Application: CAD/CAM Systems (A)

Name: Gurvinder Nagra SID: 10248274

Date:17/11/22

Description of the demo/activity

Brief description of the demo/activity. The task you are performing (or the task which could have been given to you to perform)

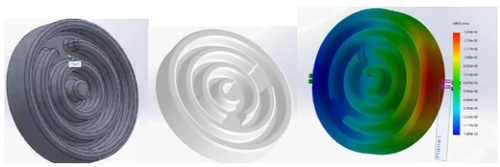
The task given to me was to design a ball bearing maze game of my own choice, though I was given constraints. The constraints being the maximum size was 50*50*40 mm width*length*height, the ball bearing size D=3mm as well as software and machine capabilities. I needed to start with first designing it with a fully constraint sketch and then make it into a 3D solid design using solid works.

The exercise output

The start was to sketch a design of the maze in solid works according to the design requirements that I was given for length, width, and height, I was also sure to take into consideration the size between each wall needing to be 3mm for the ball bearing, though I decided to increase this slightly to 3.2mm to ensure that the ball wouldn't have a hard time rolling through the maze. I also made the walls themselves at around 3mm to ensure a precise cut for them. Next, I made sure to save the design and send into CAMWorks which is an extension of solid works but for CAM, this was to make sure that the correct measurements will be inputted so the maze could but cut properly. First, I generated the G code using CAMWorks to the CNC machine would know what to do when cutting and as such I simulated the toolpath.

Challenges

The challenges faced whilst doing this, were for one I had never used solid works before meaning this was a new learning experience and I had to get used to the software first off and it took a bit of trial and error to get the hang of it. Though I still had a few errors when creating the maze which I had to work on and fix. Another challenge with this was making sure the measurements were just right according to the constraints we had been given as this meant being very careful with all the measurements meaning my design had to be kept relatively simple and I could not make a complicated maze. As such I stuck with a simple circular maze which required less issues with the edges and it would be easier to fulfil the measurements.



Benefits to industry

Identify the issue this application could improve

CAD is a computer-based tools software which aids the process of designing a 3D model as well as drafting, analysing, and simulating it, CAM is a computer-based tools software (as well as hardware) which aids the manufacturing process, specifically processing, planning, and verifying the part production and assembly of a product. Both of these applications can help improve the development process of a product.

Product development involves designing a product and later manufacturing it, usually both of these tasks are done entirely separate from each other which can lead to issues between them since there is a greater barrier between the 2 when it comes to communication. This can lead to issues with design and production which can cause a product to be delayed and, in some cases, costing more if the quality doesn't end up being good enough. To solve this the best thing to do would be use a singular application which can bridge the gap between design and manufacturing by integrating CAD and CAM together and solve these issues.

"By using an integrated CAD/CAM platform, what was once a linear, sequential workflow with a high probability of costly, time-consuming iterations at the back end becomes a concurrent, collaborative process with more efficient, timely, and cost-effective interactions occurring early in the sequence. The critical factor underlying this improved design through manufacturing workflow is the common data format and the valuable communication that it facilitates. An integrated CAD/CAM system provides one model supporting both design and manufacturing functions instead of having various file formats, numerous data translations/conversions, and different CAD and CAM models. To the CAM system, the CAD model becomes the sole geometry in play." (Dassault Systems)

How it will impact on the product/production life cycle

CAD/CAM integration will allow for a more collaborative approach between manufacturing and design which will improve communication as well as save money and improve overall product quality which also saves time. This will have an impact on the product/production life cycle as it means there will be less issues between design and manufacturing by ensuring the design is correct leading to much better pre-production. As well as that since all the model and data will be within the same format that means there won't be a need to import or convert anything which leaves less room for error and keeps the design highly accurate between stages. Compared to the current product/production lifecycle this is making product development faster leading to quicker mass production by being able to complete the process of going to designing to manufacturing quicker.

The product/production life cycle

Where in life cycle and how can it be integrated with the previous and following step in the life cycle

In the product life cycle, there are many different steps which are as listed : Product concept to Design Engineering to Drafting to Process Planning to Order New Equipment & Tolling or Production Scheduling to Production to Quality Control to Customer & Market.

CAD/CAM can be integrated with the previous step in the life cycle by adding in Computer Aided design, computer automated drafting and documentation, computer aided process planning, computer scheduling, material requirements planning, shop floor control, computer-controlled robots, machines, computer aided quality control. (vask82, 2015)

The common characteristic that describes the application

Common characteristics that describe CAD/CAM systems would be:

- Computer graphic workstation which constraints hardware/software packages
- Graphical inputs for the design parameters as well as machining parameters as well as allow for graphical processing of a product via tool path and process simulation.
- Numerical Control of the machine using an input interface as well as G code which is the instruction logic given to the CNC machine, and memory for an output interface
- Automation with robots and machines for things such as the manufacturing process and working with materials. (Reddy)

Identify important attributes which affect the application, for example format of information sharing

CAD/CAM can be affected by a variety of different attributes such as hardware limitations, such a limitation would be using differently specification computers, one being older and lower specifications. This would show a difference in performance with the software as it would make it harder to do the work on a slower machine meaning it would take longer overall for the design process leading to a delay in product manufacturing and overall product/production life cycle. As well as that there can be issues within compatibility of the files shared between different CAD/CAM software as some file versions might be too old to run with certain software or not properly supported.

Reflection and conclusion

Reflection on how the application can impact on industry 4.0 and the digital engineering environment

CAD/CAM applications being integrated can have an impact on industry 4.0 and the digital engineering environment, for starters many companies are already moving over to this solution with software such as solid works. With such change there is now much better support for integration and automation meaning it is now possible to properly automate certain tasks which is an improvement from previous industry states to industry 4.0. This would lead to much smarter systems and allowing for greater change with designers and manufacturers being able to communicate much better and sharing information with machines used to implement processes and increase production.

As well as that with this it will lead to an increase in investment, as well as increase employment because companies are more likely to invest in such an application to improve the industry and it will lead to more skilled individuals being trained to handle such applications meaning more jobs as companies integrated CAD/CAM applications. This will affect the digital engineering environment as there are many different markets using such an application like solid works which utilises CAD/CAM because the markets will have greater investment and with these systems there is less room for error which will cost companies much less overall for product design and production. (Luis, 2022)

Implementation requirement hardware

The specific hardware requirements for implementing CAD/CAM systems will be the possible need for a hardware investment in order to keep up with new software. Workplaces will need changing with employee job roles being altered with the addition of new applications, meaning they could need new training to continue pursuing this career path. As well as that it will take a lot of resources when investing into new manufacturing machines and companies will need to do this as efficiently as possible to ensure good results are yielded by this investment.

Bibliography

Dassault Systems. (n.d.). *CAD/CAM Integration:*. Retrieved from Solidworks: https://www.solidworks.com/sw/docs/SW_WP__CAD_CAM.pdf

Luis. (2022, May 25th). *CAD/CAM in Industry 4.0.* Retrieved from Computer Aided Design Guide: https://www.computeraideddesignguide.com/cad-cam-industry-4-0/

Reddy, M. C. (n.d.). *Lecture Notes on CAD-CAM.* Retrieved from IARE: https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_LECTURE_NOTES.pdf

vask82. (2015, September 11th). *Introduction of cad cam.* Retrieved from Slideshare: https://www.slideshare.net/vask82/introduction-of-cad-cam-52657373?from_action=save