Simulation is the imitation of the operation of a real-world process or system over time. It is the recreation of real-world processes in a controlled environment for the modification or adjusting of the variables as needed. It is a model that mimics the operation of an existing or proposed system at different scenarios or process changes. Simulation modelling can be used both as an analysis tool to predict the performance of the new system and also predict the effect of changes to existing system. The ability to modify and re-test a virtual design means you don't have to spend time (or money) building and testing multiple prototype iterations. You can settle on a design that satisfies the requirements in simulation before building an actual prototype

Any system or process that has a flow of events can be simulated. As a general rule, if you can draw a flowchart of the process, you can simulate it.

Automotive

Simulation allows the characteristics of a real vehicle to be replicated in a virtual environment, so that the driver feels as if they are sitting in a real car. Different scenarios can be mimicked so that the driver has a fully immersive experience. These type of simulators can help train both new and experienced drivers, offering a route to teach driving skills that can reduce maintenance and fuel costs and ensure the safety of the drivers themselves.

Biomechanics

Simulation can be applied to biomechanics to create models of human or animal anatomical structures in order to study their function and design medical treatments and devices. Biomechanics simulation can also be used to study sports performance, simulate surgical procedures, and assess joint loads. An additional example is neuromechanical simulation that unites neural network simulation with biomechanics to test hypotheses in a virtual environment.

Engineering Systems

Simulation is widely used for engineering systems to imitate operations and functions of equipment, processes and procedures. Engineering simulations can combine mathematical models and computer-assisted simulation for design or improvement of existing processes.

Flight Simulation

Flight simulators have been used for years to train new pilots in a safe environment. This not only allows pilots to be assessed safely, but can also test instrument

failures and other problems without risking the pilot, the instructor or the aircraft. You can also easily repeat the exact same scenarios, such as approaching a runway to land, under different conditions, not to mention saving fuel and other costs compared to actual flying time.

Marine Craft Simulation

Much like flight simulation, it is also possible to simulate working in a ship or submarine. Simulators can include those that mimic the bridge, engine rooms, cargo handling bays, communications or remotely operated vehicles. These are used in training institutions, colleges and navies.

Weather forecasting

Weather forecasting uses simulations based on past data to predict extreme weather conditions such as hurricanes or cyclones.

Military Applications

Sometimes referred to as 'war games,' military simulations can be used to test out military plans in a virtual environment using computer models. These can also incorporate social and political factors and are used by governments and military organisations around the world.

Conclusion

Simulations are used for a range of applications across industry, saving time and expense while being able to test theories and ideas before implementing them in the real world. Although related techniques such as digital twin may provide added benefits due to the two-way flow of information this allows, simulations still have a great many uses.

Whether testing theories, assessing procedural performance or determining the lifecycle of an asset simulation is a useful tool for many businesses and organisations.