


Physics-based Toolkit for High-Fidelity Simulations

Simulating the behaviour of vehicles, robotics,
and heavy equipment in real-time synthetic environments.



Industrial and scientific simulations demand accuracy, reliability and speed. Leading virtual-reality developers choose Vortex because it delivers the expertise and capabilities that have put Vortex-powered realism, motion and accurate behaviour at the forefront of the simulation industry.

The ultimate physics solution for your virtual world

A highly flexible SDK, Vortex delivers both accuracy and high performance for numerous real-world applications. Vortex gives developers the tools and applied science they need to produce accurate simulations for operator training, mission planning, vehicle and robot testing, haptics devices, and immersive environments.

Vortex features fully stocked modules to simulate physics-based wheeled and tracked vehicles, particles, floating bodies, cable systems, sensors, grasping and more. Vortex easily integrates with industry-standard visualization frameworks such as OpenSceneGraph (OSG) for a fully interactive 3D environment.

The Industry-leading Physics SDK



VxVehicles puts engineering-level real-time motion into virtual tracked and wheeled vehicles.



Vortex is ideal for virtual robotics applications – it simulates mobility, manipulators, grasping, sensors, tethers and more.

“The product and technical support from the Vortex team have been outstanding. The team is quick to respond and provides very helpful technical analysis to our questions.”

Oliver Albrecht, Lead Engineer,
EADS

Vortex provides a robust framework for building virtual worlds of dynamic objects based on the fundamental laws of physics. In the Vortex world, objects interact realistically with their environment and each other, made possible by features like multiple geometry types, geometry collision detection, contact determination, and solves for collision response, plus an extensive library of constraints, including multi-body constraints. Vortex comprises the fully featured Vortex Core and purpose-built modules such as VxVehicles, VxCables, VxParticles, VxGrasp and VxSensors for highly specialized simulation development. A proven commercial product, Vortex includes full documentation, upgrades and hotline support.

Vortex Core

The Vortex Core is a C++ API that performs fast collision detection and stable collision response on arbitrary geometry. It allows users to add accurate physical motion and interactions to all objects in a scene, and to create natural interactive environments with no artificial restrictions on behaviour or interactions, and no need for scripted animations. The Vortex Core solves real-time simulation issues by calculating dynamic response, collision and contacts, and by allowing runtime modification to mechanical assemblies. Vortex developers use it to bring virtual worlds to life, make them feel real, and integrate physics into visual-simulation scenegraphs.

VxGrasp

The VxGrasp module determines grasp quality for a collection of contacts between a manipulator or gripper and target objects. It provides an easy and effective method to model robotics grasping, as well as heavy equipment behaviour like grappling claws. Grasp quality is based on a six-degrees-of-freedom wrench set generated by the grasp, and the module includes numerous options to change the reference coordinate system, rescale torques, add friction and more.

VxVehicles

The VxVehicles module equips users to produce physically accurate, high-performance simulations of wheeled and tracked ground vehicles for virtual prototyping, testing, mission rehearsal, operator training, and other applications. Much more than just a vehicle-builder, VxVehicles features engineering precision, physics-driven motion, flexible and reusable modeling, and easy scalability. Already deployed in hundreds of applications, VxVehicles can simulate the complete vehicle drivetrain, steering and braking systems, tire and track ground interactions, and suspension. For tracked vehicles, both rigid and flexible tracks can be simulated, as well as skid and geared steering.

Bring Virtual Worlds to Life

Vortex at Work

Visual simulation designers, engineers and scientists from many different industries and institutions employ Vortex for such wide-ranging applications as mission rehearsal, virtual prototyping, operator training, and design testing. For projects from the ocean depths to the surface of Mars, Vortex has been used to simulate high-fidelity vehicles, robotics and countless types of machines and heavy equipment, all behaving accurately and interacting realistically with their environment.

Vehicles

Vortex puts engineering-level motion and behaviour into virtual vehicles and synthetic environments for numerous commercial, military, training and research applications. Comprising the right balance of speed, accuracy and functionality, Vortex vehicles realistically accelerate and brake, kick up dust, collide with other objects, displace obstructions and water, roll over and more, and can incorporate machinery, cable systems or tethers, and even buoyancy for amphibious applications.

Robotics

Vortex provides a comprehensive simulation toolkit for a wide range of robotics projects. Featuring advanced manipulator and grasping capabilities, accurate vehicle dynamics, multi-application sensors and much more, Vortex gives robotics developers everything they need to design, develop and operate ultra-realistic simulations. A typical application includes the virtual testing of robots operating within simulated environments, while linking in actual control systems and input from Vortex's virtual sensors.

VxCables

The VxCables module provides efficient and detailed cable-dynamics modeling for mechanical equipment such as hoisting systems, towing and mooring applications, marine cables and pipelines, and robot tethers. Cables can interact and collide with other dynamic Vortex objects or with themselves, and complete cable systems – including winches and pulleys – can be simulated with realistic cable behaviour and interactions within virtual environments. VxCables also simulates the behaviour of ropes, tethers, flexible pipes/tubing, chains and wire harnesses.

VxParticles

The VxParticles module delivers a flexible real-time particle system that transforms synthetic environments with natural phenomena such as smoke dispersal, dust trails and fluid flow. VxParticles supports the bi-directional interaction between particles and rigid bodies, and includes smoothed particle hydrodynamics (SPH) methods for visual simulation of floating bodies and fluid flow in channels or enclosures. VxParticles produces 3D simulations of fluids, gases, and bulk materials such as rocks, earth-moving, and concrete. Particles can accurately exchange forces with rigid bodies for full simulation of body-particle interactions.

VxSensors

The VxSensors module features multiple capabilities for the unique needs of sensor systems, including sonar and laser range finders. It allows simulation developers to integrate virtual sensors – such as depth, camera, pressure, and force – within simulation environments, using sensor output to drive vehicles and robots, including autonomous control systems.

Vortex for OSG

Fully optimized for OpenSceneGraph visual simulations, Vortex for OSG enables the integration of high-fidelity Vortex objects and vehicles into numerous applications. The flexible Vortex for OSG allows users to expertly model complex systems of rigid bodies, including fast collision detection/response, extensive joint and constraint libraries, and comprehensive vehicle dynamics. OSG developers can quickly create gears, motors, suspension models, hydraulics, wheels or tracks and other components, and easily assemble them into vehicles, machines and robots that move and behave correctly.



Vortex provides offshore, marine and subsea operations with superb simulation capabilities for operator training and mission planning applications.



Heavy equipment, including vehicle dynamics, terrain interaction and hoisting systems, can be easily simulated in real time with Vortex.

Two Vortex SDK software packages available:

◆ Vortex:

Comprises Vortex Core, VxGrasp, VxSensors, and VxParticles

◆ Vortex Pro:

Comprises Vortex Core, VxVehicles, VxCables, VxGrasp, VxSensors, and VxParticles

“Vortex has been a central component of our software. The fidelity of the vehicle dynamics and the tire-terrain collision, combined with real-time performance, were significant factors in preparing us for the DARPA Grand Challenge.”

Red Whittaker, Red Team Racing,
Carnegie Mellon University

Bring Virtual Worlds to Life

Marine

Heavy equipment and operations in off-shore environments present special challenges and risks for engineers and operators. Simulation developers can model those challenges and address those risks by employing Vortex's proven physics and high fidelity to achieve the required realism for synthetic marine environments. Developers, OEMs and others choose Vortex for its rich marine modeling capabilities for applications such as port and shipboard cranes, cables, lines and tethers, and replenishment and dredging operations.

Subsea

For work beneath the waves with remotely operated vehicles (ROVs), virtual prototyping and mission rehearsal are especially important. Safe working practices are a top priority since operations in difficult seas, strong ocean currents, poor visibility, and near subsea oil and gas structures are hazardous and expensive. Vortex provides a cost-effective, flexible and portable solution for modeling everything from 3D physics-based environments to entire underwater worksites featuring true physical motion and ultra-realistic machine-environment interactions.

Heavy Equipment

Used extensively for fully fledged simulations of construction, mining and forestry equipment such as cranes, bulldozers, graders and log forwarders, Vortex puts faithful motion and behaviour into the hands of operators and OEMs for multiple training benefits. Vortex-powered heavy-equipment simulations can precisely emulate actual machines and vehicles, and are so realistic and flexible that they can prepare both novice and senior operators for specialized operations and accident avoidance, while reducing wear and tear on expensive equipment.

About Vortex

The Vortex team provides physics-based equipment and vehicle simulation solutions to companies and institutions throughout the real-time visual-simulation world. With a long history in the visual-simulation and gaming industries, the Vortex team produces feature-rich simulation tools that set the industry standard for interactive 3D dynamics and simulating mechanical equipment behaviour. Vortex expertise and technology put high-fidelity behaviour in motion in applications for training simulators, mission rehearsal, serious games, virtual prototyping and testing. Vortex customers include Honda, John Deere, L-3, Lockheed Martin, NASA, Carnegie Mellon University, and over 100 other leading companies and academic institutions.

Vortex Labs

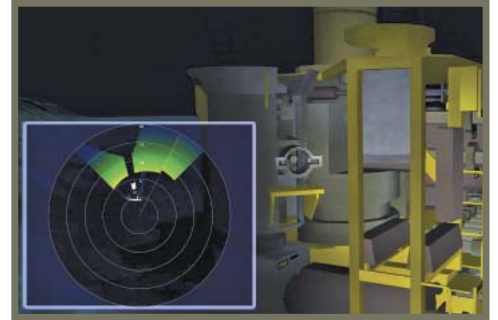
Vortex Labs is home to innovative new technologies and collaborative development projects, and is the industry's go-to problem-solver for the most challenging physics and simulation issues. With a substantial track record in both research and applied solutions, Vortex Labs puts its leading scientific, engineering and simulation expertise to work for aerospace and defense agencies, robot developers, equipment manufacturers, academic institutions and others.

Implementation Assistance

Vortex expertise is behind the industry-leading physics SDK and hundreds of cutting-edge simulations and industrial-equipment simulators. Renowned for implementing scientific, programming, and visualization/simulation solutions, the Vortex team can help you achieve timely project success while maximizing your resources and minimizing your costs.

Customer Support

We pride ourselves on excellent product quality, timely software updates, leading professional services, and responsive customer support. The experienced Vortex support team provides fast telephone, email and electronic assistance for Vortex software and simulator customers. Our dedicated engineers and computing experts excel at problem-solving and can provide pertinent technical help at all stages of Vortex project development and implementation.



Vortex includes highly specialized sensors such as sonar, depth cameras, and laser range finders for multiple applications.



behaviour in motion

