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# THE CLASSIFICATION OF PARALEL FEEF MECHANISMS AT MONORAIL ROBOTS WIGHT VELOCETY AND LONG TACKS

**Dorin HIRTE[1], Macedon F. GANEA[2], Marius NICA[3], Gheorghe DONCA[4]**
1. eng., drd., University of Oradea, e-mail: dorinhirte@gmail.com, 2. prof., PhD., eng., University of Oradea, 3. eng., drd., University of Oradea, 4. eng., drd. University of Oradea

**Keywords**: Parallel mechanisms, gantry, feeds.

**Abstract.**

Preoccupation off researcher on world wide consist in optimization of the feed mechanisms of fated advances of the machines tools, robots, monorail and manipulators which are incorporated in the flexible systems of manufacturing.

Due to the economic and flexibility factors, the performances of equipments are all exacting maul, respectively the accuracy, the speed the as well as the reliability.

## 1. INTRODUCTION.

Resolving the feed mechanisms of the machines of the tools, robots, manipulators and various aggregates which are included in the flexible systems of fabrication is one of the keys world technical developments. [2]

The researches concerning the parallel mechanisms intensified in the last decades, when appeared the alternative of their utilization, due to the advantages they present: report manipulated table; increased rigidity; accuracy of the position, dynamic behavior; activated compliant. The disadvantage of the utilization of such mechanism is due to a complex order system, compared to the conventional mechanisms. [3]

The main component, which influences the performance of the feed mechanism, is the dynamic of its rigidity. The major cause which affects the rigidity is given by the summarization of elastic elements which accidentally interferes into the system, influencing negatively the performances of the whole aggregates. [1]

A series of components of the mechanisms, such as: the screws with balls, the sideways, the driving belt, the belt pulleys, the camps, the wheels, the pinions, the, all of these having elastic and game characteristics. Fractionally, through precise pretensions, certain games can be reduced, or even eliminated, but in whole ensemble remaining deformations and games such as cumulated elasticity's like hysteresis. [5]

A big question remains the elimination of the deformations caused by the couples created at accelerations, persistent breakings, as well as keeping the task object of the mechanism. The cause of these appearances of the couples is due to the position of the adhibition point of the force on the mobile organ, which generally drifts from constructive considerations. [6]

This kind of couples enters into the system deformations that can compromise the accuracy of the aggregate, as well as a premature effeteness of the feed mechanisms. [6]

## 2. THE DEFINITION OF THE PARALLEL FEED MECHANISMS.

The mechanism of parallel feed, figure 1 is characterized through the introducing of two points of applied force on the mobile organ, thus reducing the effect of the couple on the feed mechanism and other components. [3]

This is achieved through applying two classic feed mechanisms instead of just one alone.

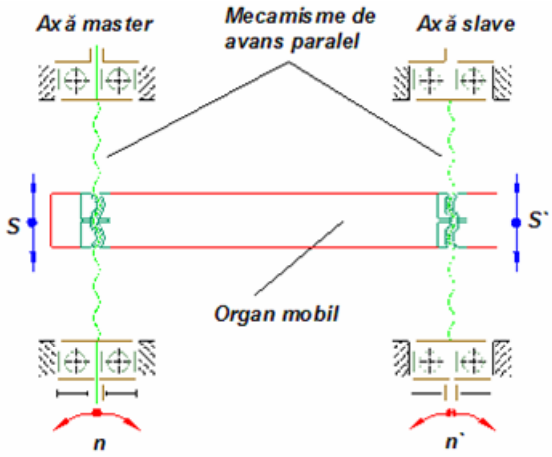


***Figure 1. Parallel feed mechanism..***

The movement of a mobile organ by dint of a parallel feed mechanism, is achieved through the actuation of the two simultaneous mechanisms in same direction of rotation, with same revolution for both axes.

In the case of the feed mechanism presented in figure 1, the axis Master and the axis Slave are driven synchronically perfect, with same revolution, = n', resulting an equal advance on each axis, s = s'.

The raise of the dynamic rigidity is the effect of actuation of the feed motion, through two parallel and synchronic mechanisms, situated to a much bigger distance between them, with the aim of taking over the couple of forces. The resultant motion as a result of the parallel actuation can eliminate the major disadvantages mentioned above. [6]

The conditions that parallel feed mechanisms are due to fulfill for linear axe CNC are:

-high axial rigidity to support the axial forces of the feed and the dynamic impulsion forces, with elastic deformations under admitted „window" by the action of the equipment CNC:

-the absence of the axial clearance of the mechanism, as well as the absence of tangential game between the actuator servomotor and the element of execution of the mobile components;

-the absence of hysterezis in the transmission of the feed mechanism , such as a linear diagram( that passes through the axes origin) between the input size(the rotation angle of the servomotor ax) and the size of exit( linear movement mobile ensemble), as well as the absence of remnant deformations to growth and descend;

-is needed an axial pretension of the mechanisms components, for the compensation of the elastic and maxim deformations on accelerating and breaking and work fields;

- tangential pretension in the feed mechanism at the movement of the rotation, for the compensation of elastic deformations and the vibrations during the operation;

- general efficaciousness of minimum 95% for the feed mechanism in order to have no loss of mechanic energy, that leads to a high sensibility;

-the absence of the motional staccato phenomenon at low speeds of feeds( stick undershoots);

-to support speeds of feeds of reduced positioning (approximate 5 mm/min.), as well as speeds of high quick feed with accelerated and braked beats correlated to the dynamic performances of the machine( sideways etc), inclusively of CNC and actuationings.

## 3. THE CLASSIFICATION OF THE PARALLEL FEED MECHANISMS USED IN THE MANUFACTURAL FLEXIBLE SYSTEMS.

The axis of coordinates, linear or of rotation, are materialized through sideways and individual mechanisms feeds for each axis. [3]

Parallel feed mechanisms found in the manufactural flexible systems:

- parallel feed mechanism acted through a mechanical bifurcation of differential type actioned by one servomotor.
- parallel feed mechanism synchronized through an adder differential mechanism acted by one servomotor.
- parallel feed mechanism acted with two servomotors electrically synchronized.
-parallel feed mechanism acted with two servomotors synchronized by a specialized CNC equipment.

Parallel feed mechanism acted through mechanical bifurcation of differential type acted by one servomotor is compounded in this case of two feed mechanisms that can be of any kind, simultaneously actioned through a mechanical bifurcation of differential type, figure 2.

The feed servomotors on axis are part of the synchronic alternative servomotors current which are synchronized with the variation of frequency, having permanent magnets in impeller, this with the aim of answering accordingly to the dynamic requirements and sensitive enforce.

In figures 2 and 3, are presented the solutions of the parallel feed mechanisms for the horizontal axis X and vertical axis Z, using teeth belt. [2]

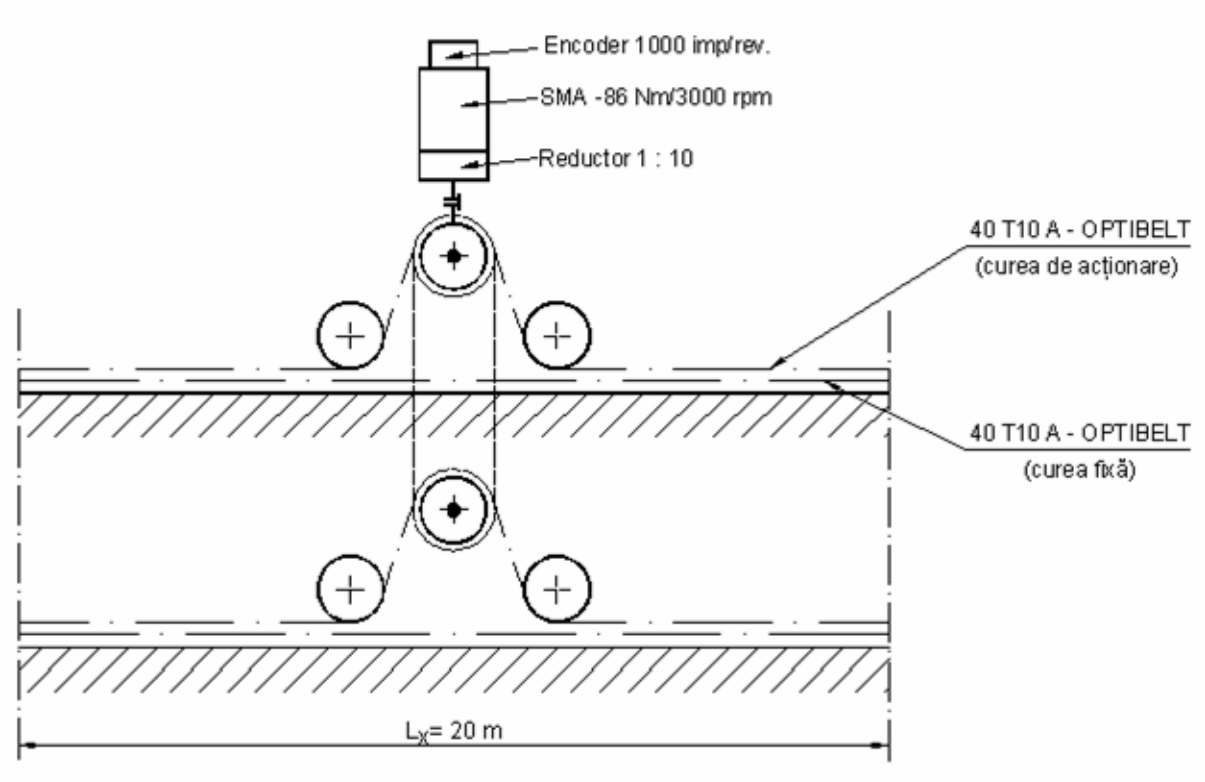


***Figure 2. Parallel feed mechanism for X axes.*** [2]

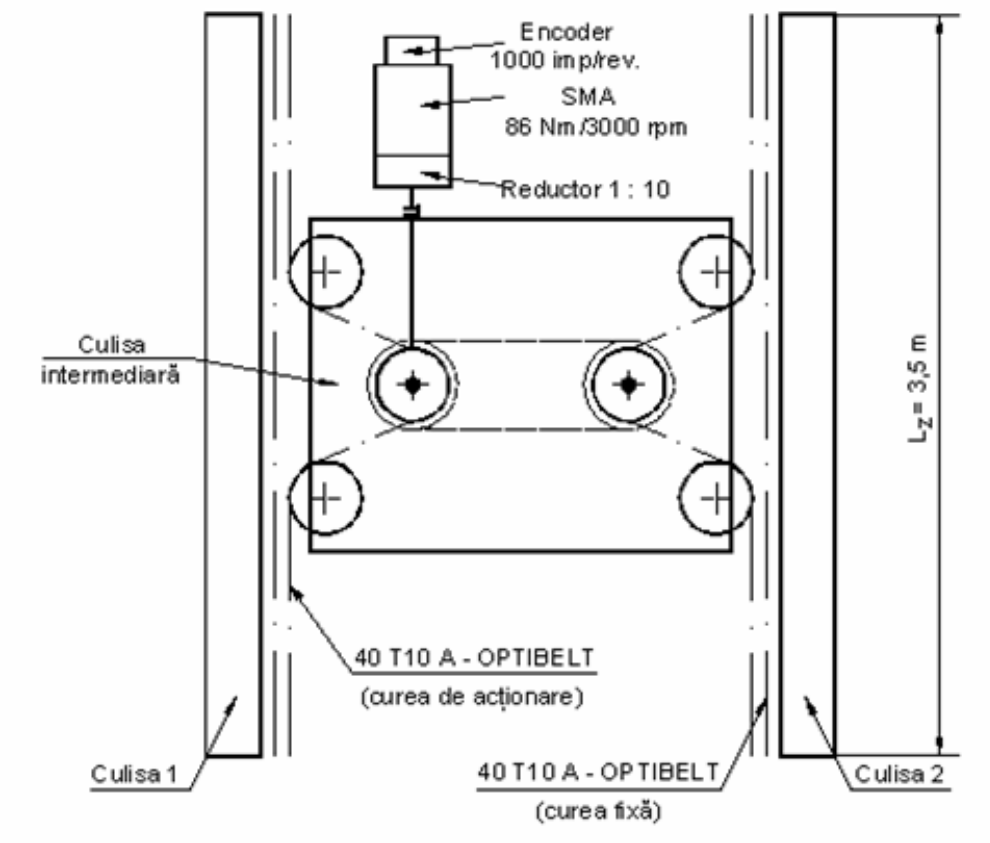


***Figure. 3. Parallel feed mechanism for X axes.*** [2]

Both cases have each, two identical and synchronically parallel branches without turning game, each branch using two denticulate long belts: one fixed on sideways used as support, and another one flexible in gear with the metric pulley belt of the feed servomotor's axle. The case of the vertical axis is referred to two mobile organs overlapped which together form race Z (mobile organ 1 being fixed), and the servomotor is placed on an intermediate mobile organ.

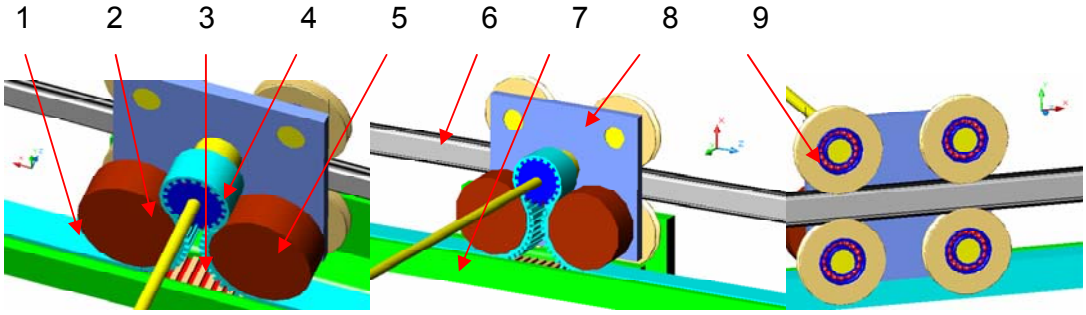


***Figure 4. Feed mechanism with Aramid insertion.*** [5]
***1 – Traction belt;***
***2,5 – preload wheel for the belt;***
***3 – fix belt;***
***4 – wheel;***
***6 – rail;***
***7 – support for the fix belt;***
***8 – support plate for INA role;***
***9 – INA role.***

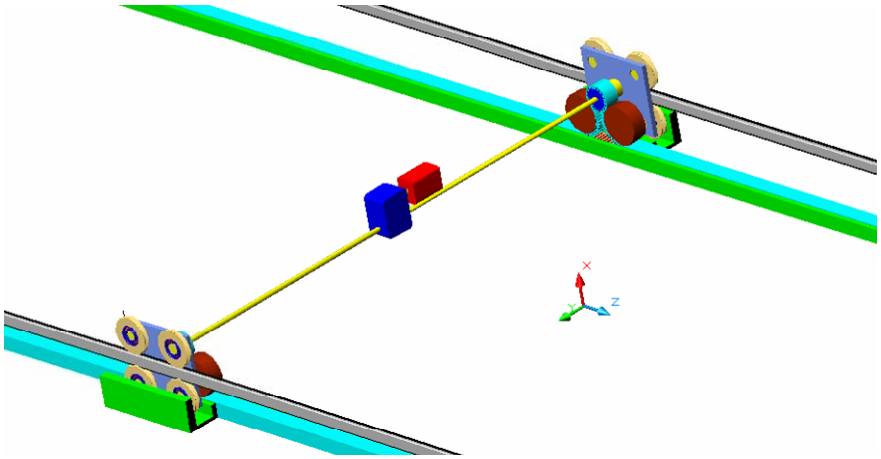

***Figure 5. Parallel feed mechanism drived with a mechanic bifurcation mechanism with a single servomotor.*** [5]

This kind of mechanism can be achieved as a rigid element, not fixable, or adjustable just static.

The parallel feed mechanism synchronized with a mechanical bifurcation mechanism with a servomotor draft , and a compensation servomotor.

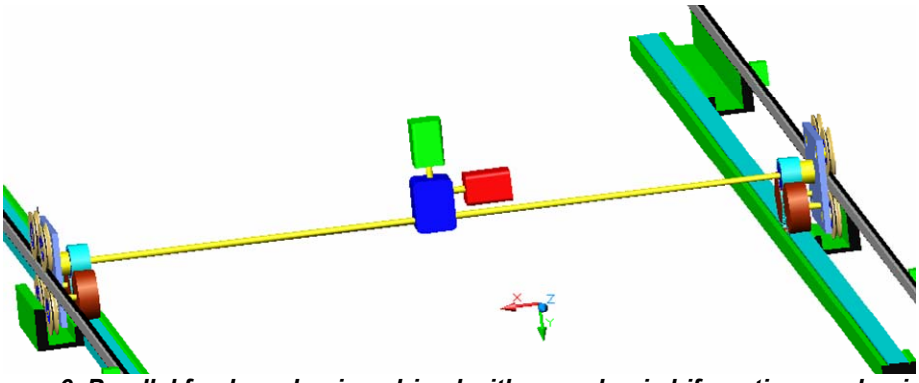

***Figure 6. Parallel feed mechanism drived with a mechanic bifurcation mechanism with a traction servomotor and a compensation servomotor.*** [5]

Linear parallel feed mechanism typical for the Gantry Drill axis, figure 6, where the compensation movement of the secondary axis is achieved through an adder differential mechanism, and the compensation is realized by a second servomotor during real time or in stationary .

The parallel feed mechanism acted by two synchronized electrical servomotors.

The linear parallel mechanism such as belt pulley, figure 7, is the typical mechanism for gantry mill axis driven by specialized CNC equipment.

The discrepancy between a parallel feed mechanism acted by two synchronized electrical servomotors and the one synchronized by a specialized CNC equipment consists especially in the fact that the second one follows and checks up on real-time the operation of the servomotors.

The management principle of this kind of mechanism is that one of the axes becomes the master axis and the other one Slave axis. [4]

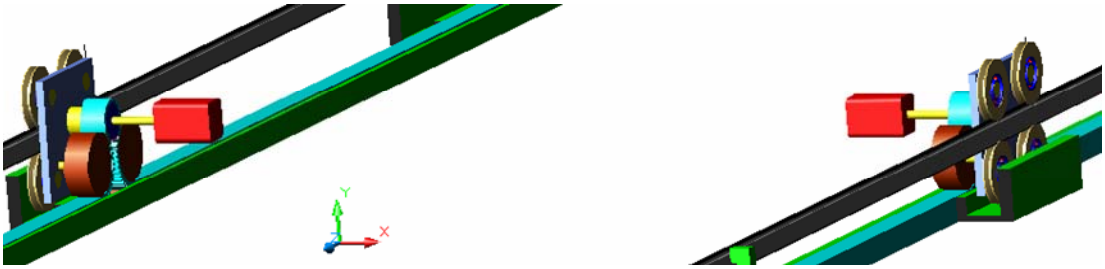

***Figure 7. Parallel feed mechanism drived with two synchronic servomotors.*** [5]

The axis Master is the axis marked as standard being controlled also a normal CNC axis. Axis Slave is synchronically driven depending on the state of the leading axis.

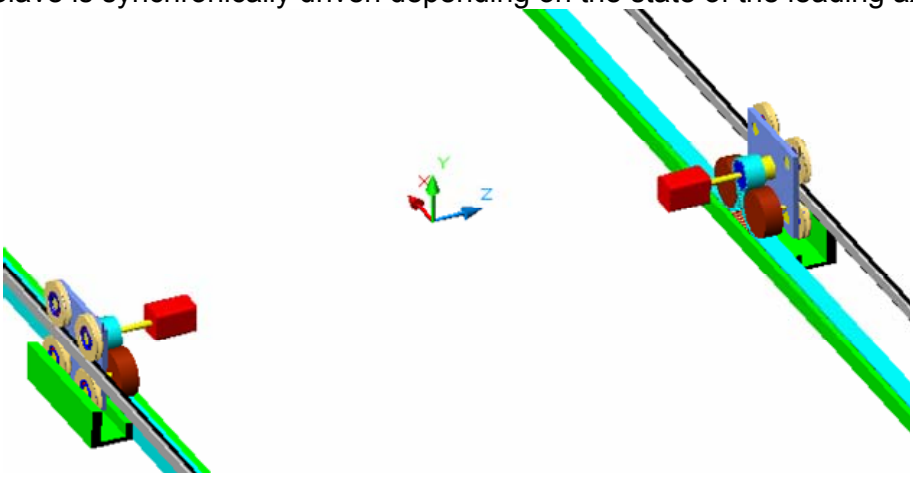

***Figure 8. Parallel feed mechanism with two synchronic servomotors drived by a CNC.*** [5]

## 4. CONCLUSIONS.

Due to the economical and flexibility factors, the performances that commit to different equipments become stricter, such as the accuracy, the speed, and the as well as the friability. These drawbacks were eliminated through the implementation of the parallel feed systems.

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