SIMPACKNews

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Dezember 2001

INTEC partners up with ETAS

INTEC and ETAS have signed a Memorandum of Understanding. The goal of the partnership is to support the product development process from classic off-line multibody analysis to real-time simulation on hardware-in-the-loop systems.

Events

Sabine E. Engert

INTEC GmbH

SIMPACK User Meeting 2001 in Bad Ischl

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Gordon Strickert

DLR Braunschweig

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INTEC GmbH

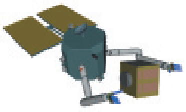
New Plug-In for SIMPACK 8.5: SIMBEAM

Robotics

Roberto Lampariello

DLR Oberpfaffenhofen

Modelling and Real-time Simulation of a Two Arm Free-Flying Robot



ETAS offers a complete spectrum of efficient tools for developing, testing and implementing embedded control systems in the automotive industry. SIMPACK is established in the automotive and rail industry in the field of off-line simulation for functional virtual prototyping. Verified simulation models with established data and substructure input methods have been and are being developed in this field. The challenge is to use these model libraries in real-time simulation, combining off-line and real-time simulations. SIMPACK has always allowed models to be exported to other environments as code. In the frame of the collaboration with ETAS this functionality will now be extended significantly.

The partnership with ETAS will enable the development of a marketable solution which combines off-line and real-time simulation within one software environment. The first step has been made in signing a 'Memorandum of Understanding'. INTEC will be responsible for the model creation, MBS-methods, solver, data path to the MBS-world and the code export. The main activity of ETAS lies in the model creation, responsibility for and support of the entire system, links to the HIL-hardware and operation of the control systems.

Combining the knowledge of both companies and interfacing

A. Eichberger (INTEC), B. Ebinger (ETAS) and B. Heppner (ETAS) the software an ideal partnership was found, which closes the gap between the real-time and the off-line world. A continuous and open solution can now be offered from off-line simulation to the hardware-in-the-loop test of embedded control units.

ETAS GmbH was founded in 1994 as a subsidiary of Robert Bosch GmbH and is having its Head Office in Stuttgart, Germany. The product range comprises a complete spectrum of efficient tools for developing, testing and implementing embedded control systems in the automotive industry. ETAS currently has 500 employees world-wide and attained a revenue of EUR 83 million in 2000.
With its own subsidiaries in Ann Arbor (USA), Yokohama (Japan) and Paris (France), distributors in Brazil and Korea as well as a sales office near Birmingham (Great Britain), ETAS GmbH assists its customers as a competent partner with support and services.

Sabine E. Engert
INTEC GmbH

SIMPACK User Meeting 2001

SIMPACK User Meeting 2001 in Bad Ischl

The SIMPACK community met on the 13th and 14th of November for the 4th SIMPACK User Meeting. In line with SIMPACK becoming more globally orientated, this year's User Meeting was the first to be held in English. INTEC revealed the positive business development and strong growth of the company during the last one and a half years and showed the concepts for the future developments. The new SIMPACK, Version 8.5, was presented and given to the customers as an early bird release. The sixteen excellent user presentations made this year's meeting a resounding success.

INTEC's Business Development

After Dr. Mauer, Managing Director, welcomed all guests to the meeting, Dr. Eichberger, Managing Director, reported on the development of INTEC's business since the last User Meeting. Since last year's User Meeting the turnover at INTEC is increased by 30% and the number of employees by about 60%. This ties in with INTEC being responsible for the overall product development of SIMPACK, while the partnership to DLR will continue in terms of research activities and project based collaboration. The new partnership with Etas has been disclosed as reported in detail in this SIMPACK News. Director of Sales and Marketing Johannes Gerl reported the ongoing internationalisation of INTEC's business. With 67% of the companies that became SIMPACK customers since the last User Meeting being from outside the home market, INTEC executed the step to a global player on the CAE software scene. The SIMPACK of the future, the product to carry forward this process, was characterised: Leaving behind the competitors in simulation technology, the new versions will offer a maximum of usability and control for the experienced user – standing to benefit from a solver that is expected to be "a hundred times faster" than today.

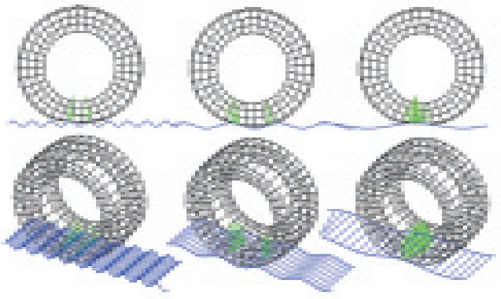
New SIMPACK Version 8.5

Dr. Wolfgang Trautenberg, Director of Product Development, demonstrated the new features of SIMPACK 8.5 with an online presentation.

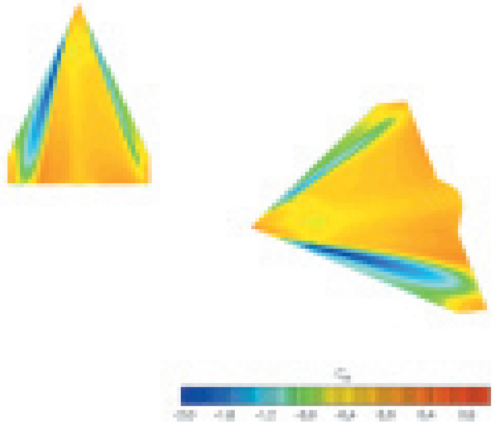
He set up a couple of well-known SIMPACK tutorial models. Many new features and new functionalities were presented both in terms of usability and in solver technology.

Dr. Stefan Dietz, responsible for the development of the SIMPACK FEA interface, showed enhancements in the new version of FEMBS, which from now on will be released together with SIMPACK. The new features include the new GUI, a new file standard that simplifies the data exchange to FE-codes and above all a brand new approach to generally interface FEA with multibody codes. This approach will allow an analytical rather than a numeric solution of the FEA-part of the combined system and it will therefore be both very fast and unsusceptible to high frequencies and big model sizes. This makes it the perfect solution, for example, for NVH calculations with flexible car body structures.

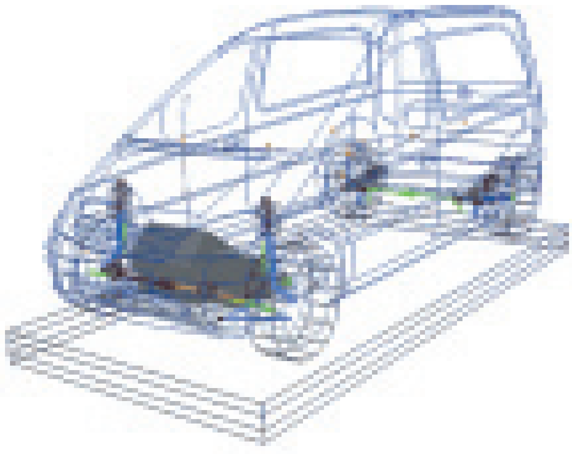
Marcus Schittenhelm and Christoph Weidemann, INTEC's experts for automotive and railway systems, then showed the applications of the new SIMPACK in connection with cars and



Tyre Model RMOD-K 1)



SIMPACK-CFD Interface by DLR 2)



Model of the Vaneo from Mercedes 3)

trains. The main highlights include the completely revised, and now 3D, track module, numerous new modelling elements and the improved database handling.

Software Associated with SIMPACK and General Applications

Andreas Fandre from gedas presented the tyre model RMOD-K which is now available with the new integrated interface directly in SIMPACK for current RMOD-K users.

RMOD-K comprises a driving dynamics (rigid ring) model and a ride comfort (flexible) model; the latter valid for frequencies of up to 300Hz. The new version 7 which is currently developed at Anhalt University of Applied Sciences and gedas available in May (rigid ring model) and October (flex ring model) 2002 will offer features which make RMOD-K one of the very best tyre models. It includes a new solver with adaptive numerics, an FEM based flexible ring model.

Christian Armbruster from Imagine showed various possible applications of a co-simulation interface between SIMPACK and the French 1D-mechanics, hydraulics and pneumatics simulation tool AMESIM.

Two new innovations for aerospace applications have been presented by the SIMPACK development partner DLR: a so-called Aero-FEMBS which uses a very effective modal approach to enhance FEMBS with aerodynamic properties (Martin Spieck) and an approach which couples SIMPACK to the DLR own CFD-code TAU (Gunnar Einarsson).

Siemens Dematic AG (Dr. Henning Bork) uses SIMPACK for simulations of the Siplace Placement Lines (machines for the assembly of electronic devices). Flexible parts are imported as FE models from ANSYS. If controlled systems have to be simulated, the SIMPACK models are exported to MATLAB Simulink using the Symbolic Code.

SIMPACK Automotive

DaimlerChrysler, represented by Volker Sing from Mercedes, presented the “Set up of an Automotive Test Rig in SIMPACK”. The experimental force data, measured at the wheel centre, was used as the input for the SIMPACK multibody simulation. The results determined the loads for FEM and fatigue analysis as well as the excitation of a hydraulic test rig. The problem of a drifting vehicle (which would appear not connected to the ground by springs) was solved in a very elegant way by eliminating the drift forces with a closed loop control system, that was completely realised within SIMPACK Control. The results of a model equipped with a flexible body showed an excellent correlation between simulation and measurement.

Andreas Raith from BMW was intensively involved in ”The application of Dynamic Reduction in Modelling Exhaust System as a Flexible Body”. His presentation gave a very valuable outline of the usage of the unique FEMBS speciality ‘frequency response modes’ and the usage of dynamic mode reduction which will be supported by FEMBS in the very near future and which was made available for BMW in the framework of an earlier project.

Thomas Schrüllkamp from IKA RWTH Aachen used SIMPACK to support the measurements taken from a kinematic and elasto-kinematic wheel suspension test rig. A mathematical simulation model was successfully derived, based on the measurements taken, which provided good correlation without having to model geometrical input or mounting elements.

The Technical University of Prague used SIMPACK to simulate ”Vehicle-Pedestrian Collision”. Prof. Kovanda demonstrated with a impressive simulation the performance of SIMPACK’s numerical capabilities. Comparisons to similar simulations in Madymo and to experimental data showed good over-all correlation.

Mr. Neubeck from FKFS Stuttgart demonstrated how The SIMPACK Code

1) courtesy of gedas gmbh

2) courtesy of DLR

3) courtesy of DaimlerChrysler AG

Export was used to carry out real-time simulations of heavy trucks with up to 35 degrees of freedom and 7 rheonomic drives that run in real-time. Industrial standard PCs were used for hardware-in-the-loop simulations and as simulation engine for the driving simulator at FKFS.

Finally Bob Thurman from Land Rover gave an overview about the activities at Land Rover. A big number of simulations in the fields of power train analysis, chassis analysis, body analysis and vehicle refinement analysis was carried out. A highlight was added showing the simulations 'bridge jump' and 'idiot start', where SIMPACK could demonstrate its outstanding stability and reliability when performing a time integration. Very good results have been shown as well in simulations with flexible car bodies imported from FEM tools.

SIMPACK Wheel/Rail

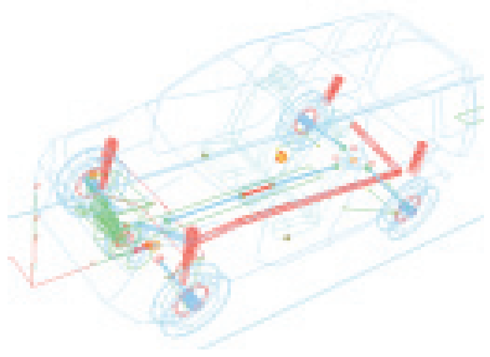
The second day of the SIMPACK User Meeting was opened by Dr. Anton Stribersky from Siemens Transportation Systems in Vienna. The SIMPACK simulation of the Vienna Metro was carried out with flexible car bodies imported from ABAQUS and a large number of model variants were investigated using a model database created at INTEC. Moreover the results obtained by multibody simulation have been transferred to a so-called active digital mock up tool. The required space for a vehicle, for instance passing through a tunnel or entering a station was calculated using the dynamic results of SIMPACK ("gauging"). The required information for the vehicle's dimensions was made available by the 3D CAD system. This project was carried out at different Siemens sites in different countries, which meant it was vital that the data was continually up-to-date.

Roger Gansekow, Siemens Transportation Systems Krefeld, showed how the structural dynamics of a high speed train were optimised with a special focus on the influence of particular coupling elements; such as hydro rubber springs or conical rubber springs. The simulation results could successfully be verified by experiments on the roller rig.

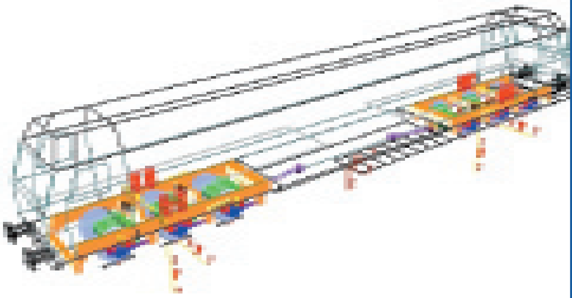
Nicola Bosso from Politecnico di Torino presented and discussed his work in rail research. Different bogie concepts of a mass transit vehicle (articulated, conventional; no traction, side traction, motor wheels) have been compared in terms of regarding curving behaviour and stability.

Mario Romani from Ansaldobreda, Pistoia showed how SIMPACK was used for the design of the low floor tram SIRIO for Naples, Milano and Gothenburg. Remarkable both for the simulations as well as for the vehicle in reality; the modularity and the variability in combining different car and bogie types. Extensive studies of linear as well as non-linear models were shown.

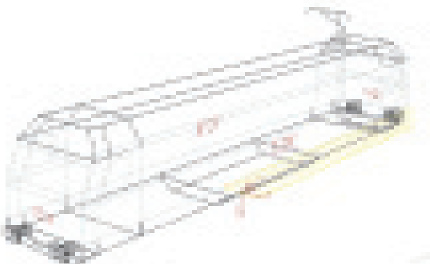
Mrs. Claudia Kossmann concluded 2001's SIMPACK User Meeting with an overview of the complex use of SIMPACK at Bombardier Transportation Winterthur, part of the company's COC for bogie dynamics. Models of urban, mass transit as well as high speed trains have been shown, having conventional and articulated as well as running and motor bogies (including drive train models). Projects were presented where flexibility of bogies and car bodies was taken into consideration and also the interaction between SIMPACK and MATLAB Simulink was covered – the simulation results compared well with the experimental data.

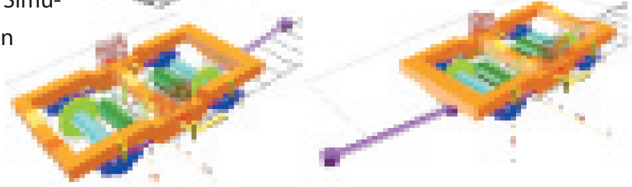


Model of Land Rover Defender 1)



Models from Bombardier Transportation 2)





1) courtesy of Land Rover

2) courtesy of Bombardier Transportation

Dr. Lutz Mauer: Welcoming

Dr. Alex Eichberger: INTEC on Track

Johannes Gerl: The International Market

Dr. Wolfgang Trautenberg:
Working with SIMPACK 8.5 and Beyond

Andreas Raith, BMW AG

Volker Sing, DaimlerChrysler AG

Nicola Bosso, Politecnico di Torino

Dr. Anton Stribersky,
Siemens Transportation Systems

Gordon Strickert
DLR, Braunschweig

SIMPACK Masters Skydiving

The Institute of Flight Research at the German Aerospace Center (DLR), Braunschweig, contributes to research and testing technologies for reusable space vehicles. The testing system has the name ALEX, which is a parafoil-load-vehicle for demonstration of an autonomous, soft, and precise landing. The design of a control-concept pre-supposes fundamental knowledge of the system characteristics and performance. In other words a model is required, which reproduces the vehicle's reactions to control inputs. As flight test data indicates, the system reacts not only to steering inputs by performing manoeuvres, but also by a motion of the load relative to the parafoil. That motion is characterized by kinematics and aerodynamics, so a suitable simulation environment should consider both.

Relative Motion

The parafoil and the capsule (load) are not linked stiffly. Lines and belts allow different deformations of the system. These additional degrees of freedom are: Relative yawing, relative rolling, lateral shifting and relative pitching.
The relative motion can be measured using a video-system which is rigidly mounted on the load with view to the parafoil. Relative motion is represented as a displacement of the canopy within the captured image. To extract quantitative measurements from the video data, the image sequence has to be analyzed by so called tracking-algorithms. This procedure makes the parafoil's position and orientation available.

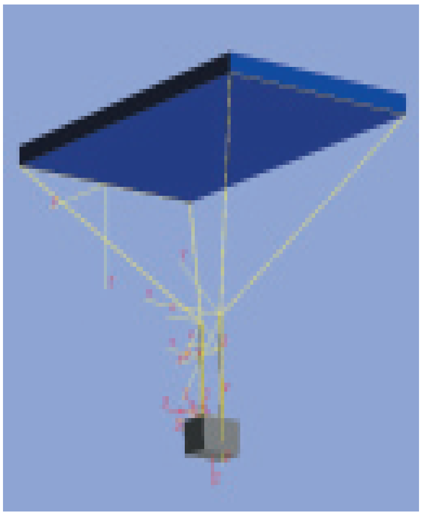
Kinematics

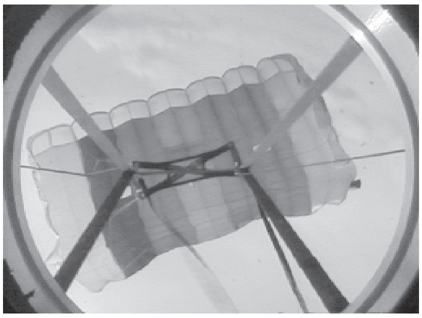
Video analysis yielded data that represent certain system qualities. A model of this system has to perform preferably the same way if it should be suitable for simulation and further analysis. Thus high demands are posed on the model; it must map the real geometry very closely. All elements involved in the relative motion should also be considered in kinematic modeling. With SIMPACK the complexity of such a model is easy to handle.
For setting up the model, first, lines and belts have been combined to functional units and then "translated" into SIMPACK-elements, for example "rods" or "prisms". Lengthening and flexibility of the lines are neglected. The underlying reason for that simplification is the initial tension of the system, resulting from the counteracting forces lift and weight. These forces prevent the lines from getting slack.
For the definition of connections between the bodies different joints, spring-damper elements and constraints have been used. The actuators and the control lines for the steering of the parafoil are represented by standard force-elements.
The parafoil-load-model covers 8 bodies with approximately 50 states. Not included are external, aerodynamic forces and moments that actuate the possible motions.

Aerodynamics

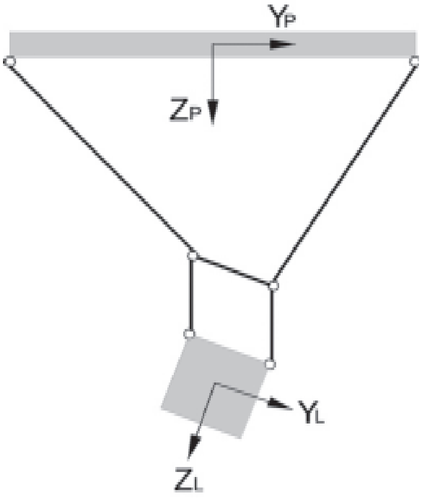
The aerodynamic behavior of our parafoil-load-system has already been modeled under the MATLAB SIMULINK environment for previous investigations. It's a simple flight mechanical 3 DOF model, which matches the flight


Alex-System


SIMPACK: Kinematic Model



Video Representation of Relative Motion



Example of Relative Motion: Relative Rolling

performance of the overall system sufficiently. This conventional model, describing only the rigid body motion, is to be enhanced by the introduction of additional degrees of freedom to allow relative motion as well.

Teamwork by Co-Simulation

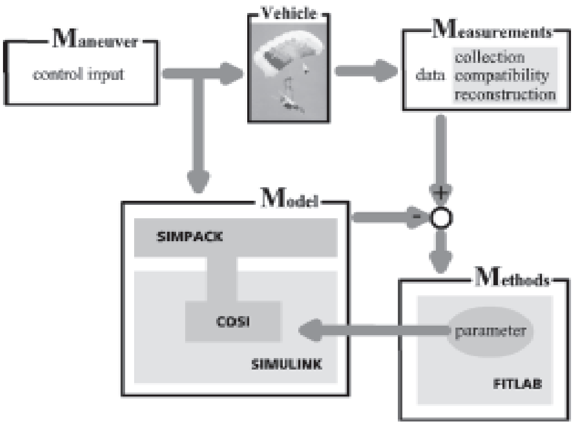
Each of the models has it's advantage, MATLAB allows easy preprocessing of flight test data and offers mathematical libraries for various engineering problems, and SIMPACK features powerful solvers especially for kinematic tasks and convenient 3D-visualisation.
The Co-Simulation Interface COSI offers the opportunity to retain all these advantages and merge the two simulation tools. SIMULINK first computes the aerodynamic forces and moments resulting from control inputs and the initial states. This information is passed over to SIMPACK, which simulates the kinematic behavior and returns the appropriate states back to SIMULINK.

Parameter Estimation

After the overall-model has been set up it's necessary to tune the model parameters. Since a real system, equipped with various sensors, is simulated, it is possible to compare computed and measured states. Tuning of the parameters should result in a least possible difference between data from measurement and simulation.
The estimation of the parameters is done automatically with the help of an output-error-method (FITLAB) which is implemented under MATLAB by DLR Braunschweig.

Fields of application

Having assembled and tuned the simulation environment, it is finally ready for utilisation. One practical use of this model is to find correction terms for flight data measurements. Understanding the relative motion allows to transform measurements taken from the capsule in corresponding values of the parafoil. Another application is performing simulation studies to find out whether relative motion has to be considered for the design of the flight controller or not.
SIMPACK and SIMULINK make a perfect team to simulate flight mechanics plus kinematics. This combination is suitable for more than the analysis of parafoil.



Dr. Wolfgang Trautenberg
INTEC GmbH

New Plug-In for SIMPACK Version 8.5: SIMBEAM

The need for modelling flexible body behaviour in MBS models has increased significantly over the last couple of years. Quite often the flexible structures can be modelled as FEA models which use beam elements only. With modern fully parameterised MBS models it was only natural to combine the powerful parameterisation features of SIMPACK with the capabilities for generating and analysing beam structured flexible bodies right within SIMPACK. This new Plug-In SIMBEAM now allows the user to create flexible bodies within the SIMPACK GUI inside their MBS models. The defined flexible structures are incorporated into the system equations via a modal description.

Simple Definition

The creation of such flexible components is very simple and straightforward. The user selects the body on which the flexible components should be created. Each flexible component is then created between two markers on that body. Materials and cross-sections for the flexible components are defined as separate elements and can be reused in the whole model and even be read from and stored to the SIMPACK database. A material and a cross section is assigned to the flexible component and the number of beam elements which should be created between the two markers is defined. After this the definition is complete. Typically one body consists of a set of flexible components which are connected to each other.

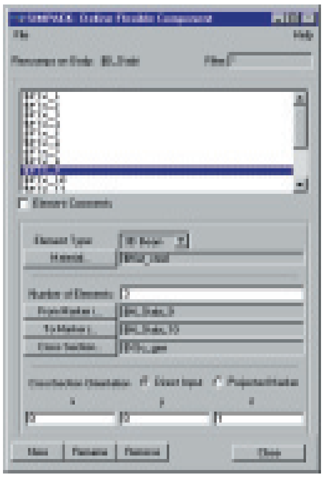
Flexible and Parameterised

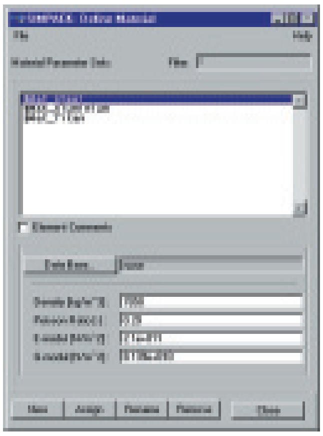
The flexible components of one body may branch at any marker and even form closed loops. The only requirement being that all flexible components of one body must be connected to form a single flexible body.

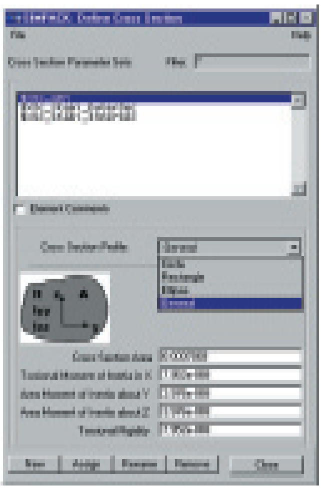
The direction of the beam elements, the cross-section and the material can vary for each flexible component which is created on a body. This way complex structures such as twisted stabiliser bars and tubular trellis frames can be easily defined. Since the flexible components reference standard parameterisable SIMPACK modelling elements such as markers they are fully parameterised. Once defined the flexible components are stored in the model .sys file along with all the other model data like bodies, joints and forces.

Built-in Modal FEA Solver

After the flexible components have been defined for a body the elastic properties in the modal space are calculated with a single mouse click in the SIMPACK GUI. The built-in FEA solver first creates the mass-, inertia- and the stiffness-matrices for the system and then performs a modal analysis. These results are written to the SIMPACK flexible body input file (.fbi) which can be run through FEMBS and then be used to define an elastic body in SIMPACK like any other flexible body results from traditional FEA programs.



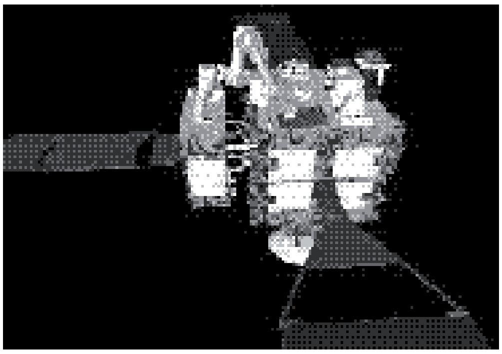




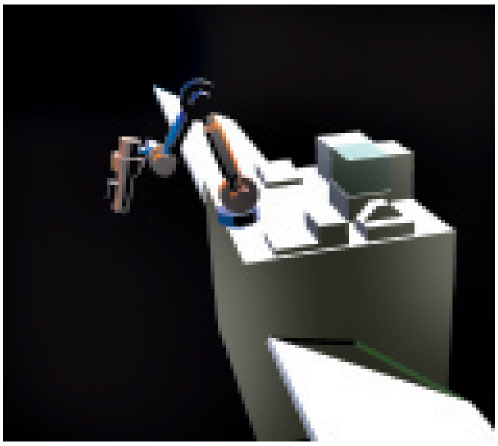
Roberto Lampariello
DLR, Oberpfaffenhofen

Modelling and Real-time Simulation of a Two Arm Free-Flying Robot with SIMPACK

The research and development in the field of free-flying robots at the Robotics and Mechatronics Institute of DLR has been supported, ever since its beginning, by the SIMPACK multibody dynamics software tool. Both modelling and simulation of these systems in the SIMPACK environment have been of aid in performing tasks such as path planning, parameter identification and control strategy development. The greatest contribution however, due to the symbolic code export capability, has lead to the development of a simulator, to run in a Unix environment, for a two arm robot system. This application was devised for tele-operation thus requiring real-time capabilities of the underlying software.



ETS - VII free-flying robot: Orbital set-up
(courtesy of NASDA)



ETS - VII free-flying robot: SIMPACK simulation model

The motivation behind the development of a free-flying robot simulator lies in the fact that such systems are still at an early stage of development and optimal strategies of operation as well as feasible operational tasks are still to be determined. The Robotics and Mechatronics Institute of DLR (Deutsches Zentrum für Luft- und Raumfahrt) was actively involved with what was the first free-flying robot to be flown in Low Earth Orbit in 1998, the ETS-VII experimental satellite of the Japanese Space Agency NASDA (see figure on the left site). Further research at the Institute is now looking at two arm systems, attempting to promote its light weight robot arm and robot hand, as well as the free-flying robot concept. Possible tasks which can be envisaged for free-flying robots are: satellite repair and maintenance; satellite refuelling; in-orbit construction; de-orbiting of non-co-operative objects (such as defected satellites or space debris).

The major characteristic of free-flying robots from a dynamics point of view is the fact that, unlike ground robots, the base is not inertially fixed. This is evident from the fact that the robot is mounted on a satellite. As a result of this, an interaction between the robot and the base motion takes place which gives rise to a particular kind of dynamic behaviour to the system.

From a modelling point of view, the robot can be represented in a straightforward manner. All that is different from a conventional robot is the fact that extra degrees of freedom are introduced by the free moving base. The system, which is generally composed of rigid bodies, will then have 3+n degrees of freedom, where n is the number of joints of the robot(s). Note in fact that 3 degrees of freedom are eliminated by the conservation of linear momentum, meaning that the system is completely described by the robot motion and only three of the states of the base body (satellite).

With redundant robots arms, which generally have seven degrees of freedom, a two arm free-flying robot will then have 17 degrees of freedom in all. This of course is not taking the end-effectors into consideration.

In order to achieve a real-time simulation environment for the above described system, the structure described in the lower figure on the right site was adopted.

The lower figure on the right site can be described as follows:

- The input to the simulator is determined by two space mice, which control the state (position and orientation) of the end-effectors of the two robot arms. This input is given in terms of small variations of the states, described in the figure by the vector variable Δx^e.

Further input is determined by the variables Δm^e and ΔI^e which represent desired variations of the mass and inertia of the load on the end-effectors.

- The state variations Δx^e are processed by the 'Inverse kinematics' module, which generates the equivalent joint position variations of the robots, vector $\Delta\theta$ required to obtain the desired end-effector motions. This module solves the inverse kinematics as an optimisation problem, minimising the robot motion as well as posing some extra constraints to allow for preferred postures of the arm during its motion.
- The desired joint position variations are fed into the dynamic model of SIMPACK. The latter was obtained as a symbolic code export of a free-flying robot model. Further modifications of the model, with respect to the one described above, are the use of rheonomically driven joints (14 in all) to drive the two robots. This resulted in a reduction of the degrees of freedom of the system to only six. The rheonomic functions were programmed in the user routines as time excitations with the spline form shown in the upper figure on the right site. The output of the 'Dynamics' module is, after integration of the equations of motion of the system which is subject to the desired robot joint motions, the state variation of the satellite base, vector Δx^b.
- The new position of the free-flying robot is updated in the simulator viewer.

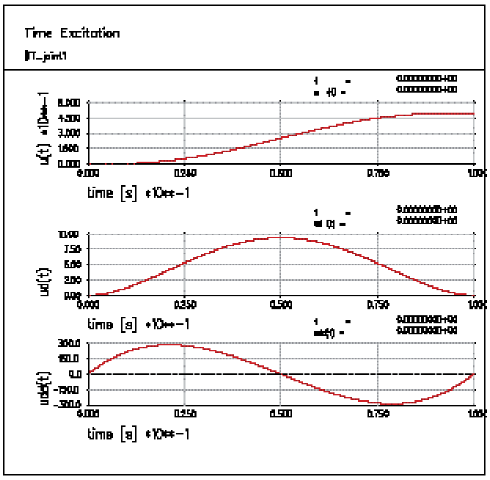
The results of this simulator structure are very good, in that the simulator runs in real-time on a standard Sgi machine (with extended graphics capabilities). The integration of the SIMPACK symbolic export code is performed with the explicit Euler integration method.

The feature of varying the mass and inertia of the load on the end-effectors of the robot (variables Δm^e and ΔI^e) was introduced in the simulator to demonstrate how the dynamic interaction between the robot and the satellite base motions varies in relation to the ratio between the size of the two. This feature was included in the symbolic code export by hand with some effort and was validated with an independent code of the robot dynamics. However, parameter dependent symbolic codes should become available in future SIMPACK versions, as the SIMPACK developers have confirmed.

The capacity to generate a symbolic code of multibody systems is a very powerful tool since it allows for a versatile means to incorporate models in independent working environments. This is in view of performing optimisation work as well as parameter identification, control and design. The advantage of saving the user a great deal of programming time is clearly evident. Furthermore, the efficient programming of the equations of motion of complex multibody systems in SIMPACK has proven to provide very good results for real-time computation.

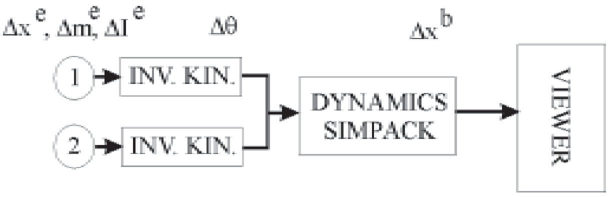
For any further information of free-flying robots research at the DLR please contact R. Lampariello at roberto.lampariello@dlr.de or refer to the web pages:

http://www.op.dlr.de/FF-DR/dr_mkd/staff/lampo/Roberto.Lampariello.html
http://www.op.dlr.de/FF-DR/dr_mkd/research/SpaceRobots.html

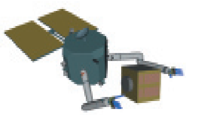


Time excitation for robot joints
(time,velocity,acceleration)

Space mice

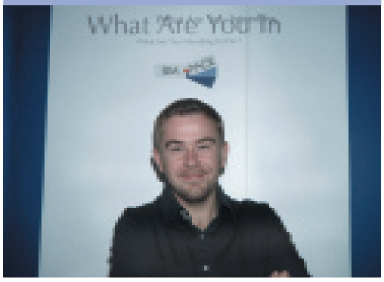


Simulator flow diagram



Robonaut free-flying satellite model

Johannes Gerl
INTEC GmbH



Global Player

SIMPACK is continuing to become a global player. During the period from last year's Users Meeting in Konstanz, April 2000, to this year's in Bad Ischl, 12 new companies became users of SIMPACK. Among them 8 are not from SIMPACK's home market Germany. This clearly demonstrates that SIMPACK is highly competitive throughout the whole world.

One of INTEC's keys to success is the fast and capable support by INTEC and its partners. This same approach is now being used to help INTEC expand internationally. Within the same one and a half years INTEC's staff has been almost doubled - among the new engineers there are English, American, Hungarian, Italian... to be continued.

Continuing Success in Japan

As already reported in the last SIMPACK News, SIMPACK has had a very successful start in Japan. Continued sales success since then has established SIMPACK in the Japanese market.

ZF goes with SIMPACK

The Central Research and Development Department of ZF Friedrichshafen AG, one of the leading automotive suppliers, has now become a SIMPACK user. We are looking forward to our collaboration.

New University and Research Licences since Juin 2001

CEIT, Departmento de Mecánia Aplicada, San Sebastian, Spain
FH Karlsruhe, Hochschule für Technik, Fachbereich Maschinenbau, Germany
Hochschule für Angewandte Wissenschaften München, Fachbereich Fahrzeugtechnik, Germany
INSA Lyon, France
Universität Erlangen, Lehrstuhl für Konstruktionstechnik, Germany
Universität Erlangen, Lehrstuhl für Technische Mechanik, Germany
Technische Universität Dresden, Institut für Maschinenelemente u. Maschinenkonstruktion, Germany

New Commercial Licences since Juin 2001

Alstom LHB GmbH, Germany
BMW AG, Germany
Bombardier Transportation, Nürnberg, Germany
Bombardier Transportation, Winterthur, Switzerland
DaimlerChrysler AG, Nutzfahrzeuge, Germany
Mannesmann Sachs AG, Power Train, Germany
Mannesmann Sachs AG, Chassis, Germany
Metro Madrid, Madrid, Spain
Toyota Motor Corporation, Japan
ZF Friedrichshafen, Germany

Dr. Stefan Dietz

Stefan Dietz has now been with INTEC GmbH for almost four years. After completing his doctorate at the TU Berlin, in connection with DLR Oberpfaffenhofen, he came to work for INTEC as a project and development engineer. In particular with the FE interface to SIMPACK; FEMBS.

Dr. Stefan Dietz
Development and Projects

He came up with the conceptual design for the FE interface and was also heavily involved in its development.

Currently he is working on new approaches for the integration of flexible structures in SIMPACK. The target is to describe deformations in SIMPACK with more detail while calculations times remain the same.

After gaining more and more experience, Dr. Dietz will concentrate more on the basic methods for new features in SIMPACK. He will now be responsible for SIMPACK FEA Methods in new fields (Engineering and Calculation Methods).

Christoph Weidemann

Christoph Weidemann joined INTEC GmbH as a new employee in September. He's not a new face at INTEC though; in the process of writing his doctorate at the Bochumer Verein Verkehrstechnik he has already spent some time at INTEC programming the wheel wear in SIMPACK. He's therefore an old hand amongst the SIMPACK users and has been using SIMPACK since 1998.

Mr. Weidemann is not only interested in simulation technologies. He took a year out from university to work in quality management at BLS AG, Lötschberg, the largest private railway company in Switzerland.

Christoph Weidemann
Support and Projects

After studying Mechanical Engineering in Aachen and specialising in railed vehicle technology he went on to write his degree dissertation at Bochumer Verein Verkehrstechnik and stayed there to do his doctorate. He has now successfully completed all the exams for his doctorate.

Mr. Weidemann is responsible for projects and support in SIMPACK wheel/rail.

Jan Zeman

The INTEC team in October 1999 was strengthened by the arrival of Jan Zeman.

Before he came to Germany he did his diploma at Czech Technical University in Prague and wrote his diploma thesis in collaboration with Skoda. Whilst studying in Prague Mr. Zeman gained experience in using SIMPACK.

Jan Zeman
Support and Projects

At INTEC Mr. Zeman has been working as a support and project engineer. The experience he gained with Skoda has helped him become one of our automotive experts. He is well known to our clients and especially to those who work with SIMPACK AUTOMOTIVE$^+$ such as DaimlerChrysler AG, BMW AG or WABCO.

In addition he is a trainer for the SIMPACK Basics training and for the SIMPACK AUTOMOTIVE$^+$ training.

INTEC at the Landkreislauf

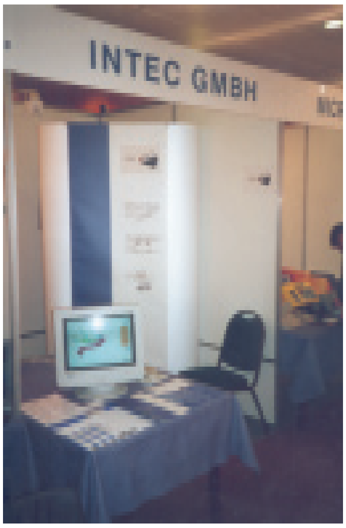
INTEC underlined its team spirit by competing in the 17th Starnberg run (13. October 2001). The team was strengthened with the help of runners from the German Aerospace Research Center (DLR) and IMAGINE Software GmbH. There were a total of 130 teams participated, with a number of teams containing international top class runners.

Nevertheless the SIMPACK team finished an excellent 20th place overall and second within the company teams entered from the Starnberg area.

The goal has therefore been set for next year's race.

17. IAVSD Symposium in Lyngby, Dänemark

Already at the 16th Symposium Professor Kortüm, from the German Aerospace Research Center (DLR), was appointed president of the IAVSD. And now, two years later, the 17th symposium was opened by Professor Kortüm on the 20th of August at the Technical University of Denmark. On Thursday, the 23rd of August, the conference left Denmark over the Öresund bridge and headed to the Technical Lund Institute of Technology in Sweden. The conferees were greeted at the institute by Professor Führer, who was involved in the development of the numerical solvers for MEDYNA and SIMPACK during his time at



XXXII. Meeting of Bus and Coach Experts, Budapest

XXXII. Meeting of Bus and Coach Experts

This was the first time that INTEC had attended the meeting of Bus and Coach Experts. The conference was held in Budapest in October and was mainly for companies from Hungary. However, a number of international companies also attended and some presentations were held in English.

INTEC GmbH was the only company represented from Germany.

Mr. Szaip, INTEC GmbH, at the Congress of Railway Bogies and Running Gears

Railway Bogies and Running Gears

This was the second time for INTEC to be represented at the Budapest Conference. Christoph Weidemann, our new Wheel/Rail representative, presented a paper on using SIMPACK for analysing the horizontal dynamics and wear characteristics of rubber damped wheels.

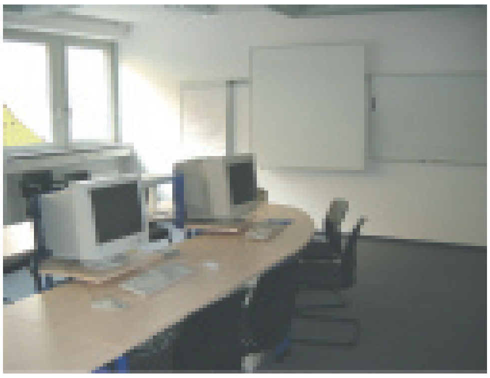
World Congress on Railway Research, Cologne

This was the first time that this congress has taken place in Germany, with the Research and Technology Centre of Deutsche Bahn AG taking care of proceedings. There were over 400 papers presented at this conference. INTEC was present at this acclaimed congress along with the new SIMPACK stand.

SIMPACK Training Courses

from	to	Training Courses
21.01.02	22.01.02	SIMPACK BASICS Training
23.01.02	24.01.02	SIMPACK WHEEL/RAIL Training
23.01.02	23.01.02	SIMPACK AUTOMOTIVE⁺ Training
18.02.02	19.02.02	SIMPACK BASICS Training
20.02.02	20.02.01	FEMBS Training
21.02.02	21.02.02	SIMPACK USER ROUTINES Training
22.02.02	22.02.02	SIMPACK CONTACT MECHANICS Training
18.03.02	19.03.02	SIMPACK BASICS Training
20.03.02	21.03.02	SIMPACK WHEEL/RAIL Training
20.03.02	20.03.02	SIMPACK AUTOMOTIVE⁺ Training
22.03.02	22.03.02	SIMPACK NVH Training
15.04.02	16.04.02	SIMPACK BASICS Training
17.04.02	17.04.02	FEMBS Training
18.04.02	18.04.02	SIMPACK USER ROUTINES Training
13.05.02	14.05.02	SIMPACK BASICS Training
15.05.02	16.05.02	SIMPACK WHEEL/RAIL Training
15.05.02	15.05.02	SIMPACK AUTOMOTIVE⁺ Training
17.05.02	17.05.02	SIMPACK CONTACT MECHANICS Training
17.06.02	21.06.02	SIMPACK BASICS Training

The price for one day´s training is 390,- Euros.
Trainings can be organised at your company site. Please contact us for further information and prices.
The dates, as published here, can be subject to change.



Room for SIMPACK Training Courses

We would be glad to welcome you to our SIMPACK training courses.
To register for a SIMPACK training course contact Sabine E. Engert by E-Mail:
sabine.engert@simpack.de
or by telephone:
+49 8153 9288 40
or by fax:
+49 8153 9288 11

Ms Engert looks forward to hearing from you.

SIMPACK at Conferences and Exhibitions

20. - 22.02.2002	5. Schienenfahrzeugtagung 2002, Dresden
5. 04.2002	AMESIM European User Conference, Paris
04. - 05.06.2002	International Automotive Conference 2002, The Mathworks, Stuttgart
09. - 13.09.2002	AVEC '02, Hiroshima, Japan
24. - 27.09.2002	InnoTrans 2002, Berlin
01. - 02.10.2002	VDI Tagung Berechnung und Simulation im Fahrzeugbau
07. - 09.10.2002	11. Aachener Kolloquium, Aachen

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INTEC GmbH
Argelsrieder Feld 13
D-82234 Weßling
Tel.: +49-8153-9288 - 0
Fax.: +49-8153-9288-11
E-Mail: intec@simpack.de
HTTP: www.simpack.com

SIMPACK Version 5,6,7,8,8.5
FEMBS, LOADS,
ProSIM, CatSIM,
SIMAT, SIMAX
(INTEC GmbH, DLR)

Contact

United States and Japan

Altair Engineering
1757 Maplelawn Drive
Troy, MI 48084-4603
Tel.: +1- 248-614-2400, Fax: +1- 248-614-2411
www.altair.com

Altair Engineering, Ltd.
Tact No. 4, Bldg. 9F
2-23-12 Mimami Ikebukuro
Toshima-Ku, Tokyo Japan 171-0022
Tel.: +81-3-5396-1341, Fax: +81-3-5396-1851
www.altairjp.co.jp

Korea

SV Korea Inc.
RM 101, 1360-1, SA-1DONG
ANSAN, KYENGKI-DO, 425-171, KOREA
Tel. +82-345-501-4030, Fax. +82-345-501-4032
www.svdigital.com

Worldwide

INTEC GmbH
Argelsrieder Feld 13
D-82234 Weßling
Tel. +49-8153-9288-0, Fax. +49-8153-9288-11
E-Mail: intec@simpack.de
www.simpack.com

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Name Company Adress

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Applications