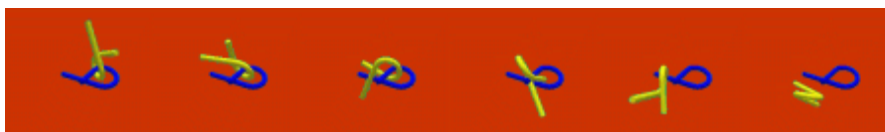




# KineoWorks™

## Product Overview

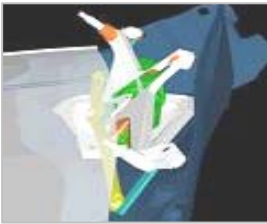


## Introducing KineoWorks™

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Motion Planning issues are becoming increasingly important in many application areas, ranging from robotics and CAD assembly to 3D virtual environments and video games.

### Typical Motion Planning Problems are:



- ✓ *Can I extract the wiper motor of this assembly without colliding the other parts?*
- ✓ *Can I extract the part respecting a given clearance value?*
- ✓ *Can I see the volume swept out along the extracting path?*



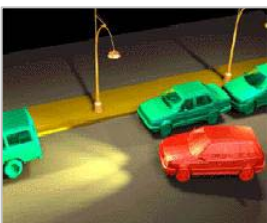
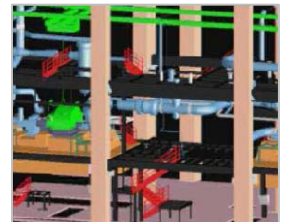
- ✓ *What is the optimal trajectory between these two welding points?*

- ✓ *How should I design my robot so that it would carry out a given task?*



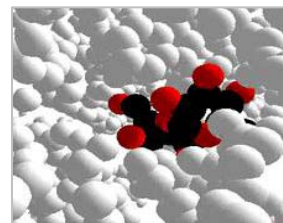
- ✓ *What is the best way to move this turbo pump?*

- ✓ *Shall I use a rolling bridge or a crane?*



- ✓ *How can I automatically provide realistic motions to a mobile in my 3D-simulator?*

- ✓ *How can the amylosaccharase reach the protein's active site?*



If you have ever asked yourself one of these questions, KineoWorks™ will meet your expectations for automated Motion Planning.

## KineoWorks™: Motion Planning Solution

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KineoWorks™ is the most efficient off-the-shelf Motion Planning Solution addressing real-world industry needs:

### Technological Breakthrough

KineoWorks™ integrates the state-of-the-art results from 15 years of research in robotics and algorithmic motion planning.

### Easy and Intuitive

With KineoWorks™, describing and solving your Motion Planning task becomes an easy and intuitive job.

### Fully Integrable

KineoWorks™ integrates seamlessly with your software solution. The packaged set of API's ensures accurate integration.

**KineoWorks™ got IEEE award 2005 Best 3 applications of the year**



## Differentiating Features

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### **Performance**

KineoWorks™ integrates the latest motion planning technology based on a multiscale probabilistic approach: it will automatically find an optimal solution in very little computing time even for systems with numerous degrees-of-freedom in highly cluttered environments.

### **Reliability**

KineoWorks™ integrates “probabilistically complete” methods: it finds a path where others failed.

### **Ease of use**

No parameter tuning, no expert skills needed, no more time-consuming and tedious 3D-model manipulation: the algorithms adjust their parameters automatically ensuring dynamic adaptation to the environment.

### **Versatility**

Features a Powerful and Simple way to describe your Motion Planning Task:

- Kinematic chain and static constraints description,
- Forbidden zones and clearance definition.

### **Interactivity**

Users can control the computed solutions by imposing via-points.

### **Flexibility**

- Use KineoWorks™ built-in Collision Detector, KCD™, featuring dynamic and integral collision avoidance along trajectories,
- Or use your in-house collision detector plugged into KineoWorks™.

### **Integrability**

KineoWorks™ Software Development Kit provides application developers with a complete and well-documented set of API's ensuring rapid and tight integration.

### **Portability**

KineoWorks™ supports Unix, Windows and Mac OS X, and is easily portable to any other platform.

## KineoWorks™ for Virtual Assembly

Assembly maintainability studies in highly constrained environments are a critical step in your PLM process, requiring days of expert studies or the use of expensive physical prototypes.



### Turning days of work into minutes with KineoWorks™

With KineoWorks™, within a few minutes, the design engineer easily achieves the assembly maintainability study, using a dedicated one-click algorithm. Customer feedback set KineoWorks™ as the world-class benchmark.

### Supporting the design engineering

If there is no feasible extraction path, the design engineer will retrieve the computed path pointing out the blocking elements. This instantaneous feedback yields tremendous improvements in productivity.

### A unique feature

The design engineer controls the extraction path quality by setting the “clearance value”: committed and continuously collision-free path will be computed with positive clearance values, while negative values allow micro-collisions, ensuring very fast collision-checking of extraction paths.

### Manage your product life cycle

KineoWorks™ algorithms can exploit a previously computed extraction path for faster computation. Re-using an existing path with an updated version of your assembly will shorten the studies, and your time-to-market.

### Integrate KineoWorks™ in your CAD systems

- KineoWorks™ is fully flexible and open: either use KCD™, or your in-house collision detector plugged into KineoWorks™.
- Using KineoWorks™ API, integrate it within a few days in your software environment.
- Off-the-shelf plug-ins to popular CAD solutions are available.

### Benefits

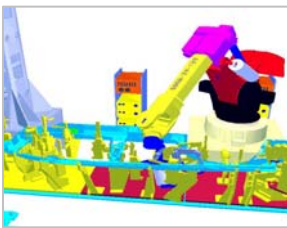
- Anticipate assembly maintainability studies in your PLM process.
- Detect design errors at early planning stages.
- Validate a design update in a mouse-click.
- Eliminate the time and cost of expensive physical mockups.
- Improve productivity with a focused, easy-to-use solution.

## KineoWorks™ for Manufacturing

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- ✓ *What is the optimal path for a 6-R welding robot between two welding points?*
- ✓ *Is your manipulator robot able to remove that part from the assembly?*
- ✓ *What is the optimal multi-axis machine tool path between these control points, respecting the clearance distance you specified?*

KineoWorks™ addresses these specific questions by:



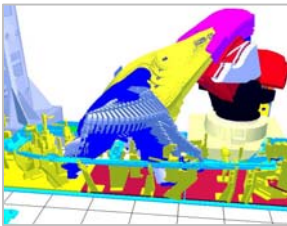
### **Offering easy modelisation possibilities**

KineoWorks™ uses the kinematic representation of your robot or machine tool and offers an easy way to add various standard kinematic constraints.



### **Supporting the design engineering**

KineoWorks™ one-click algorithms and KCD™ enable automatic path planning in very little computing time. The design engineer will quickly determine the best placement and configuration of the robot cell.



### **Increasing in-use productivity**

KineoWorks™ generates an optimal path within a few seconds and reduces your cycle time.

### **Reducing the breakdown factor**

KineoWorks™ generates committed and continuously collision-free path, thus increasing path safety in constrained environments. Every mobile part stands apart from the obstacles by more than a user-defined clearance value, dramatically reducing the breakdown factor.

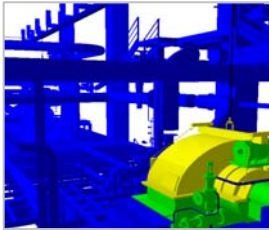
### **Benefits**

- Anticipate task-feasibility studies in your design process.
- Detect errors at early planning stages.
- Reduce cycle time, increase productivity.
- Increase path accuracy and safety.

## KineoWorks™: a generic component

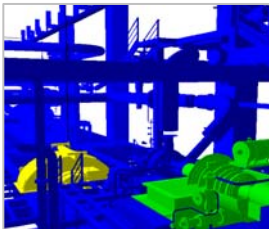
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### Process and Logistics



✓ *Is the turbo-pump movable within the cluttered environment of the nuclear power plant?*

✓ *Is this task feasible with a rolling bridge respecting special kinematic constraints?*

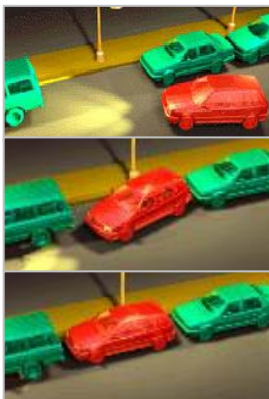


Answering those questions with by-hand techniques in the digital mock-up is a complex and time-consuming task. KineoWorks solves the problem in just a few seconds, saving days of tedious operator work.

### Transportation



✓ *Can I drive through this village without colliding any obstacle along the road?*



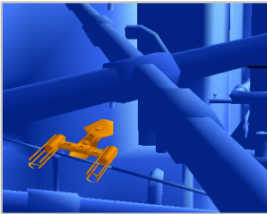
✓ *Can I park the red car automatically, respecting its specific motion constraints?*

KineoWorks™ uses your own motion constraints to generate realistic and feasible motions.

## KineoWorks™: a generic component

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### 3D-Simulation



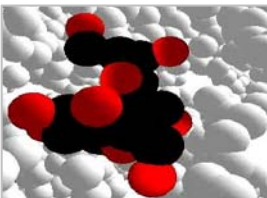
✓ *Can I compute and send the possible motions of this spacecraft over the internet, with a small data-structure?*



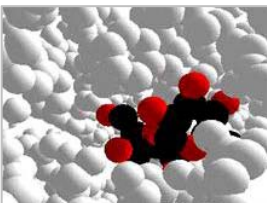
✓ *Can my character walk through the room, avoiding the furniture?*

KineoWorks™ provides motion compression and obstacle avoidance for 3D-simulators.

### Bioengineering



✓ *Which ligand will be able to reach the protein's active site?*



✓ *Is a binding between these two proteins possible?*

KineoWorks™ algorithms handle kinematics with a high number of degrees-of-freedom, allowing motion planification for complex molecular structures.

## Technological background

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### A Leading-edge technology

During the 90's, famous robotics research labs stated the main principles of automated motion planning. They developed collision free path computation techniques that are the roots of KineoWorks™ technology.

At the beginning of year 2001, a team of scientists from the French National Centre for Scientific Research – CNRS – created the KINEO C.A.M company to develop the KineoWorks™ technology.

KineoWorks™ implements Random-Tree Diffusion algorithms exploring the free configuration space of a mobile artefact. The *high efficiency* of KineoWorks™ relies on the probabilistic completeness of its algorithms. If a solution exists, it has a probability of one to be found.

KineoWorks™ integrates innovative mechanisms that automatically adapt to the complexity of the environment, i.e. within a not so constrained part of the space, the sampling step will increase. The combination of these original techniques provides a *fast one-click solution*.

Every calculation inside the configuration space uses simple 3D geometric operators like collision detection and distance calculation. It guarantees *the robustness* of the algorithms.

By its unique capability, the dynamic collision detector ensures *continuous obstacle avoidance* along the path.

## Contact

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Models are courtesy of Renault, EDF, DRE, Kalisto, Daesign, LAAS-CNRS.

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