DOCUMENTATION

For direct access to information, the Users Guide and Help manual are available via your favorite navigator (HTML).

PLATFORMS

The modeling environment of **SAMCEF for Machine Tools** is available on Windows NT, 2000 and XP Pro. However, remote computations can also be launched on any UNIX workstation.

SERVICES

SAMTECH provides worldwide engineering professional solutions to industries managing the design of machine tools.
SAMTECH also provides services from punctual assistance to global or partial studies to industries willing to externalize this design phase.
Continuous improvement of SAMTECH CAE technologies, allows SAMTECH to provide a high level expertise to automation industries.
The offering of high technological professional solutions as well as of a full range of associated services allow SAMTECH to face the challenge of a competitive and evolving market.

SAMTECH IS A GLOBAL SUPPLIER OF CAE SOFTWARE AND ASSOCIATED SERVICES

Stress Analysis

Virtual prototype

Software maintenance

Mesher

Integrated Software Solution

MACHINE TOOL ENGINEERING

SERVICES

Engineering expertise

Global or partial studies

Multi-Body Simulation

Courtesy of ITIA

CAD geometry

Training

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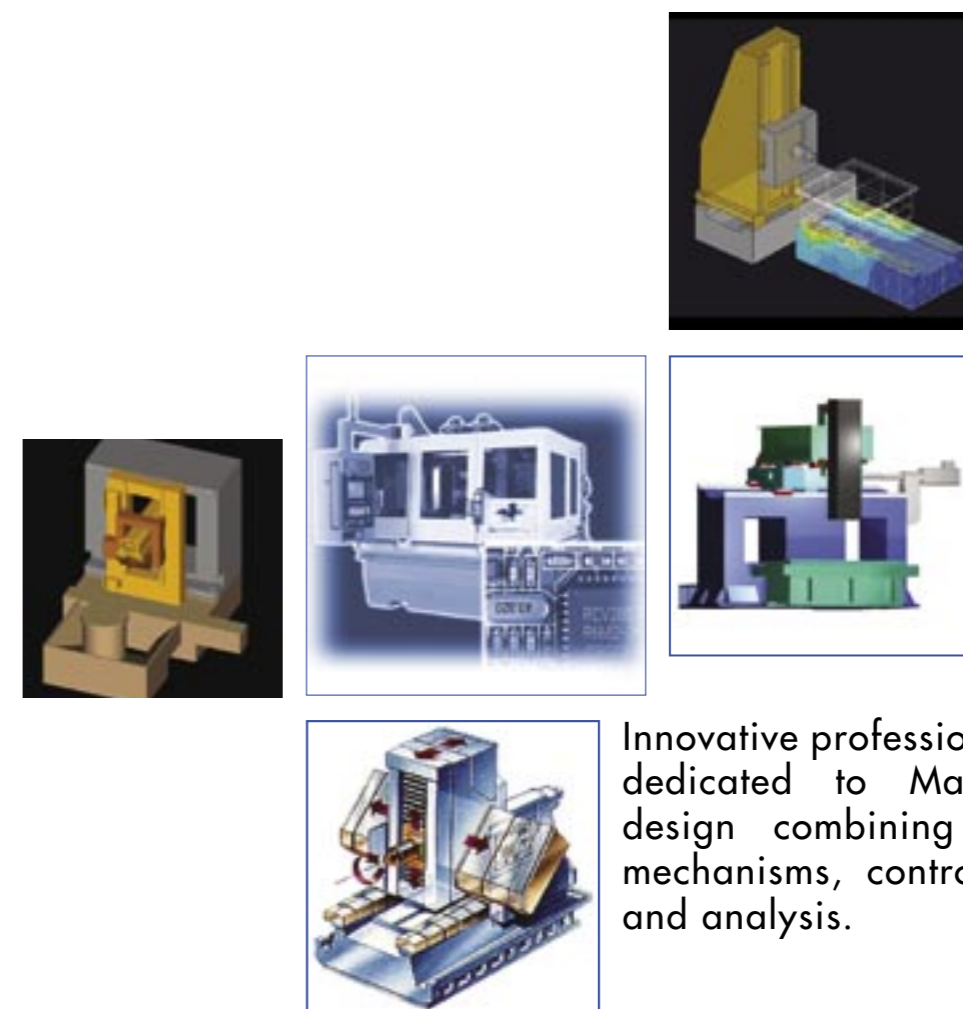Fax : +39 02 46 94 998
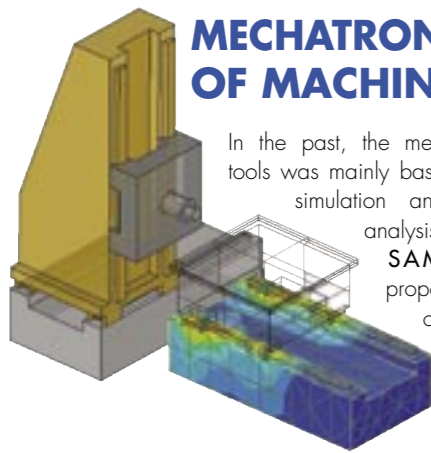
SAMCEF for Machine Tools

SAMTECH Mechatronic Solutions

Innovative professional solution dedicated to Machine Tool design combining structures, mechanisms, controller design and analysis.

SAMCEF **for Machine Tools** offers a unique environment for the global design and the detailed mechatronic verification of Machine Tools. It is a Computer Aided Engineering tool completely based on geometries defined locally or imported from well-known CAD systems. It offers a complete toolbox of components giving for the first time to the designer the possibility to use the same modeling environment during the whole design process from A to Z, i.e. from simple rigid body simulation to check the global kinematics of the Machine Tool to very detailed verification using Finite Element technique of the dynamic behavior of the machine tool interacting with its controllers.

MECHATRONIC MODELING OF MACHINE TOOLS

In the past, the mechanical design of machine tools was mainly based on rigid body mechanism simulation and separate local structure analysis using Finite Element Method. SAMCEF for Machine Tools proposes now the integration of these complementary disciplines into the same modeling environment with, in addition, the management of behavior laws of servomechanisms.

SAMCEF for Machine Tools is based on the following software tools developed by SAMTECH s.a.:

- SAMCEF Field, the associative object oriented modeling environment of SAMCEF;
- SAMCEF Linear, the complete set of linear modules of SAMCEF for structure analysis :
  - o linear static analysis (SAMCEF Asef);
  - o modal analysis and super-element creation/restitution (SAMCEF Dynam).
- SAMCEF Mecano, the powerful non-linear module of SAMCEF for both mechanism simulation and non-linear structure analysis in static, kinematical or dynamic conditions;
- BOSS quattro, the open object oriented task management and optimization platform, allowing also parametric studies, sensitivity analyses, statistical analyses, model updating with experiments, design of experiments and response surfaces.

Users can define simple control boxes directly in SAMCEF. In addition, direct interfaces allow to import digital control boxes from external functional simulation tools (MATLAB Simulink® for example) into SAMCEF Mecano, but also to export the output of a linearized configuration, giving it back to the functional simulation tool that can serve for the design of controllers or servomechanisms (MATLAB Simulink® for example).

Using SAMCEF for Machine Tools, the designers can chose the appropriate mechanical modeling of the machine tool depending on the progress of the design. The mechanical model can contain a description of all the parts (bodies) and the connection devices (joints) of the machine tool. Different modeling levels may be chosen, depending on the objectives of the analysis, not only for bodies (rigid bodies, beam, shell, volume FE models, super-elements…) but also for joints (ideal kinematical joints with or without friction laws, flexible sliders, ball screw element, linear motor, contact/friction conditions…). In order to connect the controllers to the mechanical model, "sensors" can be defined to measure inputs of controllers and "actuators" sending back the outputs of the controllers to the mechanical model. Finally, different types of mechanical analyses are accessible from the same modeling environment (transient non-linear analysis, static analysis, modal analysis and harmonic response on linear or linearized configurations…).

MODELING ENVIRONMENT

The modeling environment of SAMCEF for Machine Tools is SAMCEF Field, which is the main pre- and postprocessor of SAMCEF. This standalone software allows the complete graphical modeling of a machine tool as well as the choice of modeling complexity and of the analysis type from the same data definition completely based on geometry:

- Parts with rigid/flexible behavior, with linear/non-linear material behavior;
- Management of super-elements (creation, use and restitution) to reduce CPU Time if the behavior is linear;
- Assembly/kinematical joints (hinge joint, prismatic joint, cylindrical joint, slider, …);
- Motors and control boxes written by the user or generated by commercial functional simulation tools.

CAD GEOMETRY AND MESH IMPORT

SAMCEF for Machine Tools provides efficient tools to import and correct geometries coming from usual commercial CAD systems, through:

- Import of industrial standard formats: IGES, STEP;
- Direct import of proprietary formats: CATIA v4, CATIA v5, EUCLID 3;
- Import of meshes: NASTRAN, IDEAS Master Series.
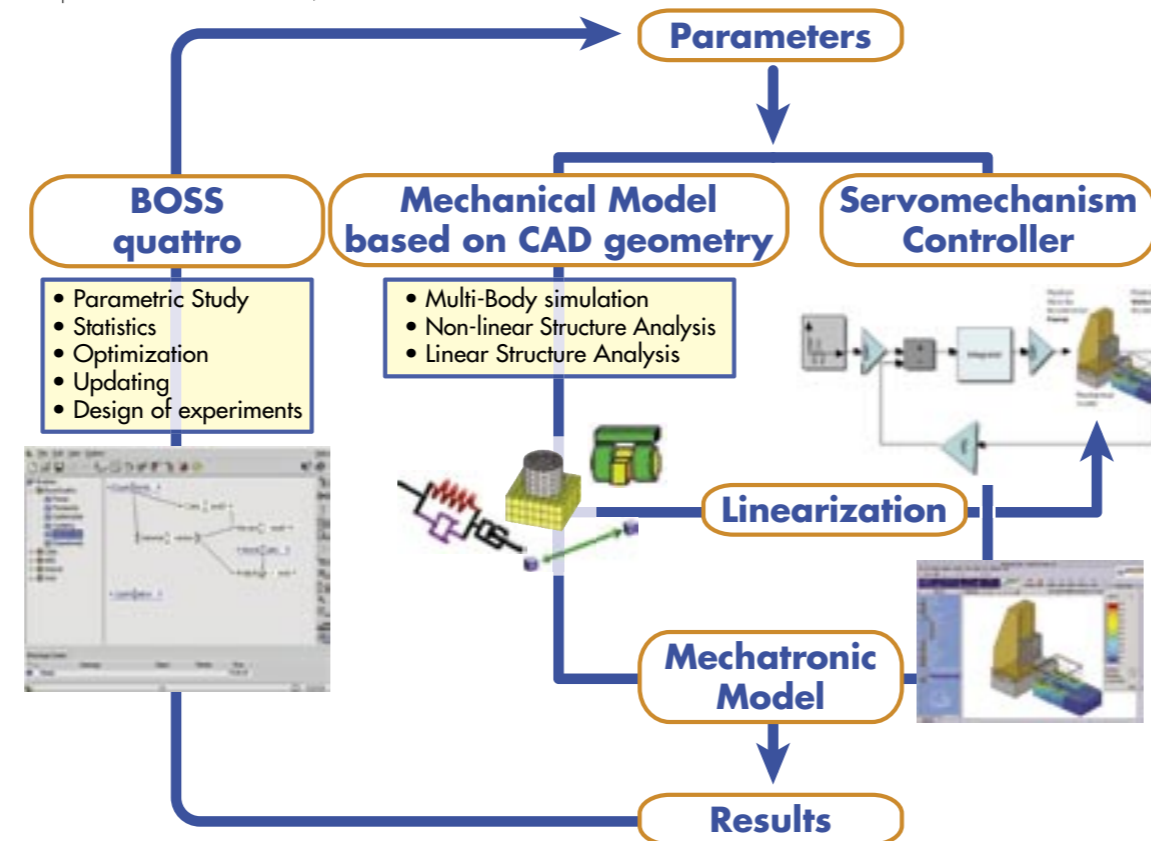
CREATION OF CAD GEOMETRIES

SAMCEF for Machine Tools benefits from a very efficient integrated parametric modeler. The user can, if required, create its own CAD models or import existing models and then optimize them. The geometry can be parameterized and automated functions provided by BOSS quattro allow the users to optimize the geometrical parameters.

SAMCEF for Machine Tools integrates simulation in the design process. It includes 3D design tools making it easy to create simple or complex parts in a very intuitive way, but also to rework existing mechanical systems starting from imported geometries.

- Surfacic et volumic geometries;
- Parameterization;
- 1D, 2D and 3 D modeling.

Nearby the creation of complex geometries in a single and integrated environment using powerful modeling tools, SAMCEF for Machine Tools allows to:

- Offer advanced modeling and solving capabilities;
- Provide tools to optimize geometry for machine tools;
- Apply modification to the geometry at any stage of the design process;
- Enable the user to view the model in assembly kinematics mode to ensure all parts work in unison without interference.

ANALYSIS DATA

A key feature of SAMCEF for Machine Tools is that it maintains the associativity between the data and the geometry; for example when changes are made to the grid, all related items are easily updated.

SAMCEF for Machine Tools provides you with intuitive tools for data definition and pre-visualization, as well as import and use of existing data libraries.

- Use of the mechanical engineering language;
- Assignment of the analysis data to the geometry or the F.E. mesh;
- Pre-visualization and association of a symbol to each data;
- Linear and non-linear isotropic and orthotropic materials (elastoplastic, hyperelastic, etc) for thermo-mechanical analysis;
- Physical data for volume, shell, membrane, beam and bar element;
- Flexible or rigid behavior;
- Mass & inertial moments in rigid behavior;
- Boundary conditions and loadings;
- Definition of springs, contacts and gap constraints;
- Joints (fixed cylindrical, prismatic, hinge, slider, sensor, distance, etc).
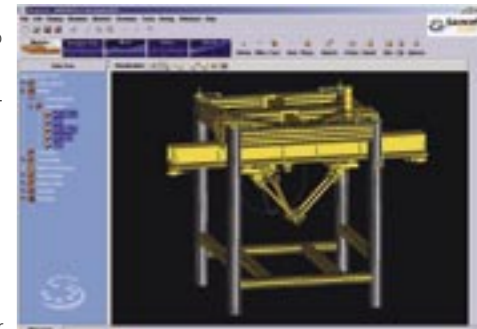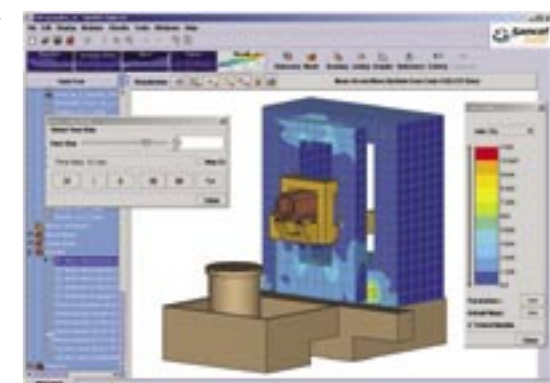

Courtesy of ITIA-Cnr

SOLVERS

From the same modeling infrastructure of SAMCEF Field, SAMCEF for Machine Tools gives a direct access to :

- Rigid body simulation (SAMCEF Mecano);
- Linear static, modal (SAMCEF Asef, SAMCEF Dynam);
- Non-linear structure analysis (SAMCEF Mecano);
- Creation/Restitution of super-elements (SAMCEF Dynam);
- Rigid body simulation with super-elements (SAMCEF Mecano);
- Coupled rigid body simulation with super-elements and non-linear structures (SAMCEF Mecano);
- Linear structure analysis on a linearized configuration coming from SAMCEF Mecano (SAMCEF Asef, SAMCEF, Dynam).

ANALYSIS RESULTS

SAMCEF for Machine Tools benefits of advanced post-processing capabilities depending on the analysis type. Results are post-processed graphically in the form of maps of results, animations (mode shapes, kinematical modes, successive configurations, strains, stresses, …) or curves (time evolution of a value for example).

In addition to standard graphical outputs (i.e., X-Y plots and isovalues), results may also be inserted in tabular forms in the analysis report. Results may be displayed in many different forms over the whole structure or through user's defined cross sections to study its behavior. Navigation and video functionalities (zoom, replay, etc) allow you to turn around the piece, to observe details thanks to simultaneous multi-windowing, to scan a shape, etc.

Courtesy of Comau SpA & ITIA-Cnr

Parameters

BOSS quattro
- Parametric Study
- Statistics
- Optimization
- Updating
- Design of experiments

Mechanical Model based on CAD geometry
- Multi-Body simulation
- Non-linear Structure Analysis
- Linear Structure Analysis

Servomechanism Controller

Linearization

Mechatronic Model

Results