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„GRAPHICAL ANALYSIS OF MOTION – DIAGRAMS" USED TO CONTROL THE SYNCHRONIZATION CORRECTNESS OF MOTION OF ELEMENTS FORMING COMPLEX PROJECTS AVAILING UNIGRAPHICS NX

Abstract: In this article using engineering support systems in order to implement specific individual production process has been described. The significance of the support is as great since high-priced processes of producing heavy casts made from grey cast iron for machine-building industry are concerned. The system enables generating virtual animation basing on previously modeled environment of process implementation and formulas of particular devices' motions could be analyzed. The implementation of such project demands not only careful planning of its realization concerning technological process requirements but also control of correctness of its realization and making corrections in order to get an accurate process simulation in the final stage.

1. Introduction

Process of founding large-capacity casts from grey cast iron (44 do 46 [Mg]) in terms of production capacity available to the foundry division involves melting the required amount of cast iron with very similar – the same properties (mechanical properties, chemical composition) in the shortest time and at the highest possible temperature in line with technology card.

The process requires the retention of gradually received cast iron in ladles (KOZ 15) 15 [Mg] minimizing heat loss and accomplishing the necessary secondary processing of liquid iron (deslagging). Observance of the process requires:

- quick and efficient pouring a part of molten iron from a ladle to two basins of gating system on a mold,
- transport of the rest of liquid iron in ladles above basins of gating system using gantry cranes,
- refilling cast iron in ladles to required level
- simultaneous opening plugs in basins [3]

2. Assumptions

The first step in studying „Utilization of CAx tools to simulate process of heavy casts founding" project was to model machine elements, devices and infrastructure of the foundry giving them proper relations and creating virtual environment of iron founding process implementation (Fig. 1.). [2, 6]

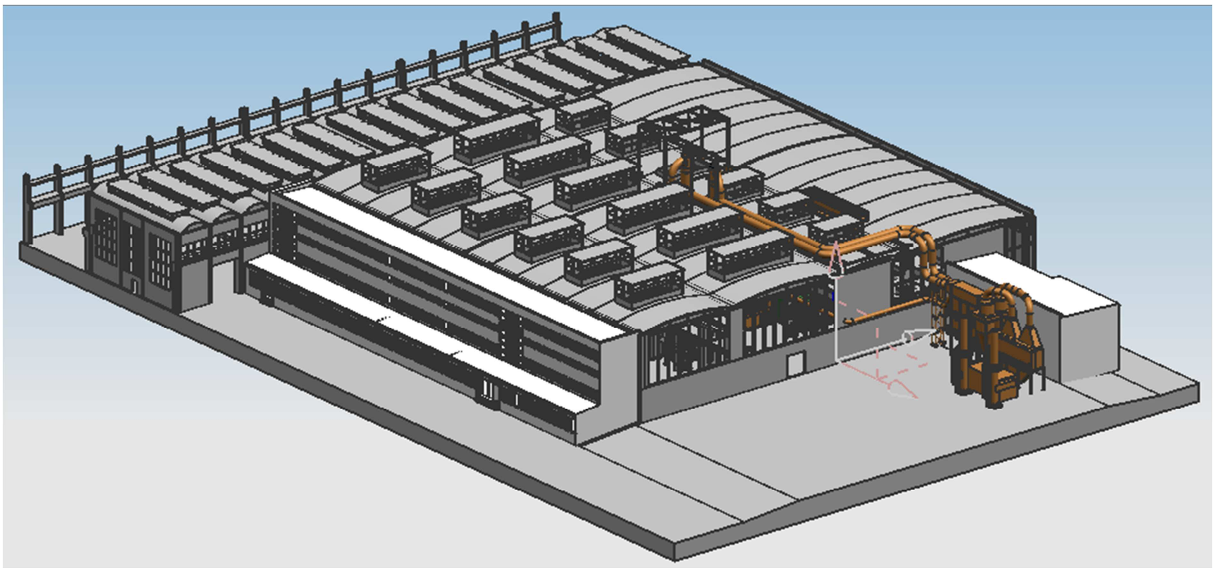

Fig. 1. Environment of production process implementation – foundry building complex

The virtual environment of the project in foundry is shown in (Fig. 2), which depicts building infrastructure with modular design of foundry's naves, ferroconcrete bearing piles with crane beams and roofing support structure with developed natural lighting – skylights, technological installations, devices, machines and department foundry equipment necessary for the process of founding cast iron in the cupola and induction furnace. [6]

Infrastructure of melting shop naves with two cupola furnaces, induction furnace, their dedusting systems, dedusting systems of shaking-out process on knock-out grates, casting gantry cranes and casting moulds have been modeled in detail. [5, 6]

Programming motions of individual elements forming virtual environment of process implementation is based on prepared schedule relying on cast technology card. The schedule determines the time intervals of molten iron amount and receiving direction (purpose) taking temperatures into account. [4, 6]

The final effect of the project is three-dimensional virtual animation of heavy casts founding process which has been programmed relying on formulas describing how particular elements move in the process.

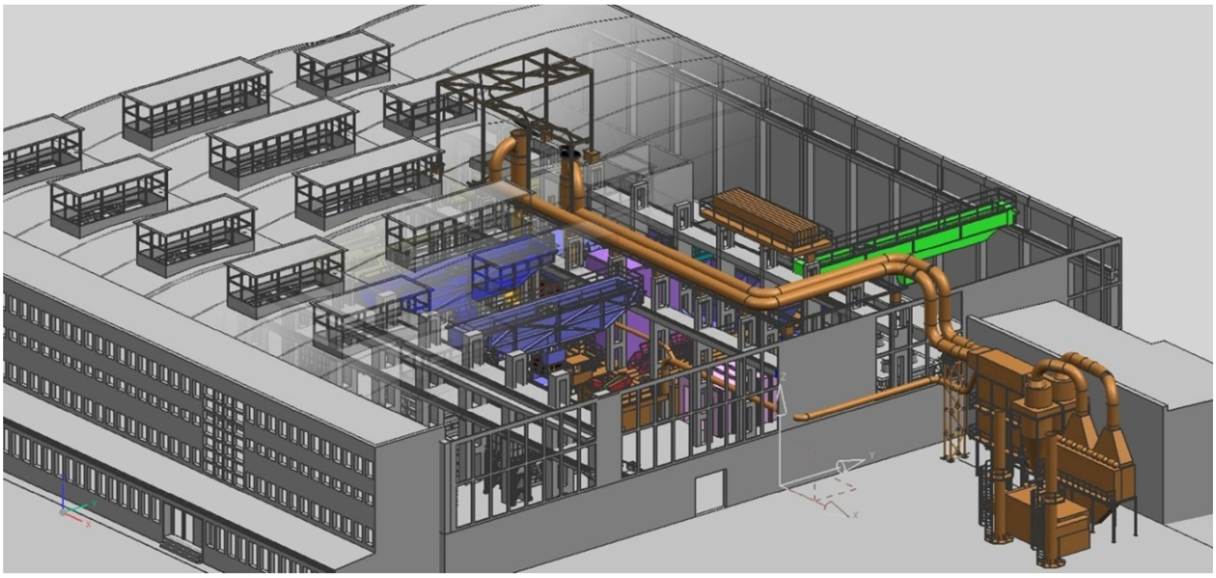

Fig. 2. Environment of production process implementation

3. Implementation

Programming so complex simulation which contains motions of more than 100 elements in over 15 000 steps, that equivalents 4-hour cycle of heavy casts founding process implementation, extremely important is to synchronize positions of certain elements on timeline. The final effect of the simulation depends mostly on time compliance – motion synchronization of certain elements. In order to meet the project assumptions, not only visualization of final effect should be scrutinized but supporting and controlling its correctness at time when it is being made with available tool is also highly recommended.

Using „Graphical analysis of motion – diagrams” to control and correct- if needed- formulas describing motions was described relying on relation – element synchronization:

Tab. 1. Description of the moving elements

——	OTTO_PokrywaD_RX – Large induction furnace cover
– – –	OTTO_Woz_TY – Charging car of induction furnace metallic charge
- - - - .	OTTO_Men_T_Tx – Induction furnace worker
………	OTTO_Men_Zuzel_Tx – Induction furnace worker of deslagging service

Diagram situated in (Fig. 13) graphically depicts motions of individual elements in relation to the timeline. Relying on first phase of the diagram where in the range up to 900 [s] double motion (OTTO_Woz_TY) of the charging car with induction furnace loading accompanied by double displacement (OTTO_PokrywaD_RX) of furnace cover deflection is presented.

Motions of these elements in the same time illustrate correctness of programming the process stage concerning getting the car to furnace loading after the cover deflection. Maintaining the correct programming of the charging car motion is also illustrated in the further part of the diagram [1, 7].

In the same way movements of the elements such as (OTTO_Men_T_Tx) and (OTTO_Men_Zuzel_Tx) related with induction furnace cover deflection could be analyzed.

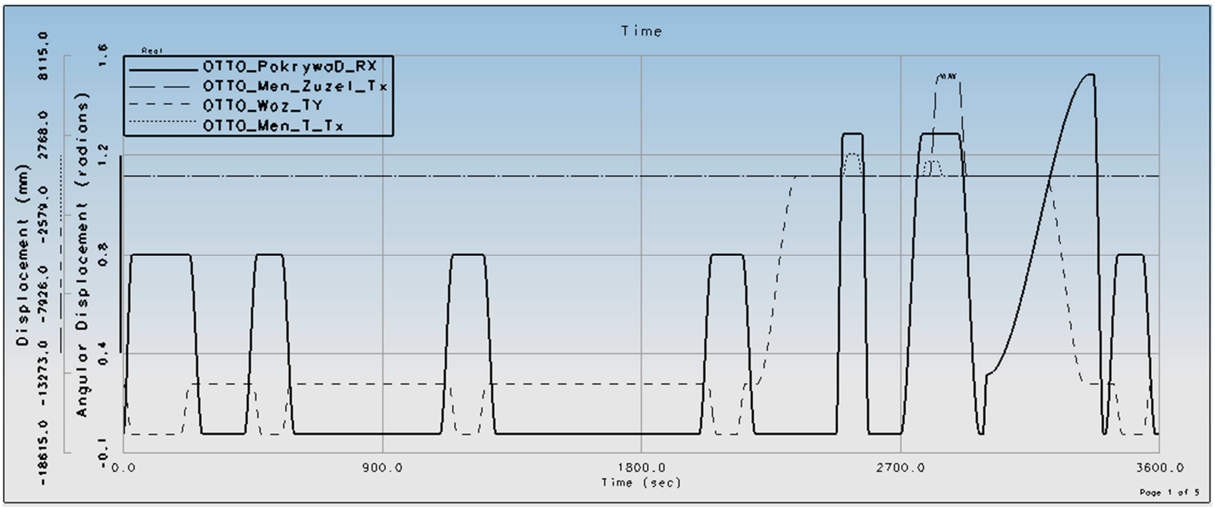

Fig. 3. Motion diagram

4. Conclusion

Utilization of „Graphical analysis of motion – diagrams" to control correctness of synchronization of elements' motion forming complex projects can be a very convenient way to control correctness of ongoing location changes of the elements which are mutually related. What is more, properly made simulation that gives perfect image of virtual process stimulates the imagination and create the feeling of reality.

References

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