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THE OPTIMIZATION OF THE REFURBISHING INSTALIATION

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ABSTRACT
The SISMET program, offers to the robotics installations designers the possibility to obtain a cinematic structure with the help of a minimum of rotations and translation couple number, arranged in a construction as simple as possible and usefully miscasted between the reconditioning robot itself and the piece orientation mechanism.

1. INTRODUCTION
The SISMET program [3], offers to the robotics installations designers the possibility to obtain a cinematic structure with the help of a minimum of rotations and translation couple number, arranged in a construction as simple as possible and usefully miscasted between the reconditioning robot itself and the piece orientation mechanism.

A robotic reconditioning instalation is composed from 3 modules with specific functions:

- the robot positioning module – M.P.R. – has the role to ensure an equidistant shifting (movement) for the pistol head to the surface of the piece that we need co cover with metal:
- the instruments orientation module – M.O.I. – must ensure the orientation of the instrument along with the direction of the normal in any point of the surface that we need to metalize;
- the pieces orientation module – M.O.P. – is used to reduce the number of couples from the previous described points, M.P.R. si M.O.I., taking over a part from the freedom grades of the mechanical structure of the robot, in the same time.

The motiv of using the M.O.P results from the next advantages:

- the metalising robot structure is simpler;
- the simplification of the robots controling equipment;
- the increase of presision for robot positioning;
- the high flexibility of the system formed by the robot couple and the piece orientation module;
- reduction facilities for the auxiliary times that comes with the M.O.P.;
- the posibility of system modulation for metalising through the encreased number of orientation modules for the afferent piece for just a simplified robot; the modules are compatible with the robot central unit.

2. THE OPTIMIZATION OF THE REFURBISHING INSTALATION
The elements that determine the cinematic structure of a robotic metalising instalation are both technological but also geometrical.

Technological, the pulvarisation of the added material will be done along the direction of the normal to the metalising surface, in every point of the piece, but with a presetlled distance between the instrument and the surface.
The piece geometry, respectivly the surfaces form that will be metalized, will determine the type and the number of robots couples and also the piece orientation mechanism. Any piece is delimited of plane surfaces, cilindrical, conical, spherical or combinations between these. Any other surface can be estimated with the geometrical surfaces from above.
For the analise (fig. 1.), the pieces will be located in a fix cartesian system 0xyz. It is known that a plane surface, perpendicular on the 0z for example, can be covered using a 2 freedom grades robot (T_xT_y). If we need to cover 2 steped sides of the piece, the robot will have an extra translation. This results from technological considerents of keeping a constant distance between the metalising instrument and the piece ($T_xT_yT_z$).

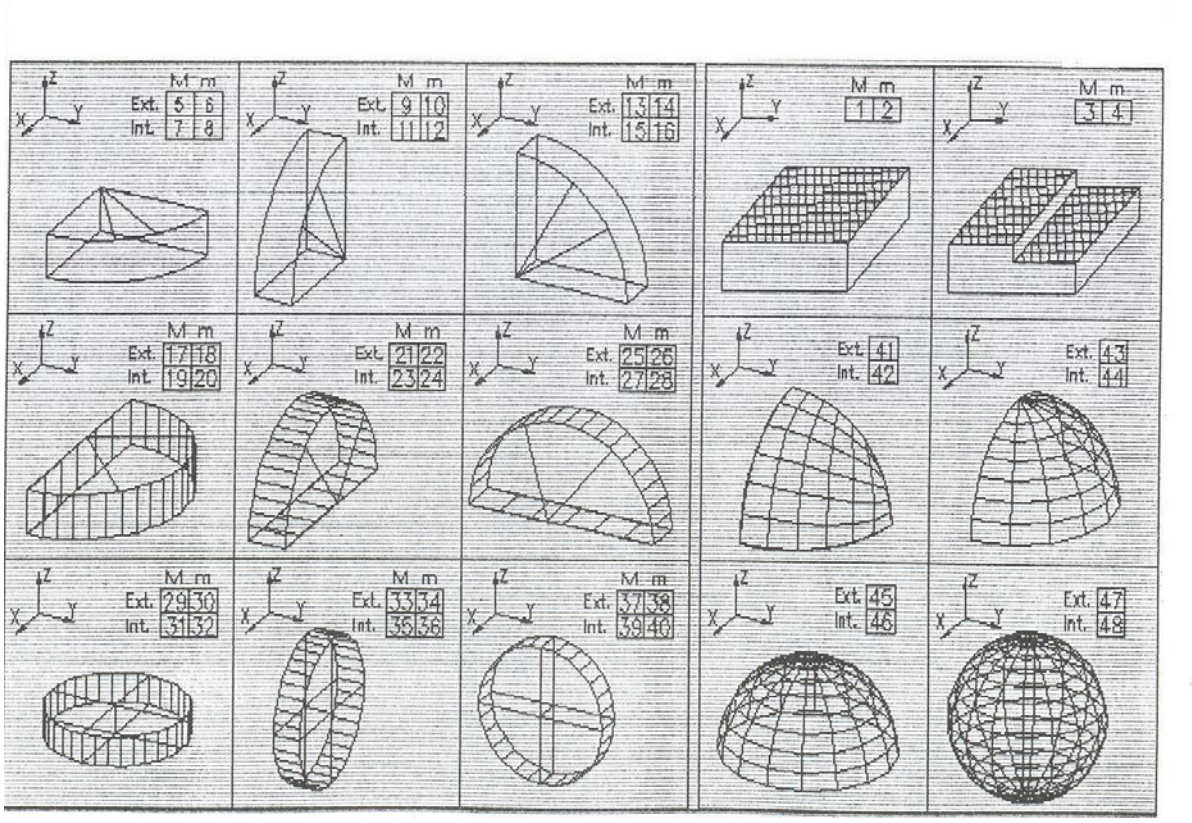

Figure 1.

If a prismatic piece will be reconditioned on two or more plane surfaces, that are parallel with one of the coordination axes (for example Oz), then the instalation will need a rotation couple for the piece orientation related to the metalising instrument (M.O.P.=R_z; M.P.R.=T_yT_z). When at least one of these surfaces is cascaded, the structure will be: M.O.P.=R_z; M.P.R.=$T_xT_yT_z$.
Comparing to the situation described before, it is possible that the prismatic piece to need additional metallization on a surface that is perpendicular on the Oz axe. In this case, the cinematic structure of the whole system will be: M.O.P.=R_zR_x; M.P.R.=$T_xT_yT_z$.
For the pieces that are delimited by the revolution surfaces with the longitudinal simetry axe orientated to Ox, through the same problem abording technique, we will distinct the following cases:

- cylindrical smooth pieces that determine the following structure: M.O.P.=R_x; M.P.R.=T_x.
- cylindrical cascaded pieces determining the structure: M.O.P.=R_x; M.P.R.=T_xT_y.
- pieces that are delimited by conical or spherical surfaces will determine the structure: M.O.P.=R_x; M.P.R.=$T_xT_yR_x$.

The problem will become diffcult for the pieces that are used with a complex shape, when the surfaces that are needet to be metalised are decomposing themselves in regular geometrical surfaces orientated after more axes (the case of forging or camber matrices).
The cases above presented are coded using the numbers between 1 and 48, where: “m” is the simple surface, “M” composed surface, “INT” interior surface metallization and “EXT” is the exterior surface metallization.

To determine the cinematic structure for a given case, we need to follow these steps:

- the piece will be placed in a 0xyz coordinating system;
- it needs to be decomposed in regular geometrical surfaces like in figure 1., identifying the orientation for every one after the system axes;
- the numerical codes for the obtain surfaces are needed to be filled;
- the cinematic scheme needs to be visualized with the freedom degrees distributed to M.O.P., M.P.R. and M.O.I.;
- if the user consider this necessary, a structure modification can be done using the “MODELARE SISTEM” (SYSTEM MODELATION) instruction, that can change the couples succession, can add or erase some couples, scaling and printing the last variant.

This way, the piece from figure 2, divided in elementary cylindrical surfaces 1 and 5 and spherical 2, 3 and 4, and analyzed using the SISMET program, has determine the cinematic structure from figure 3. This structure is the base of the technical project elaboration for the robotic installation.

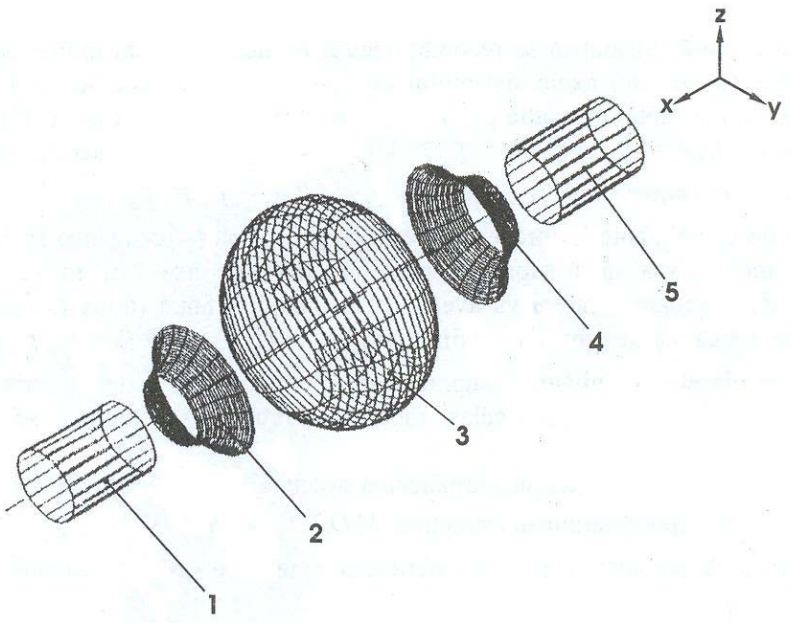

Figure 2.

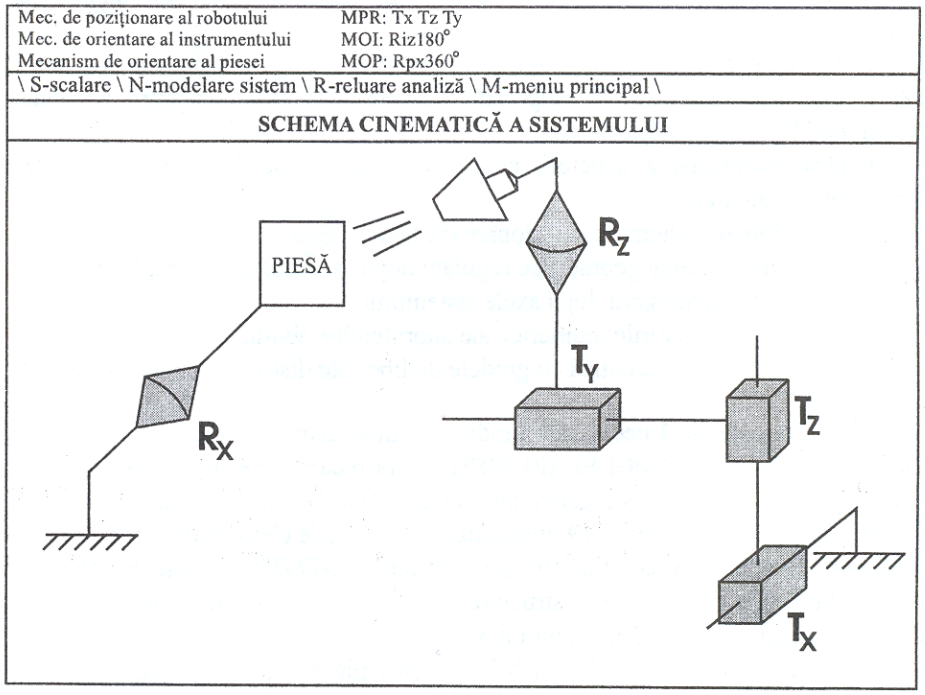

Figure 3.

3. CONCLUSIONS

By using the SISMET program, every used piece, indifferently what shape and dimensions has, can be decomposed in elementary surfaces witch will determine the optimal cinematic structure for the metallising installation.

4. REFERENCES

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