Simulation MANAGER

2/2023

FlexSim is in the WORLD

An interview with the founders of FlexSim

Bill Nordgren and Roger Hullinger

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From the editor

Dear Readers,

Life is an incessant struggle against adversity and a constant fight for survival... In nature, civilization, and business!

Planning is one of the strategies for conducting this battle and overcoming the difficulties that its challenges bring. It ensures that the goal is achieved and victory is achieved, and inherent in it is the simulation of events that answers the question "What if...?".

Continuing the work started last year of bringing together the community of simulation users and enthusiasts through the written word, we are pleased to present its next issue. The SIMULATION MANAGER magazine, which we are creating together, is a forum for exchanging ideas and experiences and a place where we challenge and share knowledge about simulation processes.

It would not be the second issue of our publication without the support of many people from all over the world who have co-created it by filling it with content; whether by writing articles, giving interviews, or contributing in other ways. Thanking all those to whom we can share our experiences together in this forum, I invite you to read on. And what can we find interesting in this issue?

In his article, the world-class authority on Simulation and process analysis, Mississippi State University Professor Emeritus Allen Greenwood introduces us to simulation as an excellent tool to support problem-solving and sound decision-making. The author emphasizes that treating the creation of a simulation model as a project and applying basic project management principles increases the chances of successful implementations. The article outlines the key elements of simulation project management, principles of stakeholder collaboration, and knowledge management methods.

During the course of, one of the twelve conferences scheduled for this year, the FlexSim InterMarium Tour 2023 series, held at the Wroclaw University of Economics and Business, FlexSim founders Bill Nordgren and Roger Hullinger gave us an interview. Answering questions, they talked about the company's history, values, and future. They emphasized cooperation with InterMarium as a key partner in FlexSim's success in Poland and Europe. They also told us about the software's development plans, including connectivity with databases and cooperation with artificial intelligence. The interviewees expressed pride in FlexSim's achievements and appreciated InterMarium's innovative approach to educational simulation games.

An article by Metroplan describes the use of 3D simulation to optimize resin production, resulting in financial benefits and a 10% increase in profits. A 3D simulation is an innovative tool for testing a variety of scenarios, predicting results, and identifying bottlenecks to increase production efficiency. The cooperation between Metroplan and Silekol exemplifies the use of simulation models to achieve desired results in production writes Marcin Malicki. Another case study is described by Jorge Toucet of FlexSim Mexico. It is a project to optimize a Mexican company's material handling process using the FlexSim simulation tool. With the help of the simulation, the company found the optimal number of vehicles, reduced the number of operators, and precisely assigned areas of operation, achieving successful production optimization.

And finally, something for relaxation...

Dr. Tomaž Berlec invites you to Slovenia and describes its attractions, from active recreation in nature to cultural excursions to historic towns and local cuisine. He mentions the richness of nature and cultural heritage. He also highlights the use of FlexSim software by small and medium-sized companies working with InterMarium since 2017.

And another portion of the magazine draws humor, this time supported by artificial intelligence. Judge for yourself, is AI already aware and developed enough to "think" in terms of a narrow professional group, and does it have the humor of a simulation engineer?

Putting into your hands the second issue of our magazine, I wish you all the successful realizations with simulation tools and fruitful relations with clients and business partners.

I promise many inspiring reading experiences, and encourage you to read it!

Work as if everything depended on you, but trust as if everything depended on God

(St Augustine)

Tomasz Białoń
Editor of the issue

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CONTENT

WHAT'S NEW IN FLEXSIM?

New features and quality of life improvements

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We would like to share with you information about the new modules and features introduced between version 2022 and version 2023. These are not only real game-changers but also visionary improvements

FlexSim has introduced many exciting new features in the past year, including our exciting collaboration with NVIDIA's Omniverse, expanded emulation capabilities, better AGV and AMR modeling, improvements to the mass flow conveyor, and more. Let's highlight some of the major updates you'll discover in the latest version of FlexSim.

USD + Omniverse

In August 2023, FlexSim launched its connector for NVIDIA's Omniverse. When paired with FlexSim's support for the USD file format, these features unlock all-new potential for interoperability and connectivity with other 3D software.

Emulation Module Update and Expansion

Customers have asked for expanded emulation support, and FlexSim has listened! In the latest updates, anyone with a FlexSim license can take advantage of improved stability and error handling in the Emulation module. Licensed users can also create Modbus and OPC DA connections for basic emulation modeling use cases.

For those who need additional PLC emulation capabilities, consider speaking to your FlexSim representative about the new Emulation license. This license will get you access to Beckhoff ADS, Siemens S7, Siemens PLCSIM Advanced, OPC UA, and Allen-Bradley connections, with more to come in future releases.

Better AGV + AMR Modeling

Key features have been added to further improve FlexSim's automated guided vehicle (AGV) and autonomous mobile robot (AMR) modeling capabilities. You'll find new ways to handle deadlock and allocation, dynamic barrier management, and custom allocation points. These features will help in modeling several types of modern material handling systems, including Kiva-type systems and high-density automated storage and retrieval systems (like AutoStore).

Export Restricted Model

FlexSim now gives you the ability to export a restricted model, which will let you hide or obfuscate parts of your model. You'll find it in the File menu under "Export Restricted Model." The restricted model file will get a ".locked.fsm" extension showing it's restricted, and users can open, edit, and run the model as normal—however,

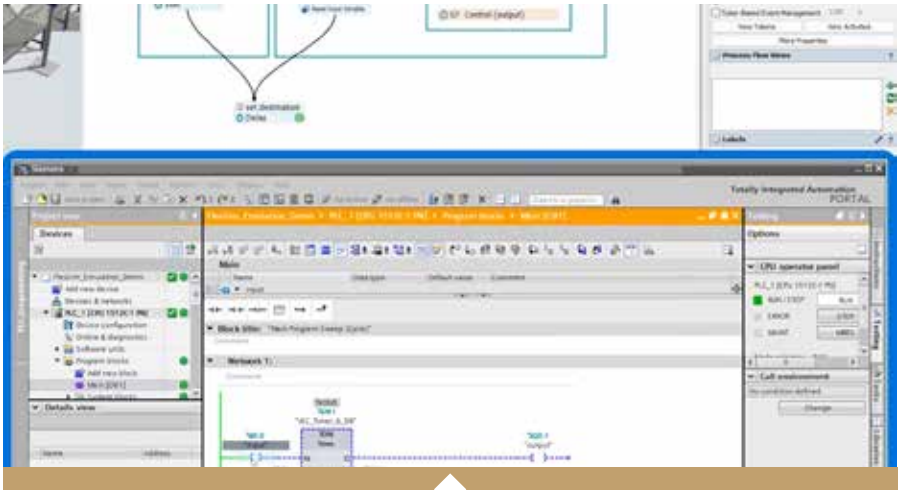

Fig. 1. 2023-PLC-Emulation.

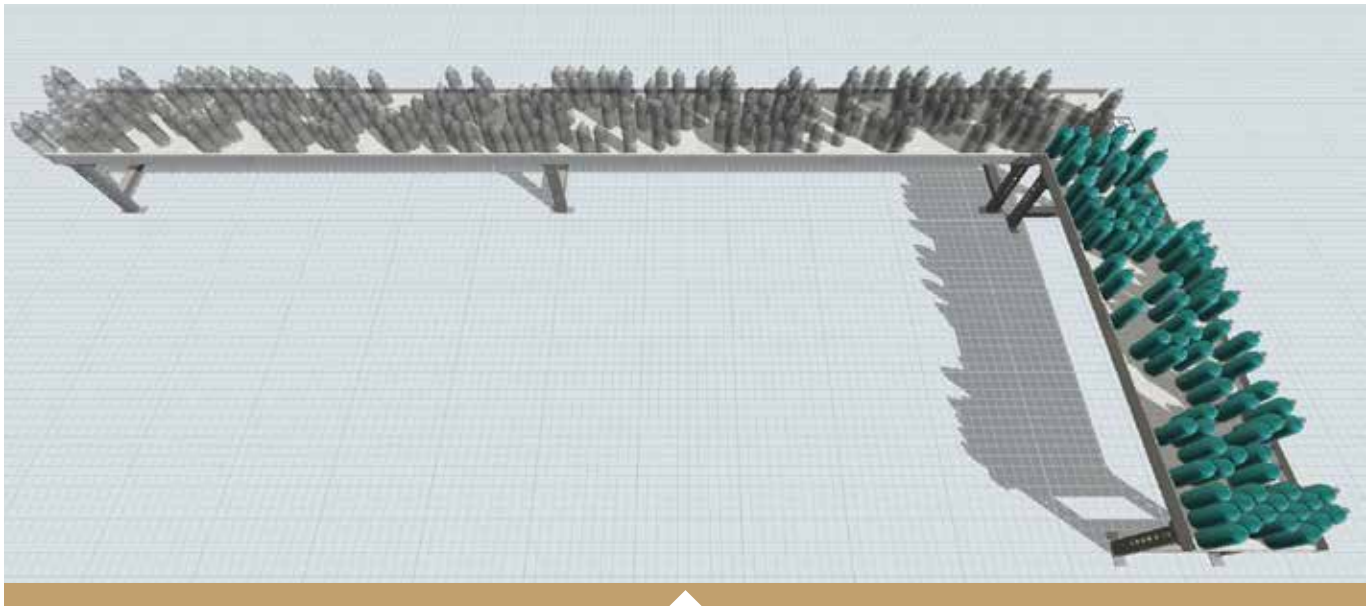

Fig. 2. Mass flow conveyor.

certain features (such as the Tree and Process Flow) may be unavailable to protect model logic.

For example, when you choose "Hide all FlexScript" during the export, all FlexScript fields (and many Process Flow fields) are hidden from the user even though they continue to run during the simulation. It's a great way to share your model without necessarily sharing everything inside it.

Mass Flow Conveyor Enhancements

FlexSim's Mass Flow Conveyor object has received several enhancements to improve the modeling of food and bulk goods manufacturing, bottling and packaging, and other high-speed or high-volume manufacturing systems. This object uses a fluid-based approach to model thousands of units with a high level of accuracy—while still being efficient with computing resources.

The latest enhancements to this object include width rules, which allow you to specify a simulated width for a conveyor segment. The new Mass Flow Transfer allows you to connect conveyors without snapping them together, and also to specify a conveyor between two different units when entities flow through the transfer. And don't forget the Randomized fill order, where entities will travel the conveyor in a random order before accumulating to add visual realism to the model.

… and More

These are only some of the features from the past year of FlexSim development. The software also includes a new Process Flow activity (Breathe), CSV export of Experimenter results, a Table Validation tool, new packing and stacking methods, GIS geocoding queries, and so much more. We hope you will enjoy all that FlexSim has to offer!

Warehouse Triplets

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CASE STUDIES

Words

As an industrial engineer freelancer supporting clients and customers with their process optimization tasks, projects, and problems, I always bear in mind (or I am still striving to keep) two aspects of my contribution. The first is to gain real practical outcomes of simulation modelling (if not working on a pure virtual process...) that gives, as a second or better parallel, the answers in real time. I mean "real time" in the automotive business, with the largest portion of my projects, that everybody expects results yesterday...

The aim of the article is to show the practical applications of simulation in optimizing warehouse processes and strategies

Thinking of some easy-to-follow examples to share, I've chosen from my model buffer three such versatile, simple models to build, yet practically useable. This use-ability has at least a few benefits to mention:

1 - when shown to managers, they can better imagine (sometimes at least) that simulation modelling is not a costly rocket science just for a few engineering weirdos hidden in a dark corner of their company

2 - it explains nonviolently to IT and/or ERP key users why these poor guys from the logistics department are bothering them and want them to re-set up their warehouse strategy or change anything within the WMS settings

3 - it gives some quick and direct hints to process or logistics engineers on how to treat their static layouts to have the overall satisfying functional warehousing process

4 - and last but not least, such simple model storming can save (or bring) interesting pocket money out of budgets at the end when countermeasure bits are implemented within the overall project organism

- to have less headcount by e.g. quicker load-unload of high runs
- balanced (cheaper) handling machinery as they do not need to travel around the globe...
- rapid INOUTS mean generally bigger turnover and more opportunities to make business

What is not mentioned in the examples below and shall be highlighted as it is valid for all of them, is the crucial role of warehouse control systems. You can simulate and design any storage basics, but without a functional and practically implemented WMS, and at least some storage logic base, it will never in reality bring in what is practically expected. To sniff, guess or look for items (even using binoculars...), leaners call it "watch and see", within any warehouse system type, these are not the features compatible with simulation modelling.

Rainbow

This model is the one that is presented quite often during my project sessions and that I leave as a gift to play with afterwards. It contains one simple classical rack row (according to standards known as APR - adjustable pallet rack) with an ASRS aside that is loading an unlimited number of pallets (containers), and unloads them into cells on-by-one in FIFO (bay-by-bay) order.

The whole trick is that there is a color pallet (gradient) that paints containers according to the time range from load time at the input buffer to unload time into a slot.

Of course, the model has a few key parameters to set which influence the output picture as per the expected real state:

- ASRS aisle speed, extraction, lift, acceleration
- APR number of bays, levels, cells
- RANGES of times to be painted within

The goal is simple:

it is to help WMS guys (and get "the feeling") learn how to put inside priority zones and adjust store strategy for key PNs as related to APR dimensions (length, height) and applied handling machinery parameters

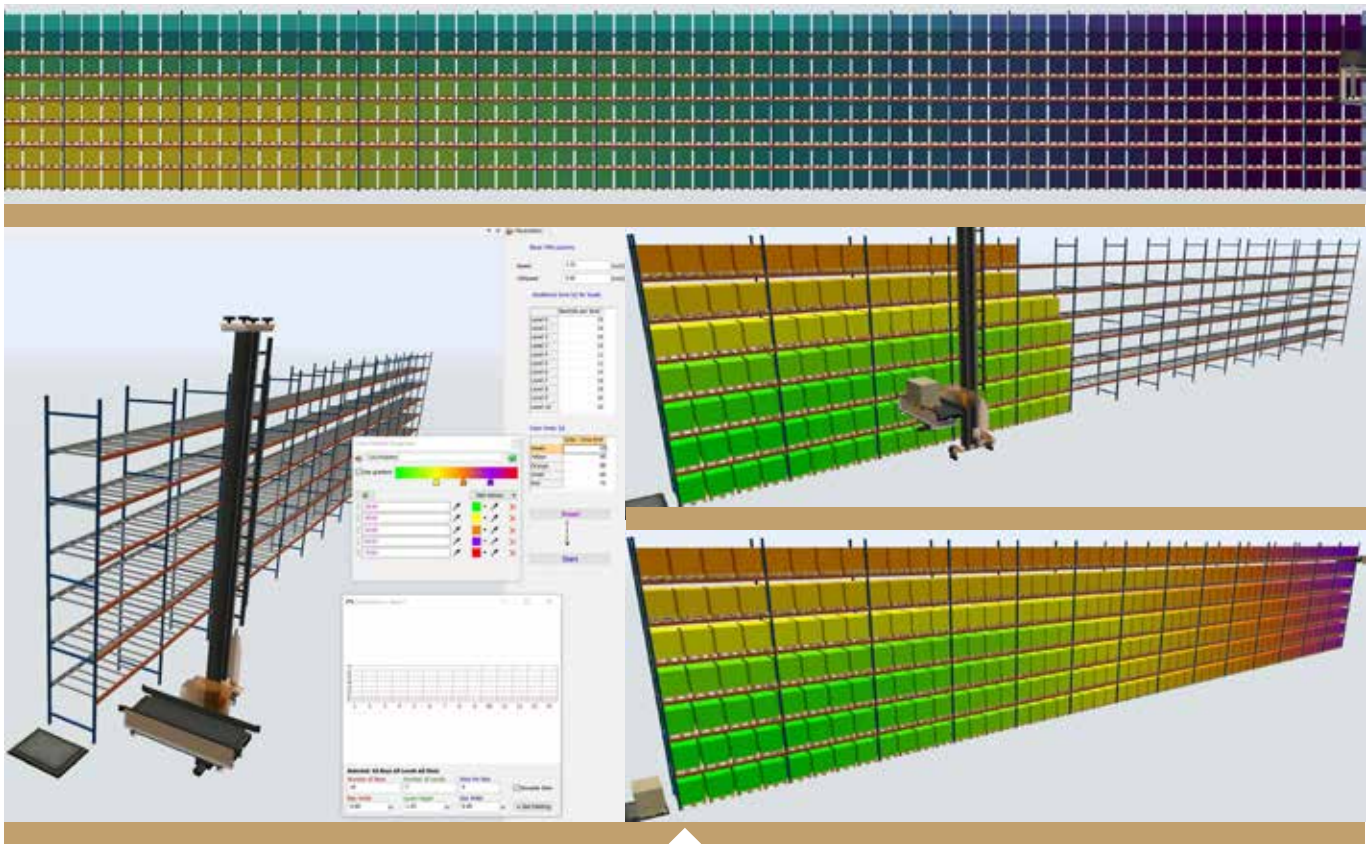

Fig. 1. Model view with all ingredients at a glance.

Eyesore

Every time logistics managers claim their warehouses, "I've got it under control, man...", I politely ask for their current warehouse state, occupation, and positions. I do not know why, but likely in all cases, they are surprised. Unfortunately, negatively.

The procedure is again relatively simple

1 - look at high runs, maybe choose a few (~2 to top 5) of the nice, suitable part numbers (PN)

2 - treat the data table for the chosen PNs matched with current real addresses

3 - put a tab in FlexSim with aligned columns for a BAY-LEVEL-SLOT assignment strategy

4 - build APRs per the given layout and let them "match

5 - run the model and generate virtual pallets (containers) colored by PNs row by row into a particular APR slot

In most (all) cases you can get such cloudy points spread around the warehouse field...

The goal is to show:
Real deployment of key or significant PNs

- Where everybody instantly questions him/herself and answers at the same time "what if these PNs would be closer to P/D (pick and deposit zones)" AND "what'd be the benefit to create clusters of those PNs..."?

Ends

It seems to me quite modern-like stuff these days that companies widely decided to create their "central warehouses". Sometimes for just RM (raw material), a few times for mixed items (FG+RM), many times the combination of APR and AKL (small crates racking) performed in full/semi-automatic or manual handling operations. One of the first strategic questions (among other ones)

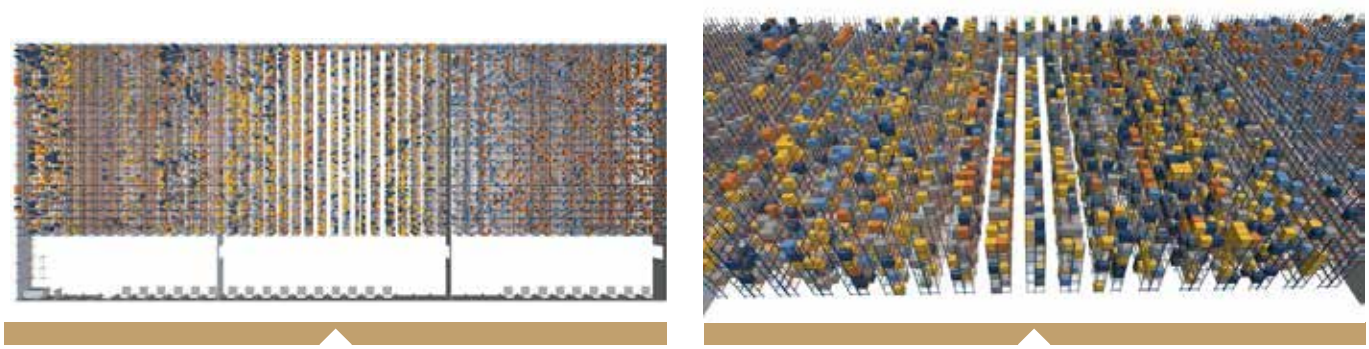

Fig. 2. Five chosen high runners spread in "chaotic" warehouse - colors mean same part number - pallet positions taken from real current WMS. The task = find some clusters.

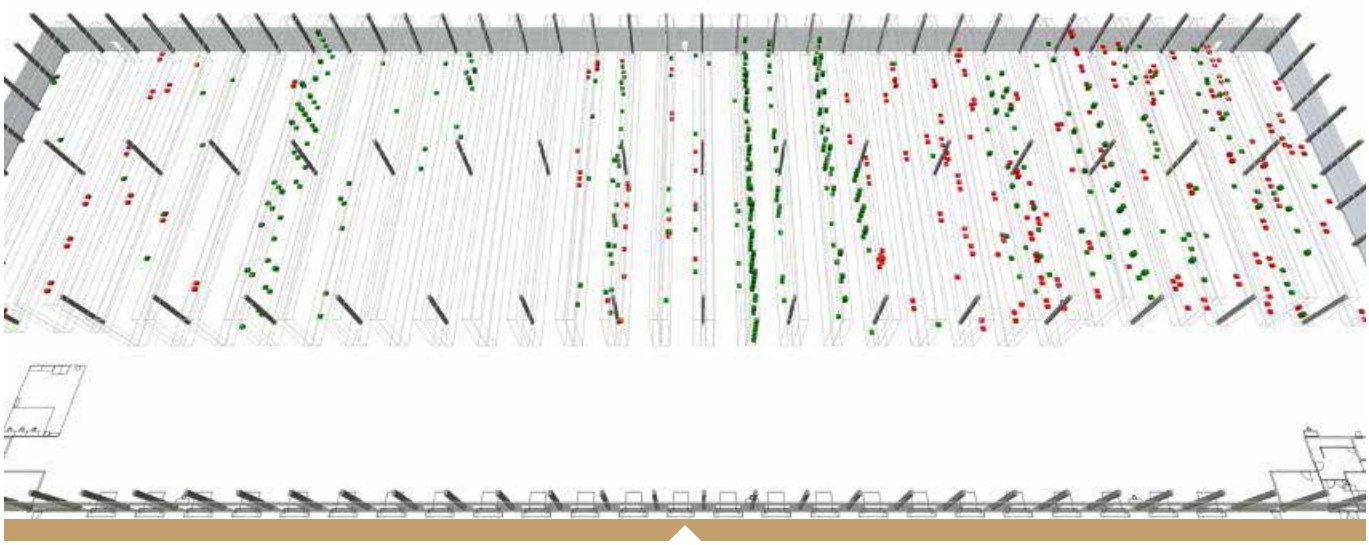

Fig. 3a. Show the client what is current spread of two specific part numbers and spare parts (blue) - some WMS strategy likely set but it worths to be more strict.

for a warehousing concept is whether to build store blocks as a one- or both-sided system. That means if we have a P/D at one side, the forehead of the racking, or construct it in transit way having Pick at one forefront and Deposit at the opposite side of the aisle.

The procedure construction is as follows

1 - Let the model reflect a well-considered warehouse APR layout - it should be built within realistic boundaries (walls, hall trusses, pillars, gates...)

- A - prepare one version with P/D at the forefront
- B - a second rack layout takes into account entry at one side, exits at the other end

2 - Set APRs with randomly assigned slots and generate pallets (containers) filling uniformly about 50% of particular APR rack row choose and apply into model handling machinery according to expected (planned) - e.g. VNA, reach-trucks, forklifts...

3 - Run the model and let handlers play with load/unload on either a limited number of pallets (e.g. 100 INOUTS) or on a determined work time (e.g. 8 hours per shift)

- A - if the number of pallets is equal then compare the significance between the resulting times
- B - if the time is equal for both models then the number of pallets - INOUTS should be compared
- ANOVA might be used to check differences on a statistical level and to get another insight into the results

It is necessary to mention that most times it is about the tradeoff between:

A - number of storing positions (warehouse capacity could be sometimes reduced due to shorter rack rows)
B - throughput speed (INOUTS count per e.g. shift is higher)
C - space utilization within a given hall (moving rack block with back away from the rear wall may cause a bit worse overall hall space occupation)
D - general, higher level material flow directions or e.g. loading ramps placement (when for instance production feeding is not backward, why make it at the opposite side of rack aisle...)

The goal is obvious:
To compare the general effectiveness of a one- or both-sided racking system

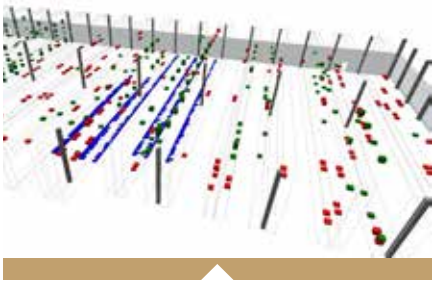

Fig. 3b.

Fig. 4. One sided model example.

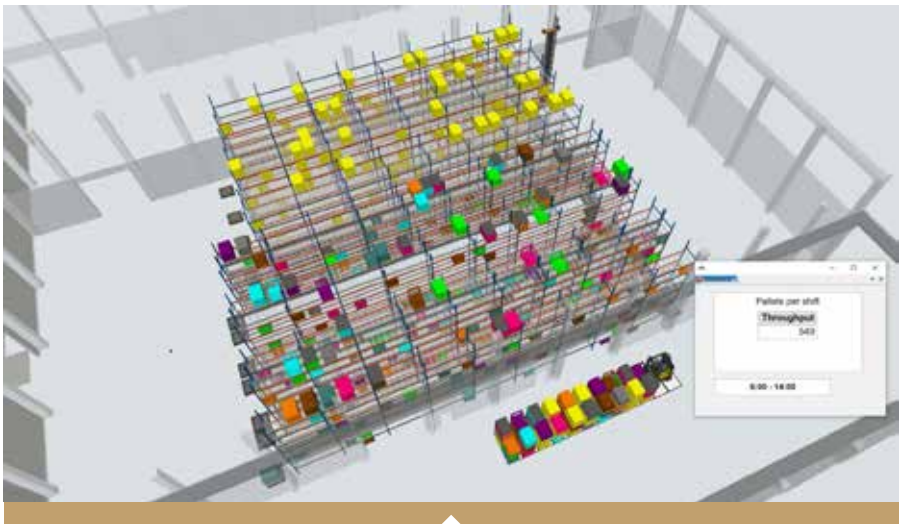

Fig. 5. One sided model example // Both sided P/D racking at the same area.

A Product Movement Solution Using FlexSim Mexico and Central America

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A company in Mexico was interested in improving production, so they asked FlexSim Mexico and Central America to model their operations. The project centered on an initiative to optimize the transfer of packaging material using towing and loading vehicles. Two or more pallets can be moved simultaneously using these tow/load vehicles, which minimizes the journey by the operators between the production lines and the warehouse.

The main objective was to identify the vehicle configuration that allows the reduction of operators moving material to the production lines without exceeding a defined budget. They also wanted to identify the areas each operator would occupy, target the number of vehicles that needed to be purchased for the movement of material, and figure out accurate service times by area. Through simulation with FlexSim, they sought to solve the following questions:

1. How many vehicles to buy?
2. What areas/routes will each operator serve with the new distribution of activities?
3. What will be my line assortment times with the new way of working?
4. What benefit will the implementation of this system have?

Model Development

For the supply of the production lines, the model had to handle consumption rates, a certain number of product changes per week, and the rate of pallets required to be taken to the landfill. FlexSim Mexico and South America created a model that met the client's specifications. It was decided that to position the pallets at their final destination once they arrive at the production line, a manual option must be used—this was due to the space and safety restrictions of the company. The options considered were a double pallet jack or a Tugger with drag trolleys. Likewise, a waiting/blocking time was considered if one vehicle met another in the opposite direction.

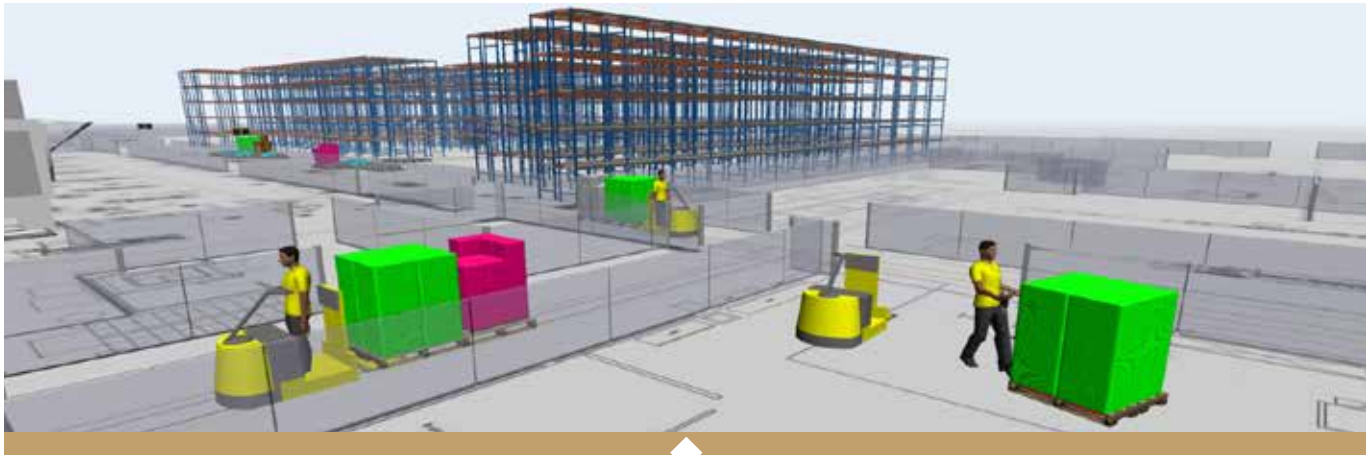

Fig. 1: We tested new alternatives for material transportation without the risk of doing it in the real system.

Results

After repeated simulation runs and data evaluation, the model showed a reduction of 15 operators (in three work shifts) would be achieved by incorporating five double pallet jacks to transport

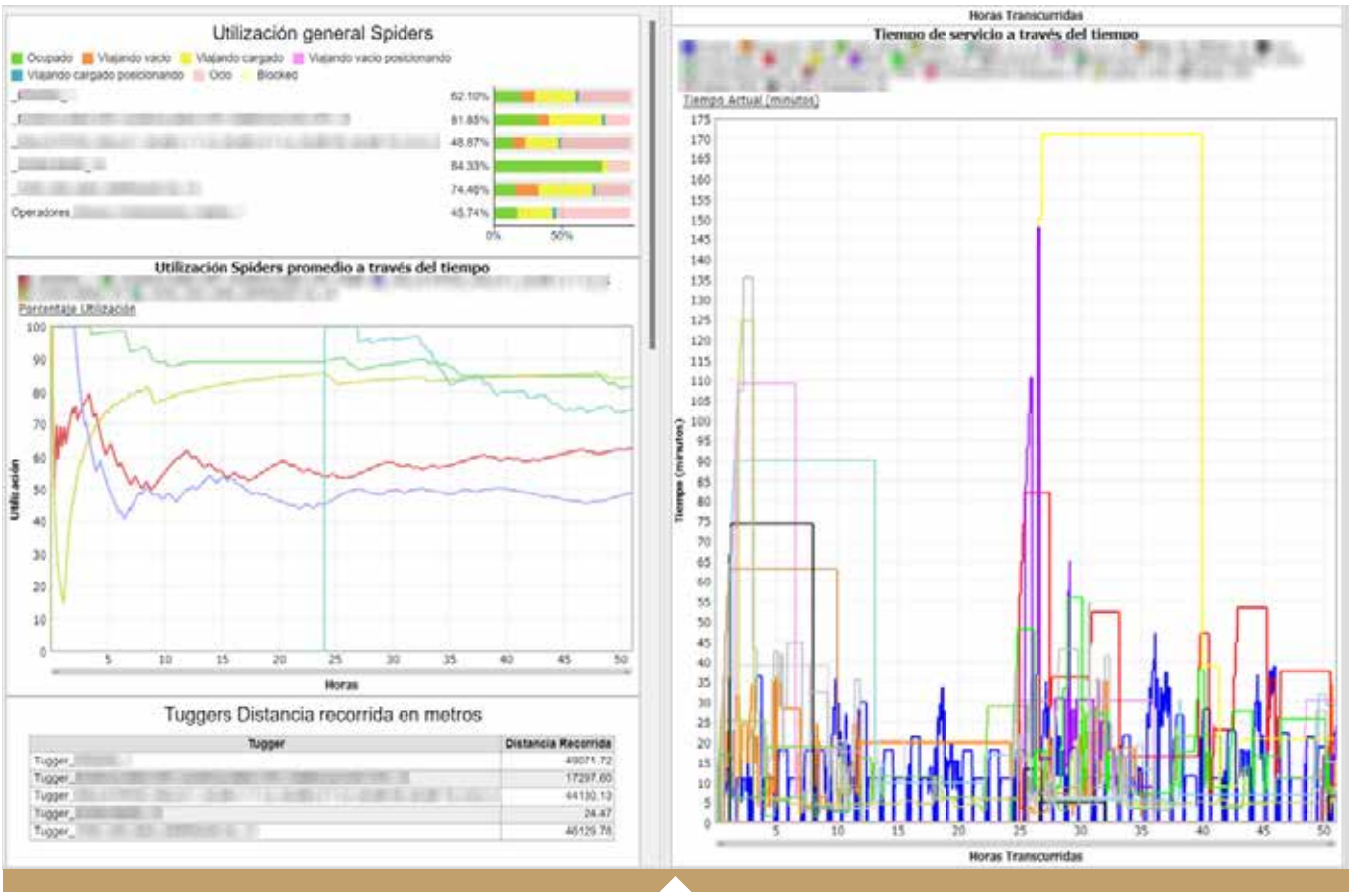

Fig. 2. Analyzing the advantages and disadvantages of different scenarios to find the optimal solution.

materials. The client chose the double pallet jack option instead of a secondary choice of Tuggers with drag trolleys because the investment of dual stakes for the pallet jacks was more in line with client's budget than the sizeable investment of Tuggers and the additional equipment necessary for them to transport pallets on carts.

In addition, the trolleys needed for the movement of pallets required storage and inventory control, and the company did not have physical space to store the trolleys. This option was discarded (although the simulation model did show that this option produced better assortment times and less use of operators within the system).

The simulation study showed five vehicles as the optimal number for product displacement. It also showed that the system could run effectively by reducing the number of operators from 29 to 14 through the use of towing vehicles. And the client was able to see a precise allocation of these operators' service areas.

Conclusion

The simulation project was a success, showing the precise vehicle count that fit the customer's needs. It was possible to quantify the benefit of incorporating cargo vehicles to transport two pallets simultaneously, and the model helped to assign the areas that each operator would attend. It also showed the minimum times required to supply the lines at the start of production and the average time required to supply material to each area.

Find out how long it takes to create a model to determine the optimal batch size for a production line.

The FlexSim environment for estimating energy efficiency of intralogistics systems based on Autonomous Mobile Robots (AMR)

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The newest intralogistics solutions based on AMR should be designed according to the idea of Industry 4.0. There are several indicators that are considered during the design process of such systems, with the most important being energy and process performance. These two parameters are interrelated, as the energy efficiency of a particular mobile robot influences the overall process performance. Therefore, it is crucial to determine the energy consumption of each mobile robot and be able to utilize this knowledge in simulation environments. The FlexSim software can be used for that purpose and allows to simulate fleet of AMRs with full scope of intralogistics process.

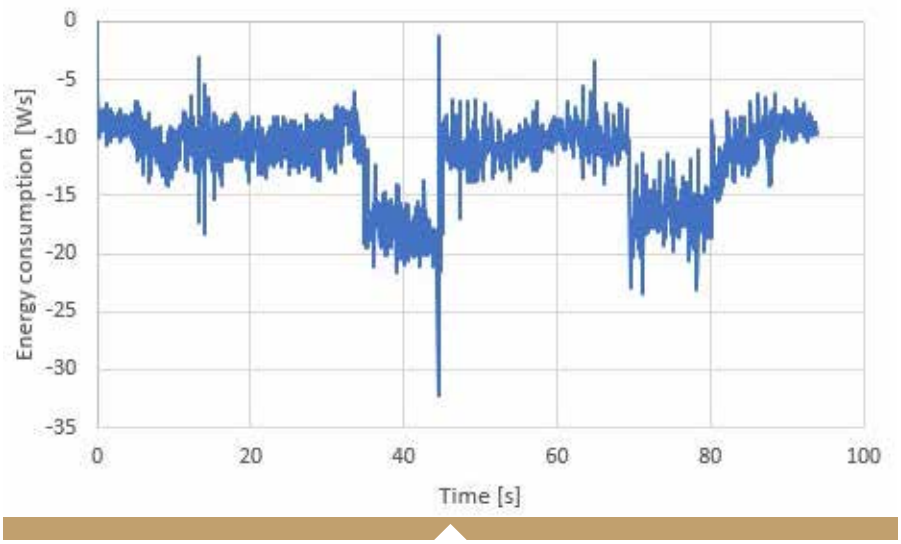

Fig. 1. The example of identifying energy parameters for IntraBot AMRs.

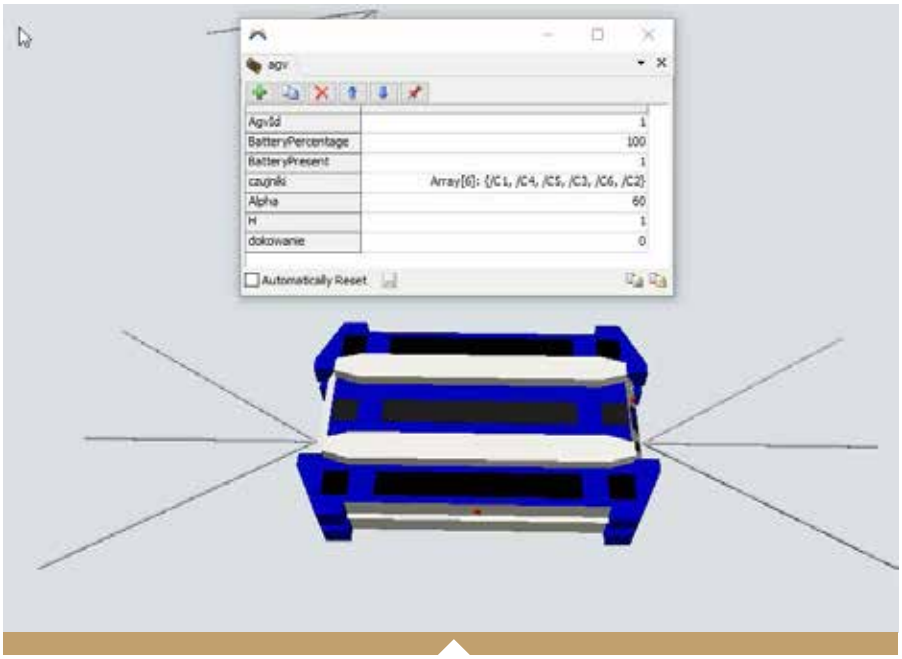

Fig. 2. The IntraBot robot model in the FlexSim environment

and design of intralogistics systems based on AMR robots. It was developed during the work on the HEPIS (High Efficiency and Performance Intralogistics System) project, carried out within the framework of the WND-RPSL.01.02.00-24-0459/19-009 project by Etisoft Smart Solutions Sp. z o.o. This method can be applied to any robotic system; however, it requires experimental identification of hardware-dependent energy parameters, which may vary for each manufacturer's configuration.

The first step in this method is the identification of the energy parameters of the robots. To do this, you need to determine, through experimentation, the energy consumption as a function of velocity, time, and elementary robot actions, such as rotation or docking.

The mapped parameters of the robot can be represented in tabular form within a robot model based on the Task Executor. The process model should refer to the elementary actions of the robot and update the state-of-charge (SOC) model of the robot batteries.

The method was developed within the HEPIS project and can be applied to various robotic systems after appropriate experiments and the choice of an optimal solution

The prepared AMR robot model can be used in the simulation of an intralogistics process. This allows for estimating the energy efficiency of the AMR fleet and, consequently, determining the required number of robots to meet the process requirements.

The presented method enables the rapid offering

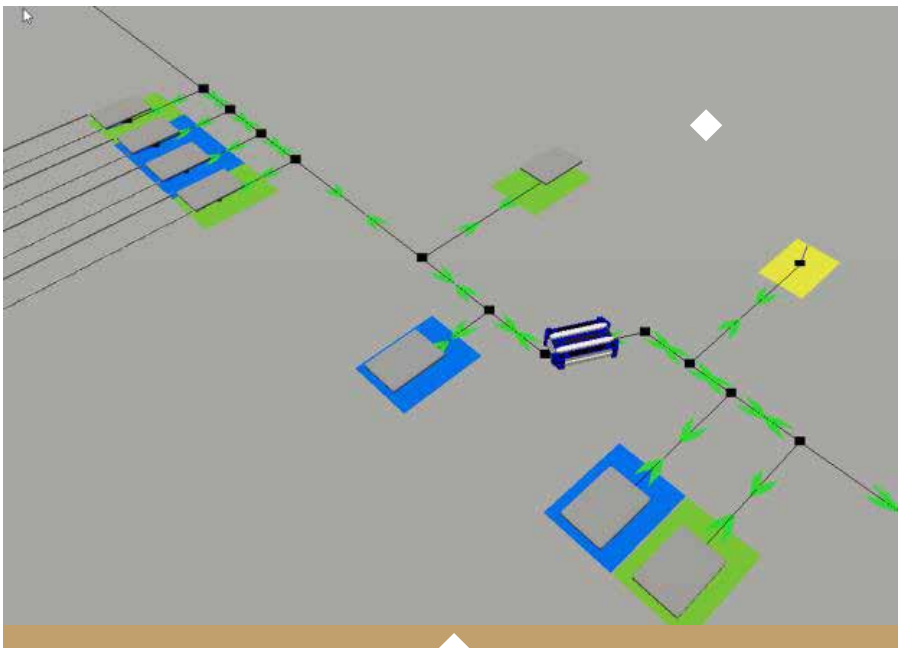

Fig. 3. The FlexSim process model associated with energy consumption for elementary robot actions.

Simulation model of a plant producing highly specialized resins - inconspicuous, yet powerful

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3D simulation models - an opportunity to optimize production processes

3D simulation models are a technological solution owing to the fourth industrial revolution. Models are approximate representations of reality that are created to better understand and study the observed phenomena or processes. Digital twins are mostly created with the intention of improving processes so that these best meet the expectations of the audience. Digital representatives of reality also enable efficient control of existing systems. The added value in the creation of simulation models is also the possibility of explaining processes to people who should be well versed in them (e.g., sales or customer service departments), but who have no direct contact with their practical course.

The simulation model allows processes to be optimized and efficiencies to be increased through virtual analysis without the need to perform real activities. It allows testing various scenarios and forecasting results. This is a convenience in any industry where it is necessary to control phenomena and diagnose dependencies.

The cooperation between Metroplan and Silekol is one of the excellent examples of how it is possible to draw on the technological advances of the 21st century. The creation of a simulation model of a plant for the production of highly specialized resins shows that simulations can be successfully used in production processes, and are not limited only to logistical processes. The success of the project was possible primarily due to the commitment of both parties, as well as experience and openness to innovation.

Photo. A section of the Silekol plant for the production of highly specialized resins.

Metroplan has been involved in innovative projects for many years and provides comprehensive

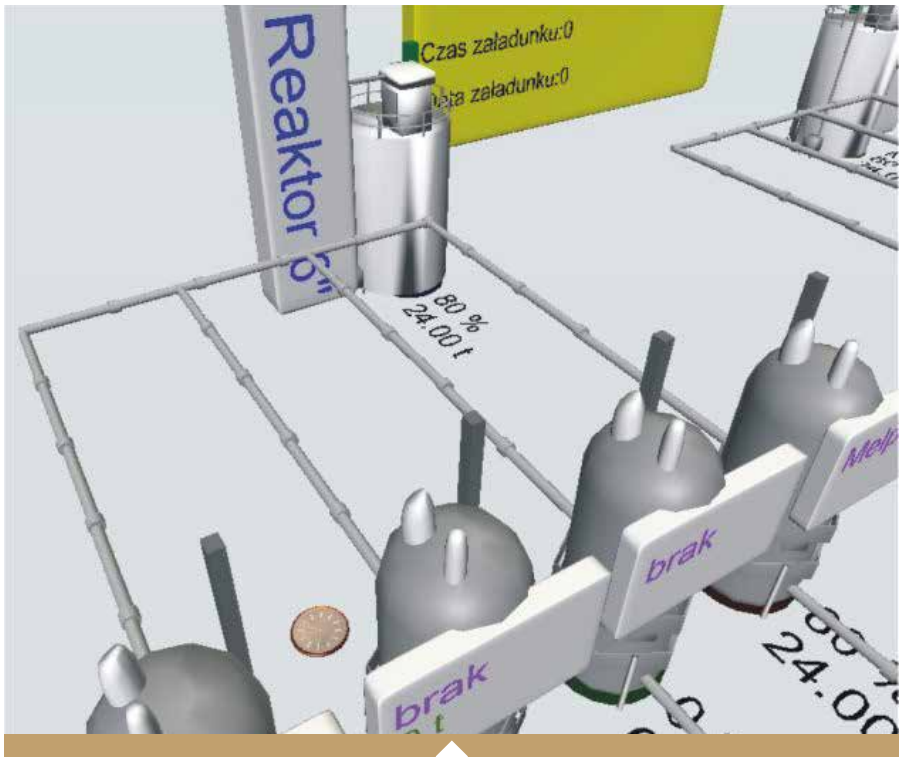

Fig. 1: An excerpt from a model of the installation of highly specialized Silekol resins in a simulation environment.

services in the design of solutions for logistics, construction, or architecture. What distinguishes the company is undoubtedly its holistic approach - specialists guide their clients through every stage of implementation – as well as prediction regarding the impact of relevant factors on the course of implementation. It is the long-term view of the project and drawing inspiration from the world of new technologies (instead of fear of them) that allows the company to achieve the desired results.

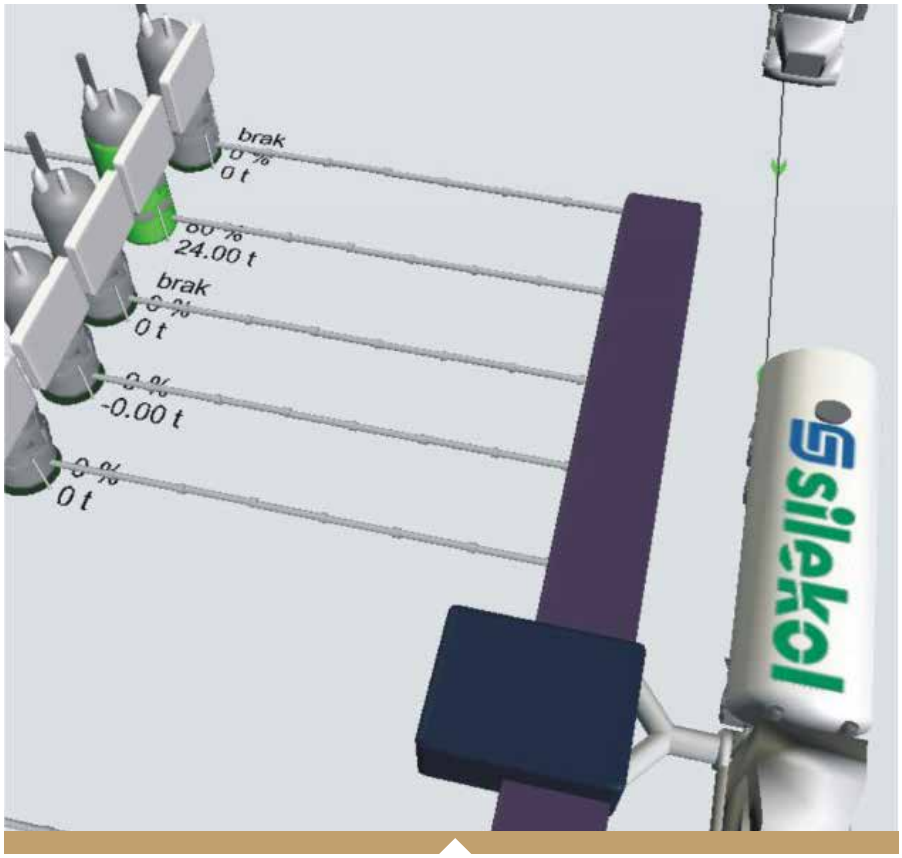

Fig. 2: An excerpt from the simulation model. Filling a tanker truck with finished product in a simulation environment.

Silekol, like Metroplan, has the openness to innovation written into its business DNA. Based on 25 years of manufacturing experience, backed by state-of-the-art facilities, Silekol offers adhesive systems (resins and hardeners) to ensure that the required ecological parameters of wood-based products are achieved while maintaining the efficiency of production lines and meeting the physical and mechanical requirements of the products. The company also has a research and application center that provides technical and development support to business partners who are looking for new market and product challenges. Importantly, Silekol is committed to green solutions, and its technologies are based on innovations that benefit the environment, as well as providing sustainability for business.

The similar values of the two companies allowed for fruitful cooperation, and ultimately yielded satisfactory results, as well as great opportunities for further optimal development of the resin plant.

Simulation model for high-speciality resin production plant - Opportunities and challenges

The main objective of the simulation model for the high-specialty resins production plant was to diagnose the process elements that needed to be improved in terms of production efficiency, as well as to find ways to optimize the process. The simulation model made it possible to analyze the company's internal processes in a safe environment, find and solve problems, known as bottlenecks, and adjust sales and customer service processes to optimal conditions.

The developers of the model themselves describe it as inconspicuous, yet powerful. Although Metroplan's engineers focused on only a portion of a huge plant, the simulation model allowed them to achieve significant financial savings and optimize key operations, leading to a profit increase of almost 10%. The approach of using recurring factors and processes as variables to give a broader view of the situation proved to be a hit.

The simulation model helped identify critical elements of the process that need to be modified and determine at which stages inefficiencies are occurring. Above all, it allowed solutions to be found and specific actions to be identified to improve process efficiency. The model also makes it possible to estimate the cost of 1 hour of downtime of a specific plant component, regardless of the cause (e.g., failure or other factors). The developers of the model and Silekol indicate that the model has further potential for development and expansion.

Fig. 3. One of the reactors, which is part of a complex of specialized reactors, provides the ability to produce highly specialized resins in both simulation and real-world environments.

In the end, the 3D model opened up many new possibilities for Silekol, but the project also involved significant challenges. Preparing the model, including setting all the parameters and strategies, is quite time-consuming, as we have the ability to set many parameters including exact production schedules, loading times, or even the speed of the pourer, etc. Thanks to the use of the simulation model, we are able to predict what benefits will come from increasing the loading speed of the tanker at the productivity level. It is also worth noting that this type of project is still rare, and is certainly rare in the Polish reality. Innovative projects are associated with great satisfaction, but they are also fraught with considerable risk. Metroplan specialists took care of its comprehensive implementation - from the preparation of the model, through thorough testing of its functionality, to training of Silekol employees so that they could use the tool freely.

The whole project would not have had a chance to succeed, of course, without the enormous commitment of Silekol representatives. These approached the task very professionally, and a special team was set up to introduce Metroplan to the secrets of the resin production plant. Testing the model, although time-consuming, made it possible to hand over a design that actually constituted a detailed production plan, with all the necessary elements, variables, and parameters. Silekol employees have access to the data in real time, so they can react to changes in real time.

Already at an early stage, the simulation model allowed the bottleneck to emerge - it turned out that the waiting time for transport was prolonged, and the pourer was also identified as a point requiring optimization. Time in the case of resin is extremely important, as its shelf life is limited to 48 hours. This, in turn, is one of the biggest challenges in daily resin production. The cost of downtime is enormous, so an accurate diagnosis of its causes is the first and most important step toward improving product flow.

Thanks to the model, there has been a complete optimization of production with an increase of 12%, which means huge financial benefits on an annual basis. Silekol approached the cooperation extremely professionally from the beginning. Its representatives were well aware that, with the right commitment, they would gain not only a predictive tool but also a production model that

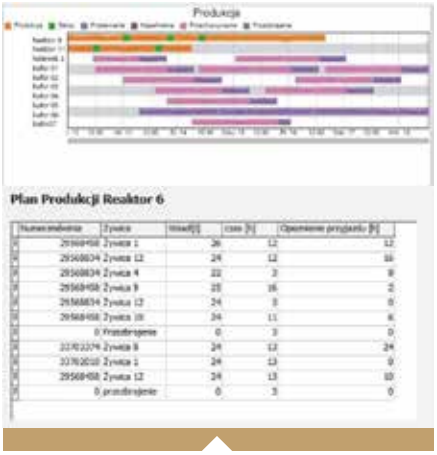

Fig. 4. Excel report based on an example parameter set.

could be successfully used in everyday work. Currently, Silekol is using the simulation model as its only planning tool.

Case study

We already know what opportunities the resin production simulation model has opened up for Silekol. Let's now take a step-by-step look at how the project worked. The 3D simulation assumed that it would be a simulation model that mapped the entire production process of highly specialized resins.

The scope of the simulation included not only the current state of the system but also its envisioned sizable form - expanded to include a newly established production facility.

The total scope of simulation work involving the visualization of production processes required a lot of preparatory activities, without which the project would have had no chance of success. Activities began, of course, with the collection and analysis of data, as well as the preparation of batch data for the program. Next, the resin production plant was mapped in the form of a simulation model.

The model took into account process and flow logic. The next step was to merge the current production plant into a single system with the newly established plant. Metroplan engineers also conducted a simulation study that included various scenarios of system operation, performance evaluation, and identification of bottlenecks. Finally, after making sure the model was working properly, it was time to train Silekol employees on how to use the model.

The simulation project was divided into 4 phases to systematize the processes.

1. **Data and requirements**
Metroplan specialists collected and analyzed data and prepared parameters for production equipment based on current technology and requirements. They obtained this information by visiting the site and collecting the necessary data.

2. **Process visualization**
In the process visualization phase, 3D models of impregnation resin production lines were created, making it possible to present the actual production process in a more realistic and understandable way.

3. **3D simulation**
As part of the simulation, the 3D simulation model was tested and evaluated and validated. The goal was to verify the correctness of the model's operation and its compatibility with real production processes, which made it possible to obtain reliable simulation results.

4. **Operation of the model**
Metroplan provided training for operators to ensure the effective operation of the model. Operators were given adequate competence through training and materials (text and video) to supplement the operation manual.

3D simulation models are an effective tool in logistics and production. They allow virtual testing and optimization of processes, leading to cost savings and sustainable production.

Simulation is a tool for analyzing and managing electricity consumption in enterprises

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The study shows how simulation can analyze power reduction scenarios, optimize processes, and potentially lead to cost reductions in manufacturing companies, given the evolving energy sector and external disruptions.

The transformation of the power sector, the coronavirus pandemic, political crises as well as the automation of business processes are all factors in the changing conditions for businesses. The nature of these changes can create the need for companies to respond quickly. With rising electricity prices, enterprises need access to tools that can help them flexibly manage their power and energy consumption. In doing so, demand flexibility needs to be harmonized with the core processes of on-time and volume production.

This problem was recognized by researchers Justyna Smagowicz and Cezary Szwed from the Faculty of Management at Warsaw University of Technology, as well as Dawid Dąbal from FlexSim Intermarium and Pavel Scholz from the Faculty of Mechanical Engineering at the Czech Technical University in Prague. Together, they developed a multi-stage method for managing energy consumption in an enterprise using simulation modeling.

The method comprises six steps:

1. Defining the subjects of energy consumption research.
2. Identification of enterprise resources in terms of power and electricity consumption.
3. Modeling individual detailed resources of an enterprise due to electricity consumption.
4. Building a simulation model of a manufacturing system.
5. Verification of changes in electricity consumption with the simulation model. Power limitation addressing.
6. Recommendations for the production process activities.

The subject of the study was the production cell of a selected mechanical engineering enterprise. The cell consists of four machines and two belt feeders. It produces two types of products (electric motors components for production machines). There is a buffer between each workstation, and an operator is assigned to each workstation. Simulations were used to test different scenarios for how the production system would react to limited power (power constraints).

The fourth and fifth stages of the method used simulation models developed using FlexSim. Energy consumption was modeled for resources in the simulation cell. For each resource, an energy consumption profile was determined depending on the state of the machines (off, processing, warming up, idle) or the type of resource.

The manufacturing process was mapped using data on the duration of each operation and the volume of energy consumption for each state on a specific machine. Simulations were performed for a specific set of production orders scheduled during an 8-hour shift.

Model logic was built using ProcessFlow and was based on three main elements.

- The production schedule, including the size and sequence of orders.

- The flow of materials through the system, including the identification of the effects of running a particular workstation to achieve the production process goals.
- Allocation of limited capacity to workstations, including the prioritization of individual workstations in the allocation process.

The simulation experiments were used to analyze the possible strategies for the company to deal with power curtailment in the assumed time interval. The analysis was performed at two levels. First, for different scenarios of reducing available power by 5, 10, 15, or 20 kW. Second, for different scenarios of handling the situation by the production system. The following factors were examined in each experiment:

- Process execution time [min.]
- Total electricity consumption [kWh]
- Overtime for employees, per workstation [min.]
- Maximum machine load [%]
- Minimum machine load [%]

Four scenarios were proposed for each level of power reduction was simulated.

1. Operations are executed in sequence, starting from the last workstation.
2. Production with the assumption of maintaining work for selected workstations (M2, M4) – machines were chosen based on production technology.
3. Maximum use of the bottleneck – according to the theory of constraints.
4. Disabling the production (every workstation state Idle) for the period of the peak power reduction.

Selected findings are presented below (fig. 1-3).

The third scenario in many cases proved to be dominant in most of the factors studied. Based on the results of the simulation experiments, practical recommendations were developed for the enterprise.

The study confirmed that the simulation can be a tool to verify the feasibility of the adopted production schedule, under certain conditions of power sufficiency and energy cost. The model can be used to determine the adverse effects of reducing power consumption, as well as a tool to seek process optimization in terms of power consumption. Such use of simulations along with the proposed methodology could provide potential cost reductions in manufacturing companies.

The limitation of available power can be a "hard" constraint (lack of power in the system) or a "soft" constraint (very high energy prices). The proposed solution can be applied in both situations. The first case may seem unlikely at the moment, but its importance will grow with political pressure to fully replace conventional energy sources with uncontrolled renewables. Signs of the second case are already visible in energy market. Enterprises should start preparing today!

Funding

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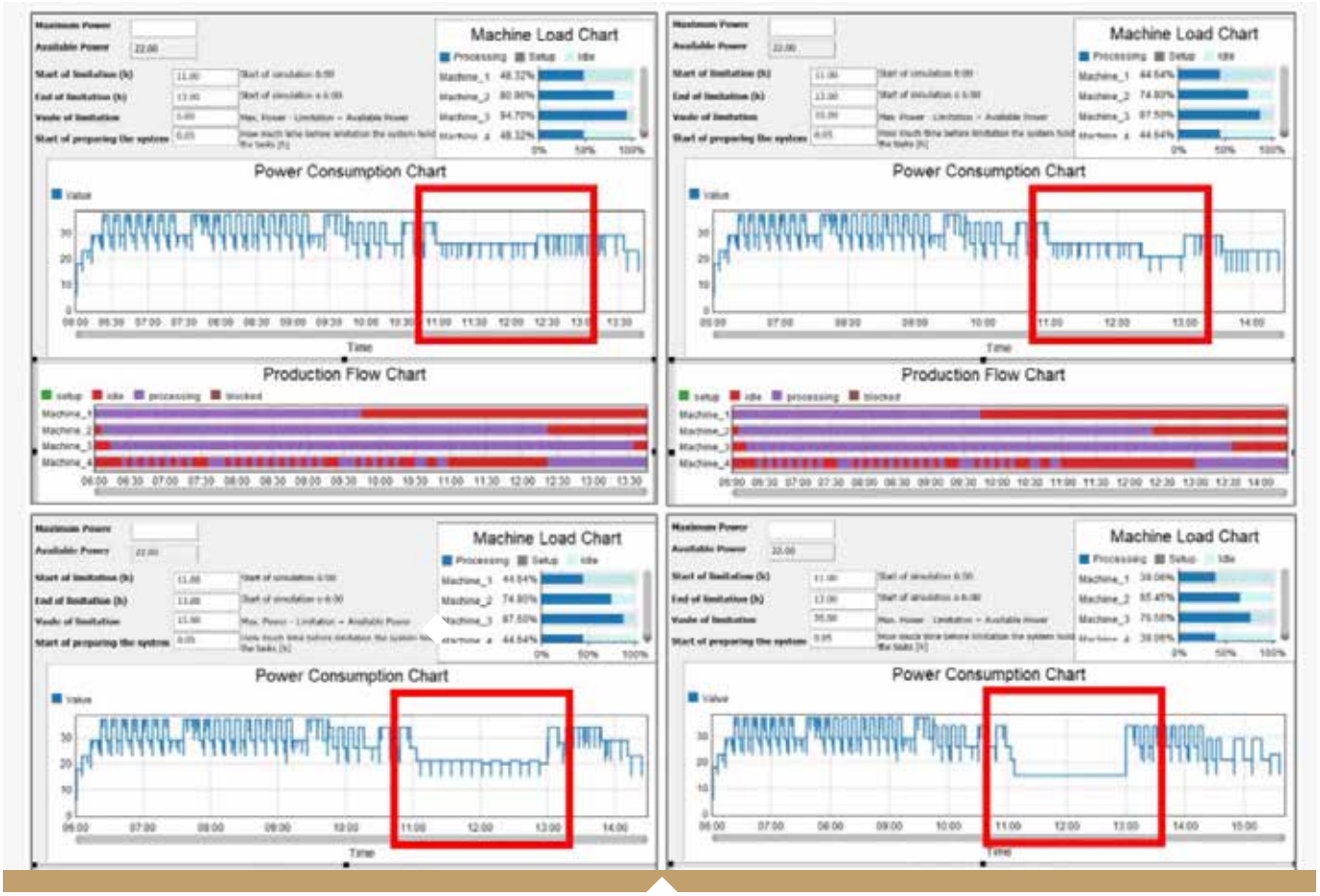

Fig. 1. Sample results from 3rd scenario – power consumption and production gantt (source: Smagowicz Justyna, Szwed Cezary, Dąbal Dawid, Scholz Pavel, A Simulation Model of Power Demand Management by Manufacturing Enterprises under the Conditions of Energy Sector Transformation, Energies, 2022, vol. 15, nr 9, s.1-27, DOI:10.3390/en15093013).

	1st Scenario				2nd Scenario			
Factor	**Variant 1**	**Variant 2**	**Variant 3**	**Variant 4**	**Variant 1**	**Variant 2**	**Variant 3**	**Variant 4**
Process execution time [min.]	489,60	493,20	504,00	576,00	492,00	493,20	541,20	576,00
Total electricity consumption [kWh]	238,50	239,63	242,25	260,25	239,21	239,63	251,55	260,25
Overtime for employees, per workstation [min.]	9,60	13,20	24,00	96,00	12,00	32,00	61,20	96,00
Maximum machine load [%]	M3—90.09	M3—89.36	M3—87.50	M3—76.56	M3—89.66	M3—89.36	M3—87.50	M3—76.56
Minimum machine load [%]	M1/M4 45.96	M1/M4 45.59	M1/M4 44.64	M1/M4 39.06	M1/M4 45.75	M1/M4 45.59	M1/M4 44.64	M1/M4 39.06

Fig. 2. Simulations results for 1st and 2nd scenario (source: Smagowicz Justyna, Szwed Cezary, Dąbal Dawid, Scholz Pavel, A Simulation Model of Power Demand Management facturing Enterprises under the Conditions of Energy Sector Transformation, Energies, 2022, vol. 15, nr 9, s.1-27, DOI:10.3390/en15093013).

	3rd Scenario				4th Scenario
Factor	**Variant 1**	**Variant 2**	**Variant 3**	**Variant 4**	**Maximum Limitation Variant**
Process execution time [min.]	465,60	504,00	504,00	576,00	576,00
Total electricity consumption [kWh]	232,67	242,25	242,25	260,25	260,25
Overtime for employees, per workstation [min.]	-	24,00	24,00	96,00	96,00
Maximum machine load [%]	M3—94.70	M3—87.50	M3—87.50	M3—76.56	M3—76.56
Minimum machine load [%]	M1/M4 48.32	M1/M4 44.54	M1/M4 44.64	M1/M4 39.06	M1/M4 39.06

Fig. 3. Simulations results for 3rd and 4th scenario (source: Smagowicz Justyna, Szwed Cezary, Dąbal Dawid, Scholz Pavel, A Simulation Model of Power Demand Management by Manufacturing Enterprises under the Conditions of Energy Sector Transformation, Energies, 2022, vol. 15, nr 9, s.1-27, DOI:10.3390/en15093013).

Interview with the founders and owners of FlexSim

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LEADER

The Wroclaw University of Economics and Business hosted one of the FlexSim InterMarium Tour 2023 series conferences on 18 May this year. The event took place at the inQUBE University Business Incubator and the Business Processes Simulation Center, located at 67 Wielka Street, in Wrocław.

InterMarium Sp. z o.o. (the exclusive distributor of FlexSim software for Central and Eastern Europe, based in Kraków) organized the conference, and hosted by Krzysztof Nowosielski, Ph.D., Professor of UEW, Head of the Business Processes Simulation Center at the Wroclaw University of Economics and Business.

Roger Hullinger and Bill Nordgren—founders, owners, and managing partners of FlexSim Simulation Products, Inc.—were the event's special guests. We took this rare opportunity to take an interview with them.

It is worth reading what they said to Krystian Kogut, International Sales Director and Member of the Board at InterMarium.

Krystian: Bill, Roger, thank you for attending this event. Your presence in Wrocław makes today's conference unique among many other events we did this year. Please, answer a few questions for the readers of our Simulation Manager Magazine. Let's start with the history! Roger, could you please describe the most important milestones on the road to developing FlexSim as a company?

Roger: The first milestone was getting the right people involved to help develop the simulation software. We announced the software in December 2001 and gave ourselves a year to prepare the first version. So, the first step was to get the right people, and they were integral to reaching that first milestone and launching our product. The second major milestone was achieved in March 2007, when we updated all object logic to use FlexScript so the software no longer needed to compile C++, which was a huge benefit to our users in terms of speed and convenience for building models.

Bill: Yes! Of course, this was a big deal. The version we introduced without needing to compile C++ before every simulation run was a big one.

Roger: Another significant milestone was the inclusion of Process Flow. We realized that we needed to build facilities more precisely for the material handling and advanced manufacturing industries than for other industries. Process Flow enables us to do this, so it represents an important milestone.

What are FlexSim's core values and why?

Roger: Values are supposed to make everything easier. When you treat people well, they will come back to you—even if you fail sometimes—because they notice that you put in the effort to help them. So our approach, which we talked about, is our slogan, our motto, our mission—solving problems for people. People contact us when they need support or when things aren't going perfectly. But the good news for us as a company is that in the production environment, the materials area, warehousing, distribution, and logistics, things never go perfectly. There are always challenges. That's why simulation is a tool that helps us focus on our mission—to help people solve problems.

It's concerning the clients, yeah, but what about treating your staff or distributors?

Bill: The average seniority of our employees is around 10-11 years, maybe even 12.

Roger: We've had very little staff turnover in the last 10 years. We have really only lost two good engineers in that time, but we still keep in touch with these individuals and invite them to office parties and events.

There is a team atmosphere at FlexSim, which we also see at InterMarium. It is important that everyone feels responsible for their role to ensure that the whole team functions well. We all realize that our work affects each other, and we are motivated to do our part to succeed together. This is key. As for FlexSim, we have an established bonus program that focuses on equal revenue sharing. Our goal is not just the performance of one person, but more importantly the good performance of the whole company. How we perform as a team has become more important to us than individual performance. This ensures that everyone is involved in the success of the company. Our bonus system is well-organized and effective, which keeps all employees engaged.

Bill, let me ask you. What is your opinion on why FlexSim is considered the best discrete event simulation software in the world? Do you think it's just a matter of coincidence or the result of deliberate action?

Bill: Well, I think it's the result of our approach to software development and the idea behind it. Our main goal was to build a flexible product and a family of products, which we are now building on FlexSim. We offer our customers the ability to implement their own solutions into the core and

develop their assets using our software.

This allowed external companies to create modules that increased the functionality of FlexSim—which was really important. As a result, we were able to respond to market changes, implement unique features that other software doesn't have, and make it easier to use.

In terms of FlexSim's ranking as the best software on the market, I believe this is due to its ability to adapt flexibly and make work easier. This was the intended strategy from the very beginning and it's great to see how it has evolved over the years. When we come to you and see what projects people are doing at this university and how other companies are creating the future of the industry using our software, we are sometimes amazed, but it also gives us new inspiration to grow.

Roger: Yes, I think the key to success is the people you have. You give them the freedom to do things and the opportunity to implement ideas. It's important to find the right people! It's good to have engineers on your team who are creative, ambitious, and want to actively solve problems. They're extremely bright, but they're also aggressive in a positive sense because they're determined to create things that benefit people and that people can use in the future.

That's why FlexSim is such a great tool because it has valuable people on the team—smart and creative individuals. It is thanks to them that we achieve so much success!

And could you please share if it's possible some general statistics regarding FlexSim usage in different business sectors?

Roger: We talked about this the other day. If you look at the different business sectors, probably 55% of worldwide use is in manufacturing, 35% to 40% is material handling, warehousing, distribution, and logistics, and the rest is a variety of industries. Among these are service industries such as healthcare or banking.

Bill: Yes, we provide many solutions for various types of supply chains for the manufacturing and service sectors.

Roger:

Roger: The production, storage, distribution and handling of materials are really difficult tasks.

And what are your predictions for the development of the simulation in the short and long term, i.e. in what direction it might go?

Bill: We've discussed this for a long time. Over the past three or four years, we have greatly expanded the capabilities for modeling Digital Twin solutions. However, some steps are still needed to reach its full potential, such as integration with external software. We have already introduced features such as emulation, machine learning, artificial intelligence, and database connectivity options, which enable us to connect FlexSim with other software. This is a valuable feature set because after importing such a factory and transforming its models into flexible objects, we can immediately start simulation without having to repeat the entire project. This gives us time and efficiency gains. As we look to the future of Digital Twins, we are emphasizing the development of artificial intelligence, the ability to connect to different data structures, and the importing of already-finished solutions. This way we don't have to start from scratch. These are the key areas we are currently focusing on.

We are just after the visit to the Business Process Simulation Center which is powered by simulation games. Decision simulation games made in FlexSim. So do you have already some idea or vision of how important or what benefit there may be in such a project? Projects like simulation games?

Roger: I think what has been done here is really

brilliant! It's a very intelligent approach. It allows students to understand that their decisions matter. When they are faced with a problem, or a situation that requires a decision, information is key. The more data, the better. The more accurately informed the student, the more accurate the decision they can make. This is what we teach them in games, that they need information. When they have it, they can develop a plan, set a direction, and thus make wise decisions. In this way, we teach students that every decision has consequences, which can be positive and beneficial or negative and costly.

Bill: Yes, we have used games in the past, but not to such a large extent. For example, we have a zombie game that involves building a factory and protecting it from zombies, otherwise, it will be destroyed. There's also a game with space cow kidnappers, where alien beings attack and suck out cows if you don't produce enough milk to pay for a shield to protect them. These are just a few examples of different things we've done in games. But now we've taken it to a new level. I'm surprised to see how complex these games are, how many aspects they cover, and how they put the process into practice. It really teaches students how to act in real life, in real business conditions. These are not simply games that just show some resemblance to what companies do. These games actually give real business justification. And most importantly, students have fun, which is extremely important in the learning process.

Roger: Of course, the game also promotes validation on multiple fronts. What is happening is visible, and the reactions to the decisions I make are immediate. When I make a decision, I can immediately see the results of that decision visually in the virtual space, as well as in the statistics and results that appear. That makes a big difference and is an important aspect of the process.

Could you maybe unveil what important features we can expect to be added to FlexSim soon?

Bill: I think we are now focusing on developing areas related to material handling, especially in the context of the Digital Twin. Anything that is helpful for database connectivity, a variety of ways to visualize the process, as well as our collaboration with NVIDIA, are elements we are putting more emphasis on. We will soon see more improvements in the software, especially in terms of connectivity to other products. This will avoid the need to reinvent the wheel and rework what has already been done.

Roger:

Roger: And that is the most important thing. When Bill talks about connectivity, he means connections to different products. Our goal is not just to create a single AI module and end up with that. As he said, we can connect, create interfaces to integrate our software with other products, and then connect those interfaces to create more interfaces, and that in turn allows us to make further connections. So we don't have to worry about what kind of AI system someone prefers. FlexSim can work with it and be integrated with it.

Bill: We are also currently working on cloud solutions. This would make it possible to run FlexSim in the cloud, create applications that did not exist before, support multiple users. We are analyzing different operating systems capabilities so that, for example, it can run on both Apple and Linux without any problems. Maybe one day, FlexSim can be used on mobile devices!

Roger: So, the Linux version is likely to appear next year. The version for Apple, on the other hand, is quite close to completion and is currently running at about 80%. Many people are asking, is it worth going in this direction? Well, the development of the Linux version will prove to be very helpful. In addition, cloud-based applications and a version for Apple will be a great support in schools. We see over time that more and more schools, including engineering groups, are using Apple computers instead of Windows computers. This allows us to better serve their needs and provide them with the right tools.

And now a very simple question. If someone is considering buying FlexSim… Why should they buy it?

Bill: They should buy it because it is the easiest to use, most comprehensive, and most functional simulation product. What I mean by that is that it requires less programming and is intuitive. Many companies choose to switch to FlexSim from other products they had previously purchased after discovering that those others did not meet their expectations. With FlexSim, they can do what they really need.

Roger: I think one of the advantages of FlexSim is that new users, even after just an hour of simulation training, are able to build a model in FlexSim that is useful and valuable. If they have a day of training behind them, they can create a more complex model, and after a week of training, an even more complex model. That's the cool thing about FlexSim—they are free to take steps and progress according to their level of sophistication. Even if they don't create the most sophisticated models right away, they don't have to worry. The ease of use allows them to continue to create useful models that are sure to become more advanced over time. This is the key to improving as a modeler—they are not expected to create complex models right away. The important thing is to learn by doing so that in a year's time, they will be a better modeler than the year before and be able to create models much better and faster. That's the point, that's the art of improving as a FlexSim user.

Yes, that's true. And I've got one last question for you. So, because together with your team, you created great software and a successful business, what are you the most proud of, and maybe what still needs to be improved?

Bill: I think we are most proud of the knowledge that companies acquire by using our product. This university, like your company, has used it with great success and built a whole successful business around it. Many programs advertise themselves as revolutionary, but in reality they deliver little. What makes us most proud of FlexSim is the fact that it is used by large companies to achieve real optimization and savings. Thanks to their engineers, the company achieves success! This is the best thing you can have when designing software that actually works as advertised. This is proof that FlexSim really delivers on its promises and delivers real benefits.

Roger: Yes, I agree with Bill. However, it is somewhat surprising that FlexSim is used worldwide. Of course, we know its advantages and advantages over the competition. We know how it works in the US, in our home market. We have seen it work, during our visits to South America and also throughout Europe and Asia. During trips to China, we have also seen its widespread use there. The most amazing thing to me is that it is so widely used across the globe.

Bill: And especially in Poland. Yes, in Europe, Poland is one of the leaders. I mean there are a lot of successes and innovations, just look at this games lab in Wrocław. We haven't seen anything like that elsewhere, it's really great!

Roger: Yes, exactly! Not to this extent and on this scale. What we saw in Wrocław surpasses the solutions of any university using it in the US.

I'm glad to hear that and referring to your answer, I have a question... Do you think, that InterMarium stands out from other distributors? And if so why?

Roger: First of all, you have a large and culturally diverse operating area. I was telling Bill yesterday that one of the strengths of InterMarium is also good leadership. I think you have an extremely bright and capable team. And most importantly, as much as we try to appreciate it, it seems to be a team that wants to work together, that strives for success, and realizes that in order to achieve as much as possible, we have to work together. Everyone in the team should do their own thing, do their own tasks, and then things will work out for the better. So I think that's what sets you apart from the others.

Ok, thank you. And what are you proud of and do you still see any things you'd like to improve in your business, maybe in the software?

Roger: Yes, we need to improve our marketing efforts. For most of our existence, we have focused on software development, assuming that the market would notice us. And we have been successful that way, but I think we now need to focus on better promoting our products and services. We need to catch up in this area. Secondly, development work. There are levels of support that are worth exploring to accelerate the use of our simulation. I'm not quite sure exactly what these levels are yet, but there are some things we can do to make it even easier for our customers to use our solutions.

Bill: We have decided to focus on self-learning. Publish more videos, training materials, and other resources to help users better understand our software. We want to create a rich database so that users can easily find solutions to problems they encounter. When someone has a question, they can simply search on Google and a video will appear showing how to solve it. This is to help our customers become more knowledgeable about our software and use it more effectively.

Roger: I was very impressed last night. I reviewed the electronic manual created by InterMarium. I found out how this training was created along with the manual. This is what fascinated me. It's amazing because different people can learn at their own pace, some faster, and some need more time. This flexibility is really clever. That is, people can start from scratch, actually adjust their pace from scratch, go to a formal course and then come back and still use the textbook. That's definitely one of the things that sets us apart. Although we can always refine it further.

Bill: When we come here, we learn. We look at your marketing and say we should be as good as you!

Thank you for the interview and the interesting conversation.

Bill: Thank you very much.

Roger: Thank you.

This is something no one expected

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It is well known that the provision of FlexSim technology and simulation software, is by definition a profit-oriented activity for both sides of the transaction. In connection with the business context of FlexSim, can we talk about friendship? Let's take a closer look at this organization and try to find an answer to the above question.

I have talked to many people about FlexSim over the past 10 years. One term regularly came up - exceptional. And interestingly, it wasn't just about the software itself, which is obvious, but about the people who make up this global organization. High competence goes hand in hand with respect. Looking at the beginnings of FlexSim, one will find that it all started with a few people, first: Bill Nordgren, Roger Hullinger, who previously founded ProModel Corp, and Cliff King. Dr. Eamonn Lavery and Anthony Johnson joined the team next. Without going into details, the beginnings were turbulent and challenging, but with a mix of vision, competence, and friendship, the team released the first version of FlexSim 1.0 in February 2003. At that point, FlexSim set a new standard for manufacturing and logistics process simulation software, a state-of-the-art simulation engine, a 3D modeling environment, and seamless integration with C++-all firsts in discrete event simulation. FlexSim has become the standard in discrete event simulation software.

The beginnings were turbulent and challenging, but with a mix of vision, competence, and friendship, the team released the first version of FlexSim 1.0 in February 2003.

I was not present at the launch of FlexSim, but I have been able to observe the organization for 11 years first from the outside and then from the inside. I must admit that what surprised me the most was the respect they have for others. It is well known that respect is the basis for building constructive relationships, but it also, as it turned out, corresponds perfectly with the Flex, or Flexible, segment in FlexSim's name. This is because respect promotes flexibility in shaping the best offerings for software and services for both parties. Hence the care that the usability of the software and services actually yields significant improvements in the economic and physical measures of the beneficiary organization. The success of the user is in some sense the success of FlexSim as well. Thanks to the fact that FlexSim relies on long-term and mutually beneficial business relationships then, over time, successive customer achievements pile up. Then the mutual effort is complemented and becomes of great value. Under such conditions, friendship can emerge.

As I mentioned before, it all started with leading figures at FlexSim Software Products Inc. and if one is comfortable with the friendship paradigm, he or she will blend well into the global FlexSim family. This has also been the case with me and many distributors and customers I know. Relationships of respect, business, and friendship are also formed between employees, distributors, distributors and customers, and customers themselves. This is an additional value, no less important than money, and it is what gives meaning to the work.

I was really fortunate to have come across partners like Roger, Bill, and many others in the FlexSim family years ago. Thanks to them, I experienced true friendship. I also experienced it from other distributors and customers.

So yes, not only can you talk about friendship in the context of FlexSim, but even without it you can't fully understand how this organization works. And finally, isn't it great that behind FlexSim's success, in addition to its vision and competence, there is friendship verified in difficult conditions?

COLUMN

Managing Simulation as a Project – A Key to Success

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Simulation is an excellent means to support problem-solving and making better decisions, but developing and applying simulations can pose challenges, especially when getting started. Of course, anything of value requires effort and poses risks. Treating simulations as projects and applying basic project management principles improves the likelihood of a successful simulation. This article shows how applying simulation is a project and must be managed as such. It draws from the essential elements of the Project Management Institute's (PMI) Project Management Body of Knowledge (PMBok) [5] and applies them to simulation. This does not imply that simulations require large project teams, only that basic project management principles should be applied regardless of the simulation's size and complexity.

This article is a bit of a diversion from the technical discussions often associated with simulation. As Pereira et al. [4] indicate, most of the literature on simulation is focused on technical topics concerned with modeling and analysis, and there is little discussion of simulation and project management. While they propose an approach for applying project management principles in simulation studies, they differ from the one posed here. The two methods are complementary, not conflicting.

Simulation of Operations Systems

Simulation means many things to many people, and there are various types of simulation. One common type of simulation focuses on work systems or operations systems. Operations systems are prevalent in manufacturing, warehousing, logistics, transportation, supply chains, healthcare, and most business processes. These systems transform input into output using various resources (people, equipment, material, information, etc.) and function in an uncertain business environment. They also exhibit dynamic behaviors (i.e., changing over time), possess inherent variability and uncertainty, and involve complex resource interactions. These traits present significant challenges for designing and managing operations systems. Organizations must adapt to uncertain and dynamic conditions to survive today's challenging business environment and improve to remain competitive. Thus, organizations must change and change frequently. Change creates even more stress on an organization.

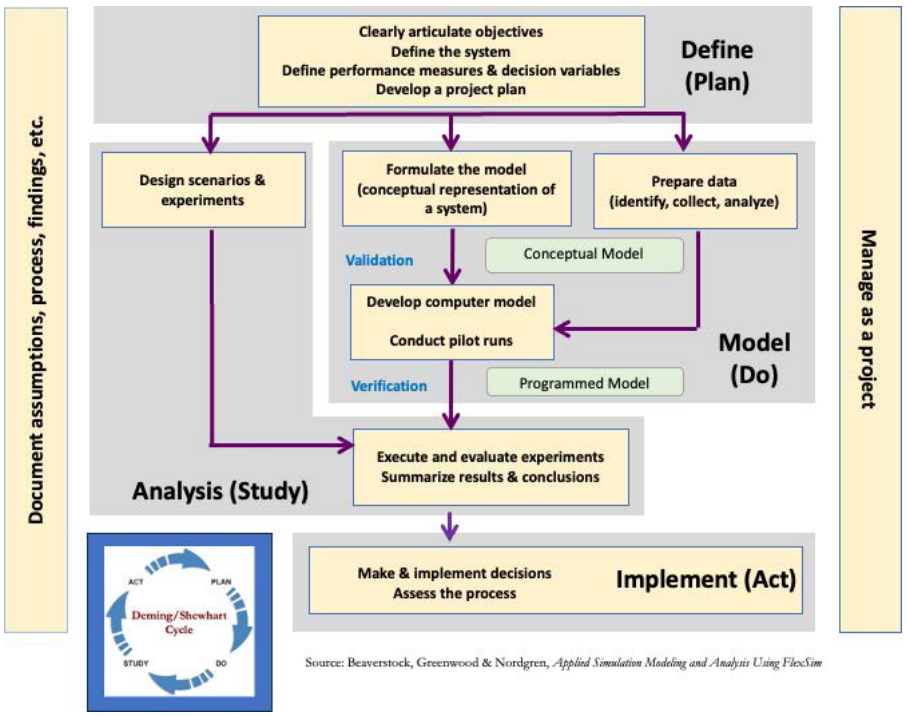
Simulation is especially adept at helping to deal with these challenges and is a powerful tool to support and enhance the problem-solving and decision-making processes. It is used to understand behavior, assess performance, mitigate problems, and generally change/improve operations systems. Simulation can quickly provide measures of the impact of proposed and anticipated changes on an operations system's performance. This is done by representing a system's salient characteristics and behavior in a computer-based model and then using the model to explore alternatives virtually without costly and disruptive changes in the actual system.

While operations may be similar, they are each unique. No two products are made the same, and no two services are delivered the same. This is true if for no other reason than the operations function in different environments. Thus, all simulations are unique.

While all simulations are unique, how they are applied is not – there are common activities that are, or at least should be, performed in all simulations. These activities form a process, and many have proposed a process for simulation modeling and analysis. These processes are generally quite similar; the one the author prefers is provided in the figure to the right [1].

Since simulations are typically employed to improve systems, this process groups activities using a model from the quality and Lean fields - the PDSA (Plan, Do, Study, Act) cycle, also called the Shewhart or Deming cycle. Thus, simulation can be viewed as a process-improvement process with the main elements being Define, Model, Analyze, and Implement instead of Plan, Do, Study, Act. Note that this representation takes a broader view of simulation beyond just modeling and analysis. The author believes all activities in Figure 1 should be applied whenever a simulation is performed, regardless of size and complexity.

Developing any simulation model requires



Source: Beaverstock, Greenwood & Nordgren, *Applied Simulation Modeling and Analysis Using FlexSim*

significant knowledge and information. At least from a technical perspective, the following are necessary.

Simulation knowledge

- Understanding basic modeling and simulation concepts, including the ability to abstract operations systems to represent them as models in software.
- Detailed knowledge of and experience with software like FlexSim.
- Basic knowledge of probability and statistics, including understanding probability distributions, random sampling, descriptive statistics, representing data as distributions, and experimental design.
- Ability to collect, store/retrieve, process, summarize, and analyze data using direct observation, spreadsheets, databases, statistical methods, etc.

Domain knowledge

- Definition of key performance indicators.
- Definition of what characteristics of a system can be changed to gain improvement and which cannot.
- Ability to define, describe, and document how a system works regarding the flow of materials and information (happy path and exceptions), data sources, resource availabilities, etc.
- Access and understanding facility layouts, product diagrams, value-stream maps, spreadsheets, maintenance and quality records, schedules and plans, operating procedures, technical manuals, etc.
- Open access to production and maintenance workers and supervisory and technical staff to discuss their experience with simulated operations.
- Understanding the less technical aspects of the system, such as organizational behaviors.

Common Aspects of Projects

The PMI defines a project as "a temporary endeavor undertaken to create a unique product, service, or result." [5] Clearly, a simulation is a project. As Greenwood [3] describes, all projects, large or small, exhibit the following common characteristics.

- Projects have stakeholders – people who affect or are affected by a project's activity or outcome. Identifying the stakeholders and their roles very early in a project is essential.
- The primary stakeholder is the customer. The main goal of any project is to satisfy the customer's needs.
- Every project is unique. Since they differ from what has been done before, they invoke uncertainty about what is expected.
- Every project is dynamic, i.e., they will change over time, which inserts risks and uncertainty into a project.
- Since resources perform the work and carry out a project's tasks, they strongly influence its scope, schedule, cost, and quality. Their availability is another significant risk factor.
- The type of work and the level of effort vary over time. Thus, different types of resources are needed at different points in time.
- Projects are temporary because they have a defined beginning and end in time.

While each of these characteristics individually creates a need for a project's activities to be planned and managed, their collective impact makes it essential. Projects that are not designed and managed well become less effective and less likely to succeed.

The general characteristics identified above lead to three fundamental tenets about projects.

1. The first two characteristics above lead to the tenet that people perform projects for people.
2. The next three characteristics make it clear that projects are risky, and the risks come from multiple sources.
3. The final two characteristics indicate that projects have a life cycle and evolve through phases with differing focuses. The figure to the right [2] illustrates how the level of effort of typical project phases and their activities change over the life cycle of a project.

Simulation as a Project

The information in the previous two sections is combined to provide critical aspects to address when undertaking any simulation project; they are presented in terms of the three fundamental tenets. Of course, the degree and extent to which these aspects are considered depend on the scale and complexity of the project. However, even in small simulation projects, these aspects should at least be considered.

People perform simulation projects for people

In simulation projects, stakeholders typically fall into two groups – those in a client organization, i.e., the consumers of the simulation, and those in a provider organization, i.e., the producers of the simulation. Even if the same company employs all stakeholders, they likely are from different organizational units and thus have different perspectives as stakeholders.

As described earlier, simulation projects require significant knowledge and expertise from diverse areas and backgrounds. Therefore, at the beginning of a project, it is essential to identify the type of expertise needed and obtain commitments that the persons with these capabilities will be available when needed. The collective of this personnel from both the client and provider organizations creates the core stakeholders.

Of course, the primary stakeholder is the customer. This is someone who will make decisions based on the information provided by the simulation. It is crucial to identify early in the project the type of information the customer needs and when they need it. Decisions are made by selecting the "best" among alternatives. Therefore, it must

be clear what alternatives will be considered, i.e., what specific things will be changed in the system.

Similarly, it is vital to identify upfront how the alternatives will be evaluated and compared, i.e., what is meant by "best." This usually means identifying what performance measures will be used in the comparisons. The measures must be clearly and precisely defined; vague terms like cost or utilization must be more explicit.

The providers must identify and define at the start of a project the types of information and expertise they will need throughout the project. Those who will provide the knowledge and expertise from the client then become stakeholders.

Since things will likely change during a project, there must be means to monitor progress and be attuned to changes that may affect a project's scope, schedule, or cost. Once a change is identified, it must be assessed for its relevance and significance. If it impacts the project, plans on how to adapt must be developed and communicated.

It is also important to identify or at least be aware of the "peripheral" stakeholders, those who are not directly involved in the project but may be affected by its outcomes. For example, a simulation project will typically only involve a few representative workers from the operation. Still, the broader workforce will be impacted by decisions based on information provided by the simulation.

While client stakeholders certainly have different roles in a simulation, they also have different perspectives, expectations, and biases. To improve the chances for success, the providers must understand, address, and manage these differences. Providers may also have to take on other roles besides model developer and analyst, such as being an investigator to pursue more deeply how a system works, an educator to help stakeholders understand simulation, a facilitator to help with implementation, etc.

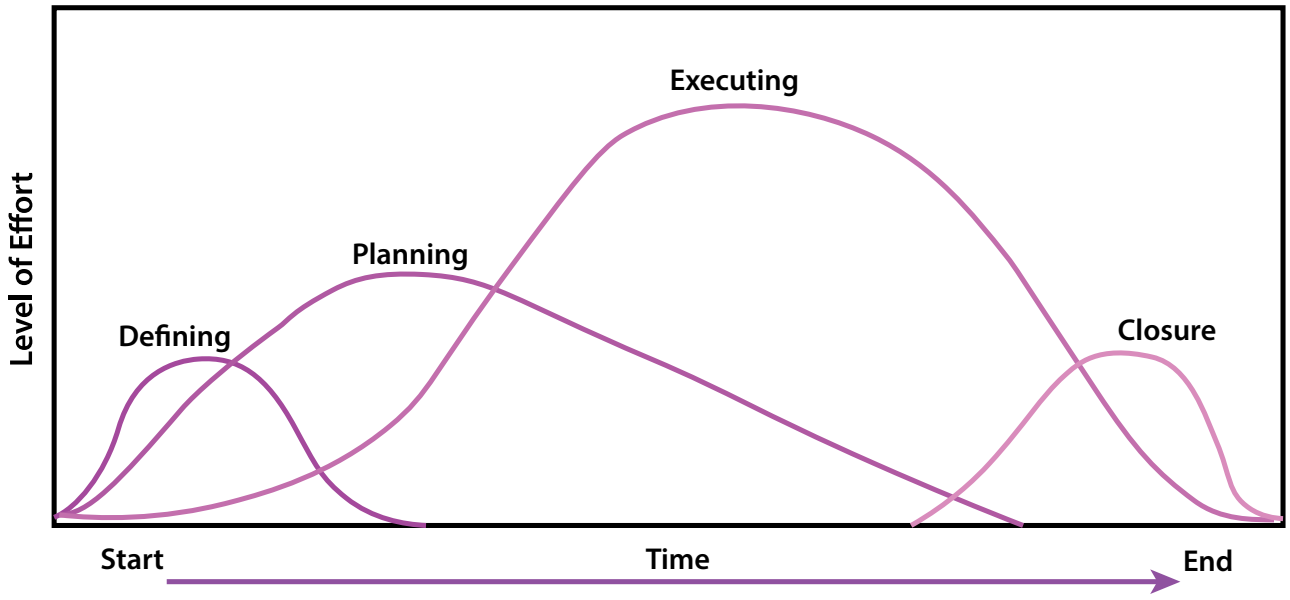
As systems become more broad and more complex, the number and diversity of stakeholders increase. This increases the risks and uncertainty and thus requires more time to deal with problems that will likely arise. This must be accounted for when developing a project plan.

This tenet relates well to Shannon's [6] discussion that simulation is both art and science. In this case, art refers to the ability to abstract and simplify a system so it can be modeled, clearly define and structure a problem, provide creative solutions, communicate and collaborate with stakeholders effectively, etc. Science refers to the more technical aspects of simulation – logic building, data analytics, computer programming, statistics, etc. This leads to the fundamental notion that technical competence and people skills are both necessary, but not sufficient, conditions for success. Therefore, to be successful, simulation projects require balancing people and technical issues (art and science).

Simulation projects have a life cycle and evolve through phases

The general project phases described above are too broad to be of much help in simulation projects. However, the activities in the Plan-Do-Study-Act cycle are similar in meaning to these phases but are much more expressive. Also, these activities are similar across simulation projects regardless of size and complexity. Therefore, these activities are shown as phases in the figure to the right. The figure shows how the level of effort for each phase varies over time. Of course, these are just for illustration purposes and will differ for each project. However, they do indicate general tendencies, such as most of the early efforts should be focused on definition and planning, most of the work involves modeling, and it dominates the middle part of the project, etc.

Notice that two simulation-specific activities are added to the figure - validation and verification. Validation is concerned with building the right model, and verification is concerned with building the model right. While each is shown as only

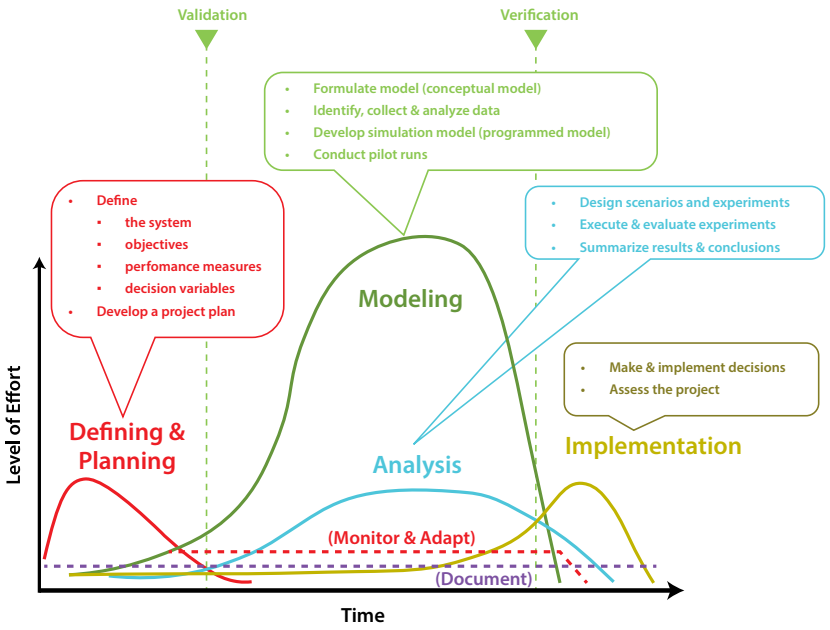


Defining
1. Goals
2. Specifications
3. Tasks
4. Responsibilities

Planning
1. Schedules
2. Budgets
3. Resources
4. Risks
5. Staffing

Executing
1. Status reports
2. Changes
3. Quality
4. Forecasts

Closure
1. Train customer
2. Transfer documents
3. Release resources
4. Evaluation
5. Lessons learned



one activity in the figure, they are typically performed multiple times over the project's duration. They usually occur as reviews of the model(s) with stakeholders.

Another two activities - Monitor & Adapt and Document - are included in the figure; dashed lines indicate both. The activity Monitor & Adapt requires continued interaction with stakeholders, especially with the customer, to identify changes in the system or environment that may impact the simulation project. If it is determined that a change has or will occur, develop a means to adapt. The Document activity means that the essence of all discussions, assumptions, and decisions needs to be captured and communicated to all relevant stakeholders. As shown in the figure, both activities typically occur throughout a project.

Simulation projects are risky, and the risks come from multiple sources

All simulation projects contain risks and uncertainties. These can negatively affect the primary constraints on projects and the overall measures of success - content/scope, time, and cost, i.e., a successful project delivers the agreed-upon content on time and at the planned cost. Some risks involve technical issues such as misrepresenting the operations, making flawed assumptions, using erroneous data, incorrectly performing analyses, etc. However, risks often result from non-technical difficulties, such as poor communication, misunderstandings, false expectations, insufficient time, etc. The project management body of knowledge offers many means to minimize and mitigate risks and make projects more successful. This paper only provides a few, but these can significantly impact making simulation projects more successful.

Just viewing simulations as projects, focusing on people issues in addition to technical problems, and developing a plan and monitoring it as a project progresses, are significant first steps to identifying risk factors and means for dealing with them.

One of the most prominent risk factors is inadequate planning and lacking clear definitions and understanding at the beginning. Too often, organizations do not want to expend time and resources to plan, and there is a desire to quickly start doing "work," e.g., in simulation, begin working in the software. This will likely lead to delays later in the project, just as the adage suggests - there is never time to plan at the beginning, but somehow there is time for rework at the end.

When planning at the beginning of a project, to use a quote from Stephen Covey, it is best to "begin with the end in mind." That is, clearly understand what the simulation project should deliver. This means defining clear objectives that all stakeholders adopt.

A key activity in any project's final phase is to critically assess the project to identify best practices and items that can be improved. This is critical for reducing problems and risks in future projects.

While simulation is widely regarded as a powerful problem-solving and decision-making tool, it becomes even more effective when applied through a project management lens and is recognized as a blend of art and science. Adopting the approaches described in this paper should help simulation projects be more successful.

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Knowledge management vs. simulation tool - how to implement FlexSim in your organization to make it a competitive advantage

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Knowledge management vs. simulation tool - how to implement FlexSim in your organization to make it a competitive advantage.

So there is a decision to purchase the software; that's great but... it's easy to fall into the so-called productivity trap that is, a situation in which investments in new technologies or machines do not bring the expected results. It's a situation in which we see improvements in efficiency but relatively small compared to expectations and opportunities. According to Drucker, the basic source of the problem is the mistake of not distinguishing between information and knowledge. There is information in the books, a lot of data and statistics come to us every day in our workplace - after all, we have to manage based on some indicators, right? But knowledge is a matter of interpretation and understanding derived from competence and experience - not feedback from the equation. Try reading into your blood test results unless you know the norms and significance of the occurrence of given factors, then you can't deduce anything of value.

Knowledge

In the scientific literature we can find many definitions of knowledge as such, but I do not want to cite them here. To me, however, three characteristics of knowledge appeal most:

1. Subjectivity of knowledge - it depends on the experience of the user and the context.

2. Self-supply - knowledge does not wear out as it is used, it is the other way around, that is, it grows when it is used.

3. Impermanence - knowledge quickly becomes obsolete.

A distinction is also made between group knowledge, these are:

- procedures
- actions
- rules
- habits
- etc.

The question is why are we interested in all this in the context of simulation software? Because through the participation of each person in the organization, knowledge can become a resource that is difficult to imitate. Which means that a simulation tool should not be just an information production machine - a calculator that will provide the result of an equation. The simulation model should be the de facto language of communication between team members, between the department analyzing an issue and another department that will be affected by the results of the analysis. Finally, the model should also be a means of communication between engineers and management, who must make difficult decisions in a constant information deficit. FlexSim helps to better understand what occurs from a given situation and what consequences and results we can expect. Understanding the role of the simulation model in this way, we can start talking about a learning organization. That is, one that consciously adopts the assumption that the basic creation of the value of the entity's functioning is a systemically produced knowledge resource, not financial or physical capital.

Design approach

To avoid the productivity trap, it makes sense to

use a project approach when implementing FlexSim. Yes, deployment - although for many years I thought FlexSim was an acute IT tool that didn't need deployment. Simple installation, training and then start modeling. All in all I was right, but only partially... because FlexSim is indeed not implemented technologically, but rather we are talking about process implementation which is necessary so that simulation does not become a niche tool used only by one department or a single engineer - which will not give it a chance to become a competitive advantage for the organization. As I mentioned earlier, the simulation tool provides information only when combined with the experience of engineers, their unique interpretation and team use can become a separate knowledge-producing system. This is only going to be a competitive advantage. Simply put, we make better decisions, in less time, and in parallel making fewer mistakes and saving key resources.

Therefore, it makes sense to use a design approach when implementing the simulation into the company's processes. A workshop should be held with a team of users and decision makers to answer the questions:

What are the most important goals of a software purchase? You will certainly find that there are at least a couple of them. Then, which are the most important "must haves"?

What stakeholders do we have in our project and how will their work be affected by the use of simulation? As in life, there is always a discrepancy between the level of benefits and losses for different audiences - and how to manage this situation?

From the field of project management, there are still many areas to take care of, including benefits management, scope, schedule, budget, quality, risk, team, communication, documentation and reporting, purchasing, change, and this list is probably not finished. If you would like a Project Grid to help manage such a project please contact me after reading this.

If we head to the conclusion that FlexSim can be a competitive advantage, we have to consciously make it happen. Buying the tool is only the first step in this direction - a necessary step, because without simulation it is impossible to analyze many things. According to Porter, the strategic positioning school focuses on unique activities that lead to a specific position in the market, so market position is crucial. To achieve it, it is necessary to think about the company's resources. So, what appears to us is a set of tangible and intangible resources and capabilities, through the use of which the company obtains a competitive advantage.

The organization's resources are key in this context. And, as we mentioned, generating knowledge and using it in a systemic way can become a separate system that produces unique knowledge - which directly constitutes a competitive advantage. Each entity has a unique composition of resources and capabilities that can condition success but not everyone knows how to use this.

So there will be organizations that weave simulation into their processes and start managing by proven knowledge - and in such an approach there is little room for intuition, hunches and "it seems to me." But there will also be companies that invest in an innovative analytical tool like the FlexSim environment, but treat it like a calculator that sits somewhere in a desk and occasionally taps out a few numbers on it looking for information... information, but not knowledge. However, it should be added that this challenge occurs always and in every company. At FlexSim InterMarium, we have a solution for this, which we try to use when working with clients.

Recent events

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Photo 1. Filip Polit, InterMarium during his speech at the LogInPack Congress in Kielce.

As you know, our ultimate goal is, following the example of the United States and highly developed countries, to establish FlexSim software as the standard in process simulation in our part of the globe. Achieving this goal is a process and we believe it will be the result of taking many small steps. That is why, especially for you, we are organizing a very large number of different events, large and small, carrying great content value. Below, we list the more important events of the past year.

Photo 2. InterMarium Simulation Conference participant, 2022.

InterMarium Simulation Conference, September 2022

The first conference in this format. 120 participants from 10 countries came. We ourselves were very positively surprised by such a large presence of FlexSim supporters from half of Europe. On our YouTube channel, FlexSim InterMarium, we have published a series of interviews and speeches recorded during the conference. We invite you to watch!

Photo 3. InterMarium Simulation Conference, Kraków 2022.

Simulation Manager magazine

That is, the magazine you hold in your hands. In September 2022 we published the first issue both in print and online via the website: simulation-manager.online. Our intention is for the Magazine to become a "display stand" showcasing the latest developments in event simulation in the FlexSim tool. Help us in our mission and recommend the Magazine in your educational and business environment. Online access is free of charge!

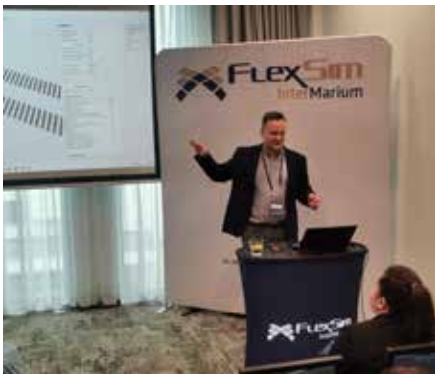

Photo 4. Grzegorz Stańczak, Spedimex/ ID Logistics, at the FlexSim InterMarium Tour in Łódź.

FlexSim InterMarium Tour 2023

In just 3 months we held 8 business meetings in different locations, both in Poland and Romania. We visited Kielce, Łódź, Mielec, Wrocław, Poznań, Warsaw and Bucharest. We have had hundreds of conversations, dozens of lectures, and presentations, and Dawid Dąbal is able to demonstrate the superiority of the FlexSim tool over Excel both after 4 coffees and while sleeping. We would like to take this opportunity to kindly thank our special guests for attending the conferences. You have made an invaluable practical contribution to the content of these events. We also thank the hosts at whose invitation we organized the Tour this year. Below is a list of both special guests and hosts, to whom once again, as organizer, I say a polite THANK YOU.

Hosts:

- Dr. Sławomir Luściński and Krzysztof Dubaj, M.Sc., Faculty of Management and Computer Modelling, Kielce University of Technology
- Prof. Damian Krenczyk, Mechanical Engineering Department of the Silesian University of Technology in Gliwice
- Prof. Krzysztof Nowosielski, Business Processes Simulation Center, Wroclaw University of Economics and Business,
- Dr. Jacek Diakun, Faculty of Mechanical Engineering, Poznan University of Technology
- Prof. Konrad Lewczuk and Prof. Michał Kłodawski, Faculty of Transport, Warsaw University of Technology

Special guests:

- Maciej Bajor, Automationstechnik
- Grzegorz Stanczak, Spedimex/ ID Logistics
- Prof. Damian Krenczyk, Mechanical Engineering Department, Silesian University of Technology in Gliwice
- Marcin Malicki, Metroplan Polska
- Bill Nordgren and Roger Hullinger, FlexSim Software Products, USA
- Paweł Woźny, ASTOR
- Dr. Justyna Smagowicz and Dr. Cezary Szwed, Faculty of Management, Warsaw University of Technology
- Marian Cretu, AD Auto Total, Romania

The FlexSim InterMarium team that planned, organised and executed the FlexSim InterMarium Tour 2023: Witold A. Cempel, Dawid Dąbal, Filip Polit, Krystian Kogut and Patryk Żuchowicz.

FlexSim.edu.pl learning platform - available from March 2023

We have refreshed our database of instructional videos, and our entire training offer. Everything now coincides with the new certification and is arranged in such a way as to further encourage interested parties to enter the simulation. We are lowering the barrier to entry into simulation all the time! Every customer for a license, whether educational or commercial, with an active Maintenance service now has the opportunity to gain access for their employees to the instructional video database and have basic training coverage at their fingertips all the time. For access, please contact your local InterMarium representative or our head office in Kraków: filip.polit@flexsim.pl.

Simulation Ambassador

During the InterMarium Simulation Conference 2022, we presented four Simulation Ambassador statuettes. Not everyone knows that these were not the first statuettes. In 2020, Stanislaw Kracik, former Governor of Malopolska and Director of the Dr. Józef Babinski Clinical Hospital in Kraków was the first to receive a statuette. In 2022, the award was presented to the following people:

Photo 5. Witold Cempel, CEO of InterMarium takes part in a debate during the Local Government 6.0 Conference in Wieliczka.

- Prof. Krzysztof Nowosielski, Business Processes Simulation Center at the Wroclaw University of Economics and Business,
- Prof. Zdzisława Dacko-Pikiewicz, Rector of the WSB Academy in Dąbrowa Górnicza, and the award was received on her behalf by Paweł Urgacz, Vice-Dean for Internationalisation, and Dr. Paweł Sobczak, who has been involved in the FlexSim implementation process and the creation of the Optimisation and Simulation Engineering specialization at the University from the very beginning.
- Marian Cretu, AD Auto Total from Romania,
- Artur Kozioł, Mayor of the City and Commune of Wieliczka

We would like to congratulate all the winners so far, and we will get to know the next winners on 14 September during the Simulation Ambassador Gala at the Qubus Hotel.

Starting cooperation with ASTOR

On 11 May this year at the ASTOR Innovation Room in Kraków, ASTOR and FlexSim InterMarium signed a letter of intent to cooperate with each other in preparing simulation models at the design stage of discrete manufacturing and intralogistics process improvements. The location was no coincidence, as the FlexSim process simulation software allowed the test preparation of a digital model of the AIR 4.0 showroom, whose authors are Patryk Żuchowicz and Tomasz Mitręga from InterMarium. The model allows for a virtual walk through the entire showroom and virtual commissioning of the line robots and installations contained therein in Virtual Reality. We describe more about this on pages 36-37 of the current issue of Simulation Manager.

Photo 6. Jarosław Gracel and Piotr Wilk from ASTOR and Patryk Żuchowicz, Dawid Dąbal and Witold Cempel from InterMarium.

21st International Conference ECONOMY - FINANCE - MANAGEMENT (ICEFM2022) and Local Government 6.0 in Wieliczka

Once again, the Mayor of the City and Commune of Wieliczka, Artur Kozioł, shows great confidence in us and, following last year's invitation to the 21st International Conference Economy - Finance - Management (ICEFM2022), this year he invited us to take part in the Local Government 6.0 conference organized at the Wieliczka Mediateka. During the two-day conference, we were present with our FlexSim Virtual Reality stand and the CEO, Witold Cempel, took part in an interesting debate on the cooperation of local government units with the academic world and business. InterMarium's participation was related to the promotion of the achievements of our Simulation project bureau from Kraków as part of the cooperation in the organization of World Youth Day Krakow 2016. Our work resulted in a number of improvements and optimization of the routes for the evacuation of pilgrims from the events carried out as part of WYD'16. The success associated with our simulation models was so great that even after 7 years we are appreciated for this work.

Photo 7. Stand at the fair "Trends in Automotive Logistics, Pilsen 2023".

Participation in Trends in Automotive Logistics, Pilsen 2023

On 16 May 2023, the founders of FlexSim Software Products from the USA, Bill Nordgren, and Roger Hullinger, and representatives of InterMarium, Krystian Kogut and Tomasz Białoń, attended the annual conference. Bill Nordgren gave a presentation entitled. "A Digital-Twin process improvement application", and the other team members gave many interesting talks at the booth.

Photo 8. Bill Nordgren and Roger Hullinger visit our office in Kraków.

Bill Nordgren and Roger Hullinger's visit to Poland

The founders of FlexSim Software Products attended the conference series organized by InterMarium as special guests. The gentlemen gave very interesting presentations, e.g. about the history of the founding of the company and the FlexSim tool, and about the potential gains that can be made through process simulation.

The GOLDEN CROSSHEAD award

We received this award from Professor Anna Timofiejczuk, Dean of the Faculty of Mechanical Engineering at the Silesian University of Technology in Gliwice, for our contribution to development. The award refers to the Faculty's first logo, which is placed on the dean's chain and worn by the dean during ceremonies and academic holidays.

Thank you very much for this award.

Participation in the LogInPack 2023 Congress for the logistics and packaging industry in Kielce

During the two-day Congress, Filip Polit gave a presentation to the assembled audience on the possibilities of the FlexSim program. We were also present at the Virtual Reality stand, manned by Patryk Żuchowicz. A transcript of the speech and a full film and photo report are available on the event website http://targikielce.pl.

Announcements

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Ladies and gentlemen,

in 2024 we will keep the FlexSim Tour formula from 2023 and visit eight cities in 3 countries as part of the Business Tour. The program we will show during these events will be similar to previous years but, as always, improved. In each city we will have a special guest, namely one of our clients, who will present selected case studies of their simulation projects. The program will consist of many of our speeches and lectures. Of course, there will also be space for questions and free discussion. As always, practice and real results will come first. We are fully confident that this formula will deliver a lot of value.

The improvement we will make in 2024 will be to split the Tour into two different formulas, for different target groups. Year after year, we notice a sharp increase in interest in simulation at universities, so we have decided to support this process by organizing an Educational Tour, which will be aimed specifically at students and didacticians. Of course, interested business people will also be welcome, but a dedicated program for them is within the Business Tour.

The Educational tour will be open to all interested parties, with no registration required. Simply if we come to your university, come and meet us. If you are a lecturer and would like to invite us to visit you, call and we will arrange a convenient time to organize the Simulation Business Tour within the walls of your university!

We will post updated information on the list of universities we will visit on the website.

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NOVELTY SHOWCASE

Virtual twin

PATRYK ŻUCHOWICZ

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Imagine the possibility of immersing yourself in the "Digital Factory of the Future," a 1:1 scale where real-life processes can be observed in virtual reality. This is precisely the project executed in collaboration with ASTOR, combining aspects of simulation and VR technology.

In one of their showrooms located on Smoleńsk Street in the heart of Kraków, participants have the opportunity for full control over three different stations, where robots programmed by ASTOR's employees perform various tasks. This interactive approach to presentation allows real-time observation of production processes, providing a better understanding of machinery operation and production efficiency.

The virtual counterpart of this "Digital Factory" has been created using FlexSim software, available in 3D. The virtual twin allows participants to fully immerse themselves in the digital environment. Thanks to this solution, one can effortlessly transition into the virtual showroom. Participants can explore sample production lines in 3D, and using VR controllers, they can operate all available stations just as they would with their hands in reality while observing robot operations, all in real-time.

This revolutionary approach to promoting and presenting industrial products eliminates the need to build multiple physical showrooms in different locations. All that is required is one model and a set of VR goggles. As a result, potential customers from around the world can experience an interactive presentation showcasing a one-to-one representation of real processes, resulting in significant time and cost savings, not to mention presentation capabilities anywhere in the world.

Projects like the virtual twin of the "Digital Factory of the Future" represent the fusion of two worlds – reality and virtual – providing innovative and advanced presentation possibilities for industrial projects. It allows the exploration of even non-existing solutions or concepts.


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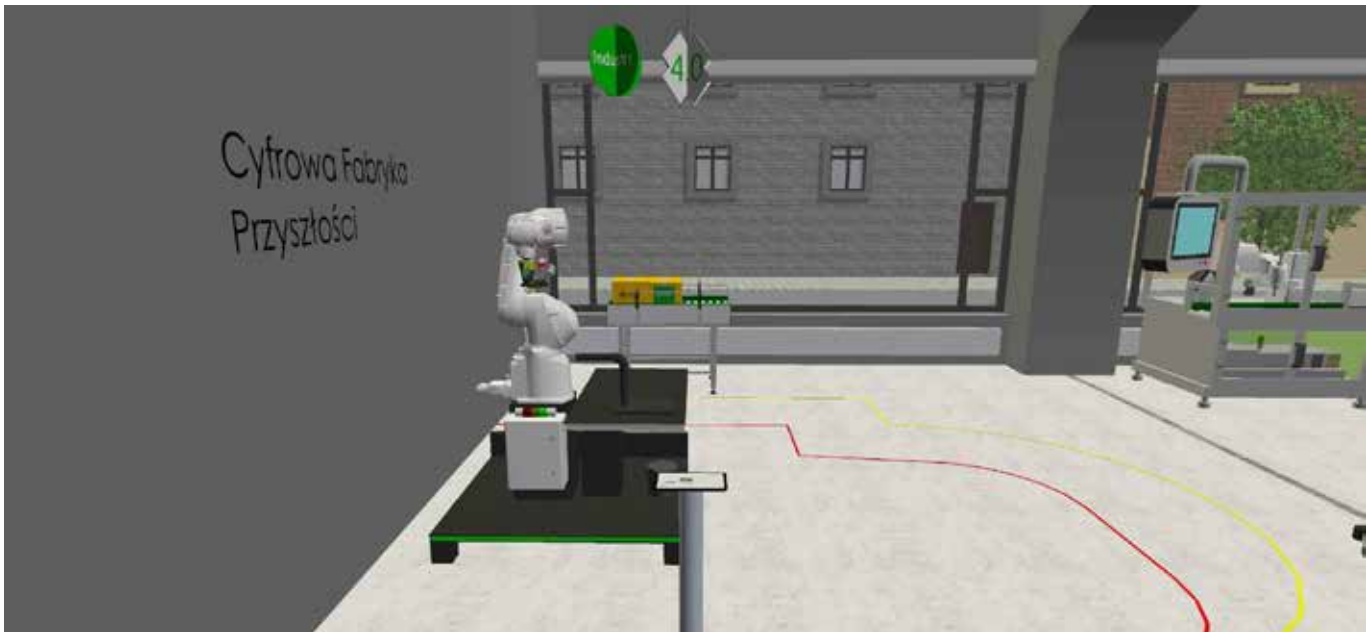
Cyfrowa Fabryka
Przyszłości

Educational platform by InterMarium

DAWID DĄBAL

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At InterMarium, we are relentless in our efforts to expand the proposition for our customers with new, valuable items. We want to facilitate access to simulation technology and help FlexSim users achieve maximum benefits from its use. Therefore, we have extended maintenance to include access to the learning platform.

Last year we published the FlexSim Handbook by Krzysztof Jurczyk, almost 700 pages of practical knowledge and exercise based on real-life examples to allow new FlexSim users to quickly learn how to build simulation models.

This year, we decided to give our users even more.

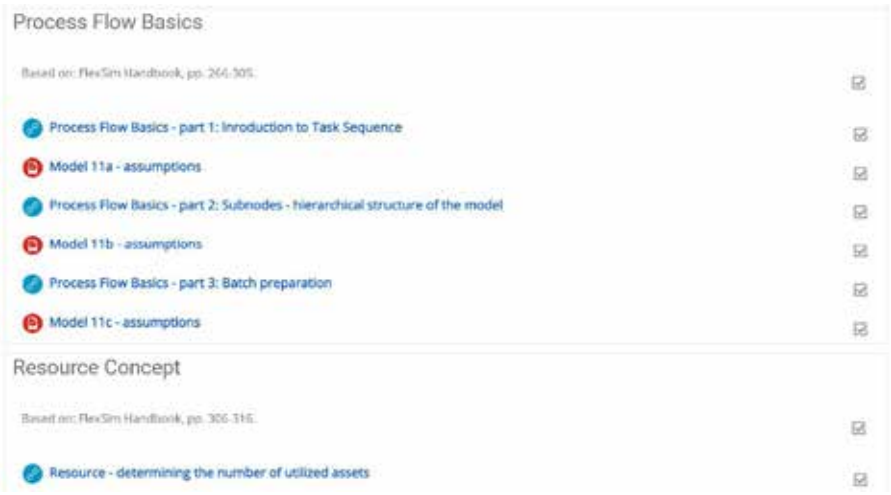
We created a FlexSim educational platform with almost 20 hours of video course materials based on our handbook (all course materials are in English).

We start with basics, FlexSim navigation, how to create a material flow, adding task executers, object parametrization... and after 17 models (and this number is increasing as we are adding more and more materials) users are building models using advanced sub-flow logic, multiple stations with AGV transportation. This course program was developed after hundreds of hours of training we did for our commercial customers and maybe thousands of hours of FlexSim courses with students. We intend to add new content on a regular bases.

Our goal with e-learning was to give our users learning material so they can learn FlexSim at their own pace when they have time between other projects and to be able to return to any part of the training when needed. It also became an easy way to introduce FlexSim to other colleagues from the same company by giving them access to our courses they don't need to figure out the basics by themselves and can build their first model much faster and with less stress involved.

E-learning courses, available on our educational platform, can be used by any user from the region served by InterMarium. Just, contact us and get your access!

While our valued customers, possessing FlexSim licenses (both educational and commercial), can use the platform as long as the maintenance of their licenses remains active. So, it's your turn now! If the maintenance of your license is expired, renew it! If your license is under maintenance but you don't have access to e-learning yet, contact InterMarium and request it now!



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FlexSim Course

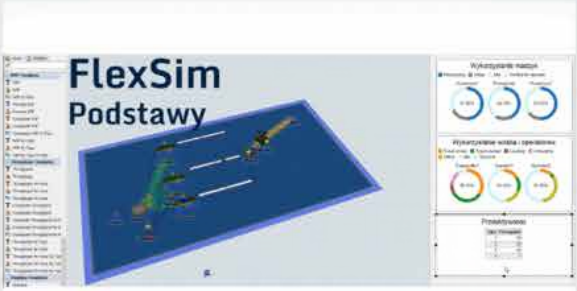
Course ›

FlexSim for Beginners

Course ›

FlexSim Basics, English ver...

Course ›



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Omniverse

MARKUS CUEVA
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FlexSim has always made it a priority to stay on the cutting edge of simulation technology. Often, this means features and improvements centered on building, running, and analyzing simulation models. Sometimes, it means something completely new and exciting.

Let's discuss FlexSim's NVIDIA Omniverse connector and USD support, the latest additions to our flagship 3D simulation modeling and analysis software.

Given how new these technologies are—USD was first open-sourced in 2016, and FlexSim is among the first group of software products with an Omniverse connector—it's worth exploring what they are and how they can improve your simulation projects.

You can't discuss NVIDIA's Omniverse without first discussing Universal Scene Description, or USD. The legendary film studio Pixar first developed this file format, which needed a solution to address the increasing complexity of 3D scenes and assets within their production pipeline. Think of USD as a bridge, allowing data to be exchanged seamlessly between various tools used in modeling, animation, rendering, and more.

Enter Omniverse, a platform to develop 3D workflows and applications based on Universal Scene Description. Through it, people can work with the tools they already feel comfortable with while collaborating with their team on a larger 3D project. If USD is the bridge between 3D applications, then NVIDIA's Omniverse is the road system that facilitates the workflows—up to and including real-time, bi-directional collaboration of 3D data.

Initial Benefits and Possibilities

So what possibilities do these technologies unlock for FlexSim users? Although it's just coming out of beta testing, some organizations have already begun integrating these features into their workflows.

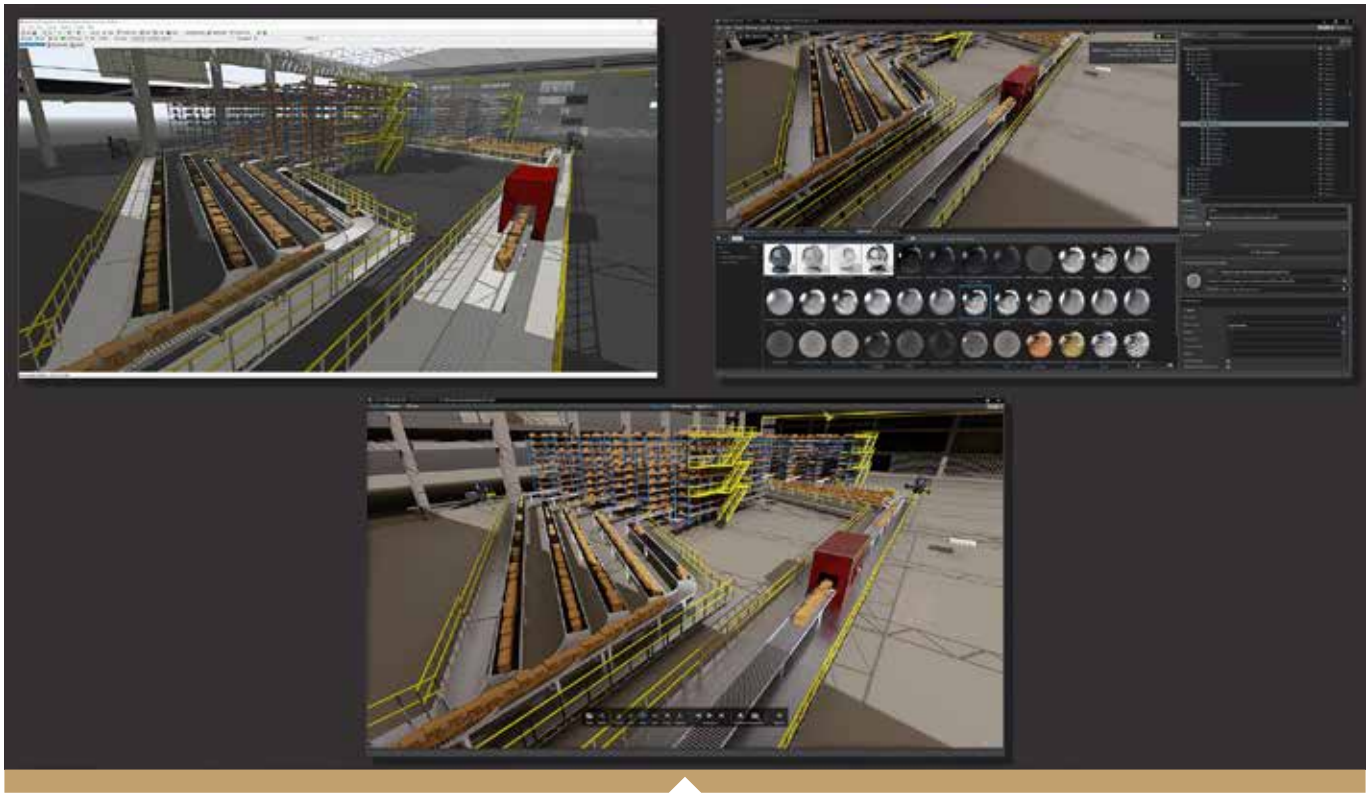

Fig. 1. Omniverse.

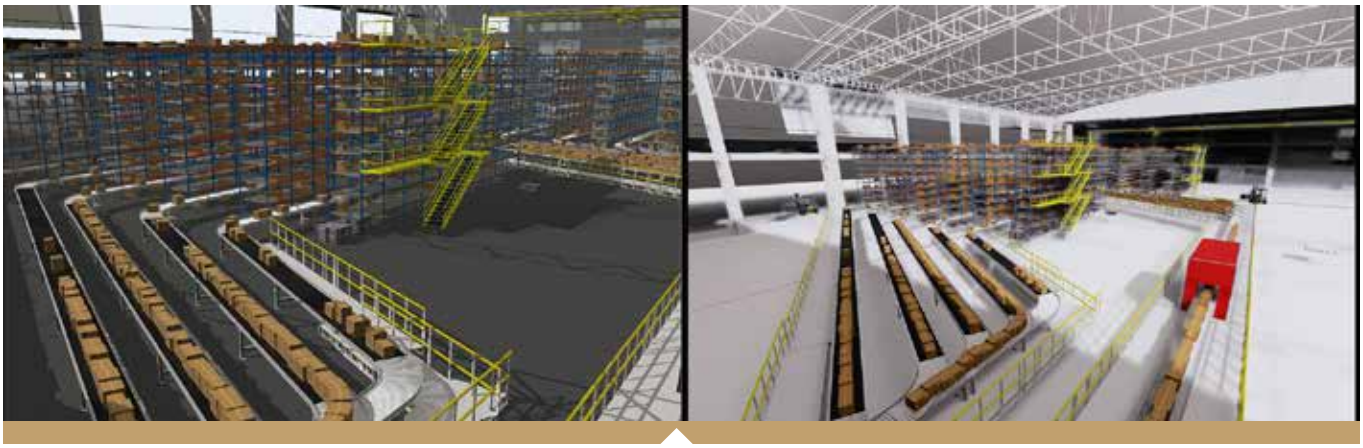

Fig. 2. Introduces-USD-Omniverse.

One example comes from a robotics research and manufacturing company. There, FlexSim is used by two teams—a design team working on certain parts of the building and a group focusing on the automation and work-cell side. Each team has FlexSim models they need to integrate into their internal tools, which has become an intensive software integration effort. But with the ability to export FlexSim models in the USD file format, this process is shaved down from several weeks to several days. It represents considerable time savings and fewer opportunities for human error.

"Different tools excel at different tasks, and you want the highest fidelity possible," says Chris, who directs simulation in the robotics division. "USD unlocks the potential for software to standardize and work together."

With an ever-expanding ecosystem of USD- and Omniverse-enabled software, the possibilities are vast and exciting. Chris mentioned physics software, where existing robotic movements could one day join FlexSim in a broader (and more accurate) simulation solution. As software packages continue to come on board, more potential applications will surely come.

What about reducing model-building time? USD can help there as well. The company's worldwide team does end-to-end simulations where many components are black-boxed, leaving out robotics and other complex modeling scenarios. Yet even without these intricacies, we're talking about extensive facilities where the simulation model takes significant time to lay out and build. A workflow that smoothly transitions from CAD to USD to FlexSim could help speed development.

Digital Twin and Beyond

First, it's worth stressing that FlexSim's Omniverse connector is in the early stages of its life cycle. More development is ahead, which means FlexSim is still metaphorically learning to walk when it comes to these technologies. But USD's interoperability suggests potential future applications for digital twins and other advanced simulation solutions.

Real potential exists for better integration and data flow, including IoT devices, production systems, and logistics networks. Could USD facilitate continuously updated simulations, reflecting the most current conditions and allowing for accurate analysis of complex scenarios? We're excited to see what FlexSim users can imagine and bring to life in the future.

Omniverse also unlocks the pathway to the world's best 3D visualization capabilities, which could breathe life into FlexSim simulations and provide a high-fidelity representation of processes and systems. This immersive environment might empower users to comprehend intricate details, spot inefficiencies, and intuitively grasp the impact of potential changes. As a result, stakeholders can easily collaborate, share insights, and devise more effective strategies.

Aligned for Efficiency

NVIDIA has big aspirations for its Omniverse platform, with one of the primary goals being to simulate and optimize processes in real-time. We couldn't agree more, as simulation and optimization have been FlexSim's singular focus from day one. By leveraging the insights gained from FlexSim simulations, organizations can make data-driven decisions with more confidence. Users are empowered to explore "what-if" scenarios and assess the impact of potential changes before implementation. This foresight helps businesses avoid costly mistakes and identify opportunities for process improvement.

The combination of FlexSim and Omniverse represents a game-changing synergy that empowers businesses to transform their operations. From visualizing complex systems to optimizing processes and making informed decisions, this integrated solution propels organizations to the forefront of innovation, efficiency, and success in today's dynamic and competitive landscape.

EXPLORE THE COUNTRIES OF THE INTERMARIUM!

Slovenia: A Green Gem at the crossroads of nature and culture

TOMAŽ BERLEC

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Slovenia is a small green country, located where the Alps meet the Mediterranean and the Pannonian Plain meets the Karst. It occupies an area of only 20,273 km2, with a population of 2.116.972. The currency in Slovenia is Euro €. Slovenia's average height above sea level is 556,8 m, with the length of the coastline at 46,6 km and the highest peak – Triglav at 2.864m. Slovenia is a unique destination committed to sustainability, where everyone can find something for themselves. From active experiences in the embrace of pristine nature (hiking; cycling; jogging and in winter skiing), city breaks topped with culture, relaxing holidays (you can swim in the sea, lakes, and rivers or swimming pools) in spa centers or gastronomic pampering with local flavors in first-class restaurants. Slovenia is one of Europe's most water-rich countries, with more than 27.000 km of watercourses and more than 300 waterfalls. Slovenia is also known for the Lipica Stud Farm and the cradle of the world-famous Lipizzaner horses. The Slovenian underground world is full of surprising beauties and adventures since we have over 13.000 karst caves. The biggest one is Postojna caves, which is the most visited cave in Europe. The Škocjan Caves form also a part of the UNESCO World Heritage.

Many Slovenian towns boast a rich history that can be best experienced in preserved old town centers. The capital of Slovenia is Ljubljana, which is considered one of the greenest European cities and is characterized by the architectural masterpieces of Jože Plečnik. Maribor is the city with the oldest grapevine in the world. The oldest Slovenian town, Ptuj, is home to the iconic Shrovetide character, Kurent. Celje is a town on which the Counts of Celje, one of the most influential noble families in Europe, left a significant mark. Kranj is the cultural capital of Alpine Slovenia and the town of the greatest Slovenian poet, France Prešeren. Novo Mesto is known as the archaeological site where the largest conglomeration of situlae was found. Koper, the town of the sun, and its port represent the Slovenian sea door into the world, while the charming town of Piran displays one of the most iconic images of the Slovenian coast.

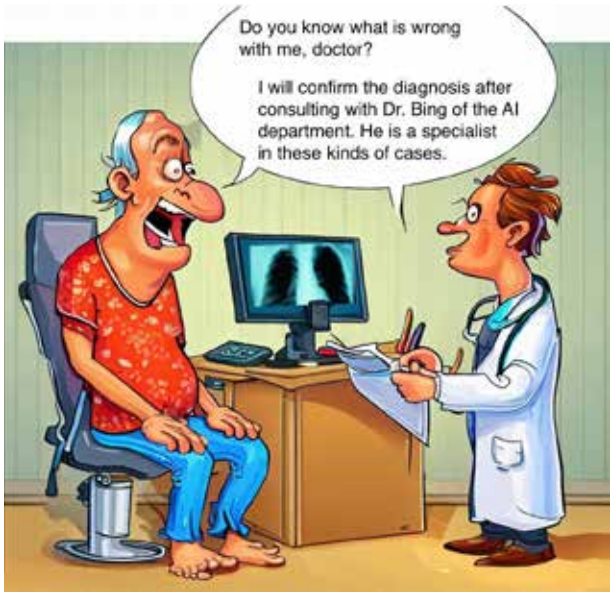
Slovenia is also a country where people eat well and is a culinarily very diverse country. You'll be able to try a varied array of traditional flavors in 24 gastronomic regions and three wine-producing regions. The most demanding foodies can visit restaurants adorned with prestigious Michelin stars. The greatest quality of Slovenian cuisine is fresh and local ingredients prepared in a traditional or more modern and creative way.

In Slovenia, you can find mostly small and medium-sized companies, which operate on the international market, some of them with the help of FlexSim simulation software and the InterMarium Sp. z o.o. through a representative office in Slovenia, managed by Dr. Tomaž Berlec since December 2017.

Fig. Postojna caves.

SimuLatte

In order not to exaggerate the seriousness of the content, our community members and enthusiasts are creating especially for you a column called "SimuLatte" with cartoon humor for coffee break entertainment... This time we were supported creatively by AI.



The computer scientist took his son to the ZOO. They are walking in the front of the penguin enclosure, when the son calls out :

- Dad, Dad... look! How many Linux they have?!

An IT specialist gets into a cab, and the driver asks:

- Where are we going?
- Home...
- Give me the address, please?
- Of course: 192.168.4.1.

A programmer in a pharmacy:

- Vitamin C++, please!

- Why do coders always mix up Christmas and Halloween?

- Becasuse Oct 31 == Dec 25!

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