commands sets, for modeling, for kinematic pair definition, for visualization and for simulation.
2. The toolbar that allows mechanic system definition, for any geometric and dimensional configuration.
3. The toolbar that allows kinematics constraints definition (kinematic pair) on any nature and class (rotation, translation, spatial and gear).

The elements and the kinematic pair defined can be modified at any time, changing geometric configurations, dimensions and materials.

3. Plan mechanism modeling and simulation

To illustrate modeling and simulation with ADAMS12 program the authors consider an articulated tetragon mechanism amplified with structural group RRT. Mechanism modeling following steps:

- Kinematics elements definition (configuration and geometric dimensions) with toolbar 2 (figure 1).
- Kinematic pair definition for different classes (in our example for 5-th class, 6 rotation and one translation), with the toolbar 3 (figure 1).
- Kinematics elements materials definition can be choused from program library or can be defined by user through properties specification according to figure 2.

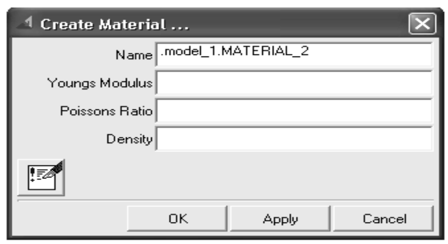

Figure 2

- Input kinematic pair specification and according to the type of motion allowed, is defined the value and the direction of crank.
- Effective resistance force definition (direction, orientation, amplitude, and kinematics elements) in action.

Through those steps, modeled mechanism are presented in figure 3.

To write equilibrium equations for a kinetostatic and dynamic study it is necessary to know kinematics elements barycenter, weight forces, inertial forces, and inertial force moments that act on these points. According to figure 3, barycenters are positioned on every kinematic element, and forces are taken automatically in consideration. The program gives informations on mass properties from the elements (mass, volume, inertial moments) – figure 4.

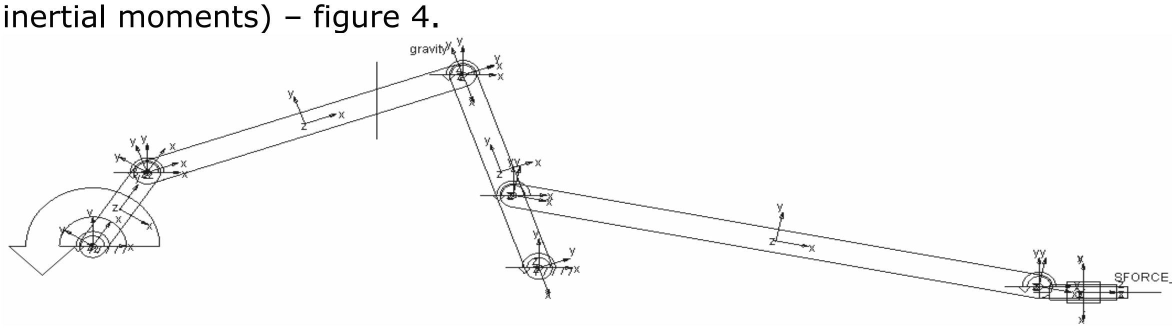

Figure 3

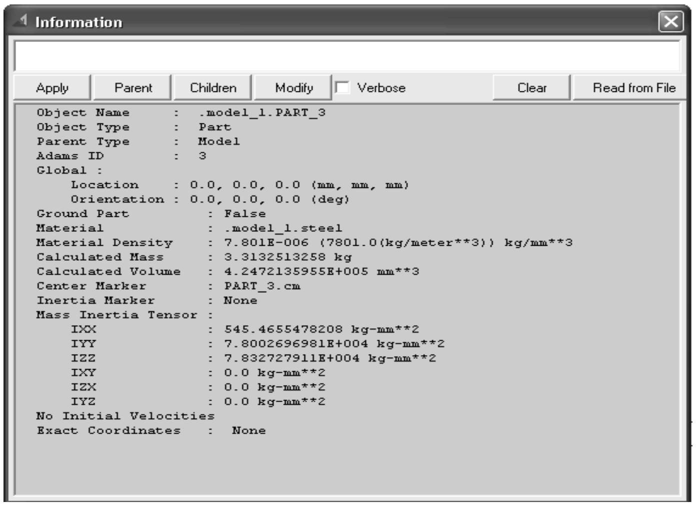

Figure 4

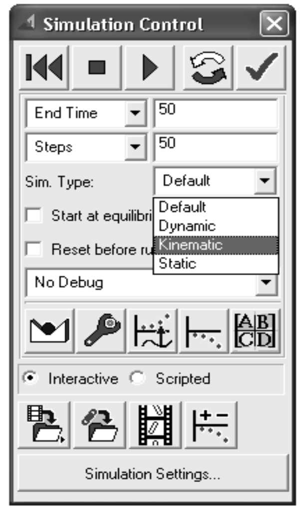

Figure 5

For the mechanism simulation, respectively to obtain graphics results is necessary to make initializations, with *Simulation Control* box presented in figure 5.

Simulation characteristics can either vary in simulation type (static, kinematic), simulation time and calculation sequences, or they must verify systems equilibrium. Graphics results are creating in real time on simulation period. For each element and kinematic pair, kinematic and kinetostatics value the program generates a diagram. User decides configuration and type disposal of diagrams.

In figure 6 the authors presents position, speed and barycenter acceleration components variation on OX axis, and in figure 7 it's presented the reaction components from the kinematic pair between cranking bar and rod.

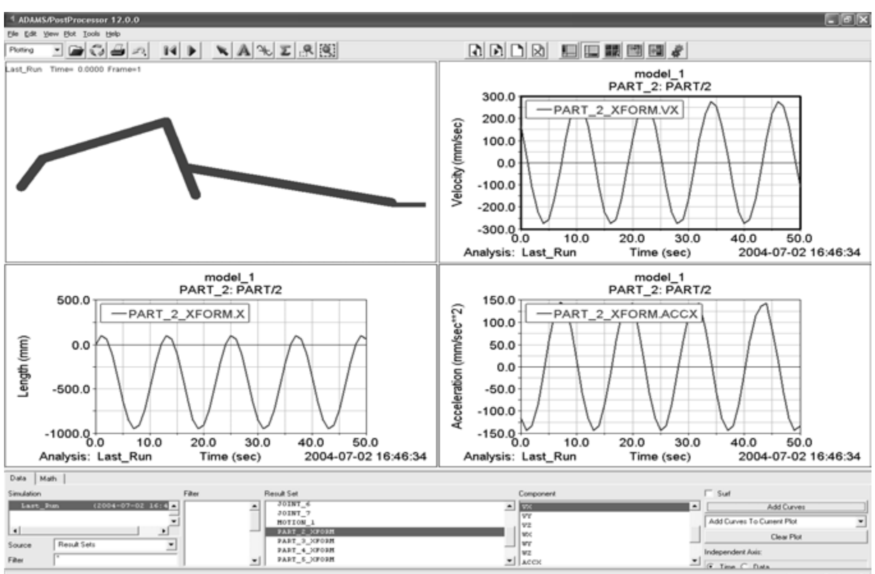

Figure 6

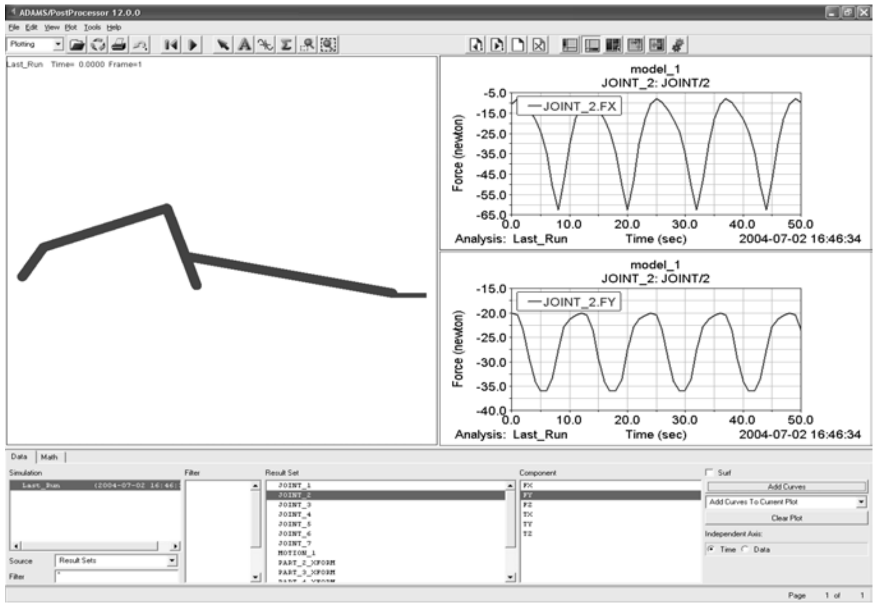

Figure 7

4. Conclusions

Kinematic, kinetostatic, dynamic modeling and simulation of plane mechanisms are analyzed with ADAMS12 program that solves much easier than known methods from mechanisms theory.

To obtain adequate results a higher attention to elements and kinematic pair modeling is required, and thy can be modified with geometric configurations, dimensions and materials. Mechanism redesigning is necessary when obtained results ask for it.

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