

# ROHR2

Program System for Static and Dynamic Analysis of Complex Piping and Skeletal Structures

SIGMA Ingenieurgesellschaft mbH





## Content

<b>1</b>	<b>The program system ROHR2 .....</b>	<b>1</b>
<b>2</b>	<b>ROHR2 Program version and scope of delivery.....</b>	<b>4</b>
2.1	ROHR2 Static and Dynamic for Windows .....	4
2.2	ROHR2 Interfaces .....	5
2.3	Integrated Interfaces .....	7
2.4	Licensing .....	8
2.5	Scope of supply and copy protection .....	8
2.6	System requirements .....	8
<b>3</b>	<b>ROHR2 Optional available programs.....</b>	<b>9</b>
3.1	ROHR2iso .....	9
3.2	ROHR2fesu.....	10
3.3	ROHR2stoss .....	11
3.4	Optional Interfaces - Integration of ROHR2.....	12
<b>4</b>	<b>ROHR2 - Input of the piping system, results and documentation .....</b>	<b>13</b>
4.1	System and load case input .....	13
4.2	Documentation and presentation of the results .....	14
4.3	Stress analyses.....	15
4.4	Loads on nozzles and supports.....	16
4.5	Additional results .....	17
4.6	Flange analysis .....	18
4.7	Documentation .....	19
<b>5</b>	<b>ROHR2 - Detailed features.....</b>	<b>21</b>
5.1	Overview .....	21
5.2	Input features .....	22
5.3	Documentation .....	24
5.4	ROHR2 calculation program .....	25
5.5	Stress codes in ROHR2 Static and Dynamic .....	27
<b>6</b>	<b>Software Services .....</b>	<b>29</b>
6.1	Program maintenance and updates, User support.....	29
6.2	ROHR2 trainings .....	30

### *Release 14.02*

Specifications subject to change without notice.

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## 1 The program system ROHR2

ROHR2 the CAE-system for component analysis, construction and structure analysis of complex piping systems

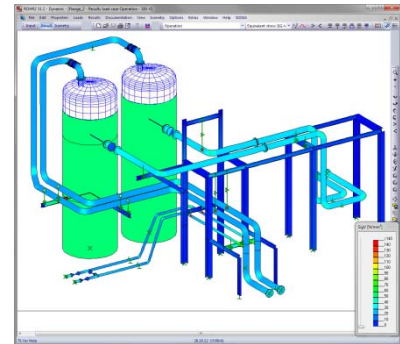
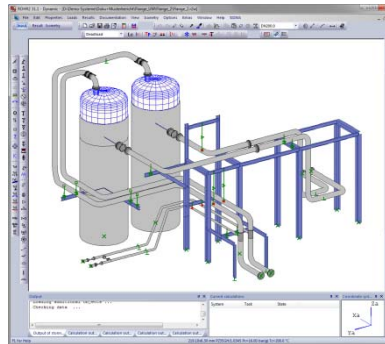
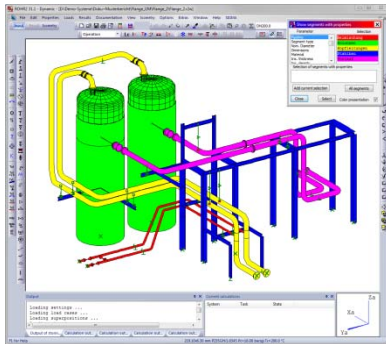
ROHR2 is the leading European Software for Pipe Stress Analysis, a standard tool for pipe static and structural framework analysis.

The main tasks of ROHR2 are component analysis, construction and structure analysis of complex piping systems.

The **static analysis** includes the analysis of any loads and load combinations according to first and second order theory for linear and nonlinear boundary conditions (friction, gap of supports, support uplift) and coupling conditions (nonlinear regulation powers of expansion joints).

The **dynamic analysis** includes the calculation of eigen values and mode shapes and their analysis by means of different modal response methods (e.g. analysis of fluid hammer forces). The earthquake analysis bases on the Time - History - Method.

An efficient superposition module enables a versatile selection and combination of static and dynamic results as well as the generation of extreme values for loads on supports, components and nozzles.



Stress analyses of pipe components can be done by a variety of specifications like **ASME, EN, ISO14692, KTA, CODETI** or **RCCM**.

ROHR2 creates the load case superposition and the equations automatically according to the selected stress specification.

ROHR2 compares existing and allowable stresses. The results will be documented in lists and graphic representations

The software is equipped by a range of additional features enhancing the engineer's daily job:  
a wide range of interfaces covering the leading CAD/CAE systems,  
ROHR2fesu FE analysis,  
ROHR2iso - isometric capabilities  
ROHR2stoss - Structural Analysis with Dynamic Loads using Direct Integration

**ROHR2 users**

For more than 40 years ROHR2 supports you with permanently developed program versions at pipe stress analysis tasks. Many well-known national and international plant construction companies as well as operators of the energy-, chemical- and petro-chemical industry trust in the quality of ROHR2.

ALSTOM POWER - AIR LIQUIDE - AE&E LENTJES - AIB VINÇOTTE - ANDRITZ - AREVA - AXIMA - BABCOCK BORSIG - BABCOCK & WILCOX - BALCKE DÜRR - BASF - BATEMAN - BAYER - BHEL - BGR BOILERS - BILFINGER PIPING TECHNOLOGIES - BP - BURMEISTER & WAIN - CIMTAS - CITEC - CNEC WORLEYPARSONS - DD-TEP - DONGFANG TURBINE CO. - DOOSAN BABCOCK - DP CLEAN TECH - DSD - ESKOM - ESTEQ - ENBW - E.ON - EVONIK - FERCHAU - FISIA - FIVES NORDON - FMT INDUSTRIEHOLDING - FOTAV RT - GASCADE - GEA - GRONTMIJ - GUANGDONG ELECTRIC - HITACHI - IDEA LTD - IHI CORPORATION - IMTECH - INFOSYS - INFRASERV - ISRAEL ELECTRIC - JACOBS - J&P-AVAX - J. CHRISTOF - KAE - KRAFTANLAGEN HEIDELBERG - KRAFTANLAGEN MÜNCHEN - KRÜGER A/S - LAHMEYER - LENZING TECHNIK - LEWA - LURGI LENTJES - M+W GERMANY - MAN DIESEL - MAN FERROSTAAL - MEYER WERFT - MCE ENERGIETECHNIK - NOELL - NORDON INDUSTRIES - OUTOTEC - OSCHATZ - OMV AG - PAUL WURTH - PÖYRY ENERGY - PETROBRAS - RAMBØLL - RWE - SENER - SEONGHWA LTD - SHELL - SIEMENS ENERGY - SMS SIEMAG - SPX COOLING SYSTEMS - STANDARDKESSEL - STEAG - STEINMUELLER - STRABAG - TGE MARINE GAS - THYSSENKRUPP UHDE - TECHNIP - TUEV NORD - TUEV SUED - TÜV AUSTRIA - VATTENFALL - VEBA RUHR OEL- VAM -VOESTALPINE STAHL - WESTINGHOUSE



and National technical control boards (TÜV), Power stations, Local energy suppliers, Manufacturers of pipe components, universities and a large number of engineering companies.

**Software Development, Sales and Support**

SIGMA, established in 1989 in Dortmund, Germany has emerged as a partner of choice for leading international companies with its software and the wide variety of engineering services. SIGMA is known as one of the leading engineering specialists in the Pipe Stress Business in Europe, offering field tested products, strongly adapted to the user's needs.

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Sales and support worldwide by SIGMA directly or by one of the ROHR2 Sales Partners in Europe Brazil/South America, China, India, South Africa, South Korea, Vietnam, South East Asia (Singapore, Malaysia, Indonesia, Thailand), USA. Meet our sales partners on [www.rohr2.com](http://www.rohr2.com).



## What´s behind ROHR2?

**ROHR2** is the worldwide used standard tool for **Pipe static** and **Structural framework analysis**, covering a variety of specifications like **ASME, EN, ISO14692, KTA, CODETI** oder **RCCM**.

The software environment can be supplemented by a range of programs enhancing the engineer's daily job, as there are FE- analysis, isometric capabilities and interfaces covering the leading CAD/CAE systems.

**ROHR2** is used by generations of engineers doing their jobs in power plants, nuclear power engineering, chemical industry, gas piping and technical control authorities.

**ROHR2**

means

**Pipe**

**Stress**

**Analysis**

<b>ROHR means PIPE</b>	<b>ROHR2 is made by engineers</b>	
Expertise in pipe analysis is shown in the product name: ROHR means PIPE in German	Started and created by one of the main software vendors in Europe - mbp in Germany - in the late 1960s, ROHR2 continues its success by SIGMA from 1989, accompanied by EDS Software in the 90's.	From the year 2000 on, the complete licensing and sales activities are in the hands of SIGMA. SIGMA is an engineering company basing on pipe engineering as well as software development. The result is a field tested product, strongly adapted to the user's needs.



<b>ROHR2 means system integration</b>	<b>ROHR2 is up-to-date</b>	<b>ROHR2 means quality</b>
<b>ROHR2</b> offers a large number of interfaces for the transfer of data from and to CAD and CAE-systems. Additionally <b>ROHR2win</b> , the graphical user interface of <b>ROHR2</b> , includes various export and import formats, working with graphics, texts and tables for viewing and documentation purposes. The integration of <b>ROHR2</b> into your workflow is additionally supported by third-party interface products.	Experienced pipe engineers and program developers answer the users' questions. The software is being developed continuously in order to incorporate the ongoing changes in the stress calculation codes and norms but also to improve the user interface and extend the capabilities of <b>ROHR2</b> according to the users' needs.	The software releases are tested and verified by highest internal quality standards and extensive field tests. The software maintenance includes periodical updates (via internet and program -CD), service releases as well as personal user support by qualified pipe engineers and software developers. <b>ROHR2</b> is one of the most frequently used pipe static software in the world.

**ROHR2** is the unique completely interactive piping analysis software and hence it offers significant time and cost reduction to your piping department which makes it part of the daily work in engineering companies worldwide.

**ROHR2 is your first choice in Pipe Stress Analysis**



## 2 ROHR2 Program version and scope of delivery

### 2.1 ROHR2 Static and Dynamic for Windows

Program System for **Static** and **Dynamic Analysis** of Complex Piping and Skeletal Structures

Stress analyses according to a great number of standards like **ASME, EN, ISO14692, KTA, CODETI** or **RCCM**

- Flange analysis acc. to EN 1591-1, EN 13445-3, ASME VIII, Div.1

ROHR2 Static and Dynamic includes the interfaces:

- Neutral CAD Interface including Export AVEVA PDMS - ROHR2,
- CAESAR II Import Interface
- PIPESTRESS Import Interface
- SINETZ Export interface
- Export Interface into the Support Design Programs LICAD, FLEXPORTE, CASCADE

The graphical user interface ROHR2win may be carried out in German or English.

Results may be printed in German, English or French.

Country specific program versions or floating licenses may differ from this specification.

Please refer to offer/quotation.

The input of the piping system is made by means of the graphical user interface **ROHR2win** ( pre- and postprocessor of ROHR2).

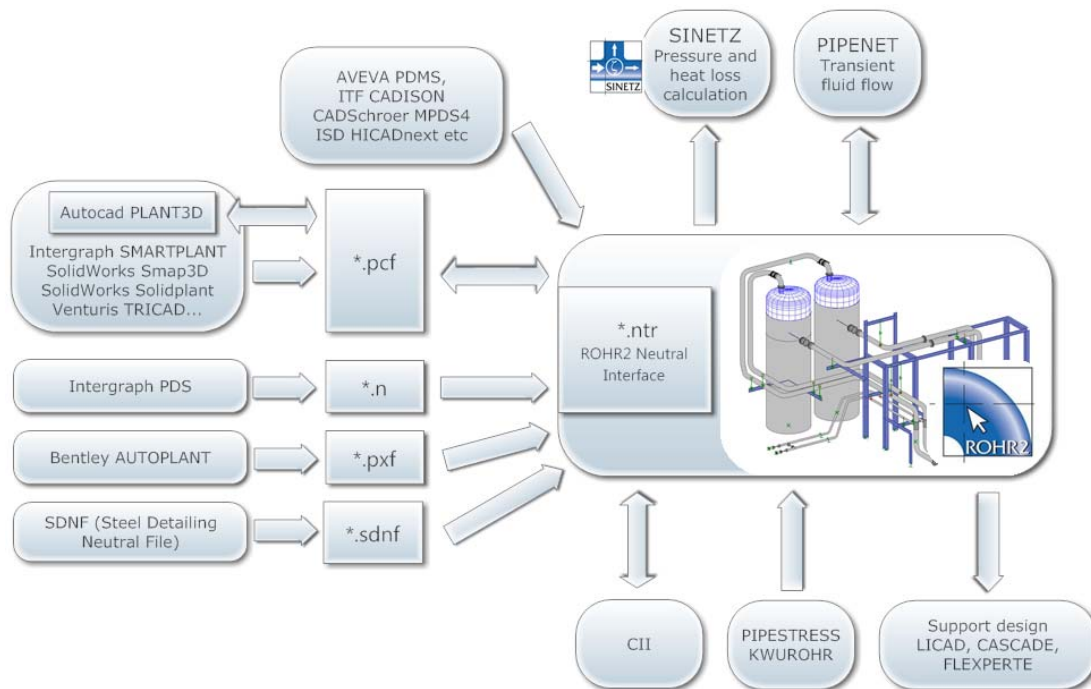
#### **Stress codes in ROHR2 listed by their fields of application**

<b>Steel pipes</b> <i>Pipelines , general</i>	ASME B31.1, ASME B31.3, ASME B31.4, ASME B31.5, ASME B31.8 EN 13480 CODETI STOOMWEZEN D1101 FDBR VGLSR Equivalent stresses according to von Mises and Tresca
	<b>Nuclear Power</b> ASME Cl. 1, ASME Cl. 2, ASME Cl. -3 ASME Cl. 1, Fatigue analysis KTA 3201.2, KTA 3211.2 RCC-M Cl.1, RCC-M Cl.2, RCC-M Cl.3
	<b>Buried pipes</b> EN 13941 AGFW, AGFW FW401
	<b>Offshore</b> B31.4 Chapter IX B31.8 Chapter VIII
<b>GRP Pipes</b>	ISO 14692 KRV WAVISTRONG GFK British Standard 7159
<b>Steel frameworks</b>	VGLSP (Stress analysis for Structural Steel Sections)

\*) spec. program version may include a reduced no of stress codes, ref. to specification or offer

## 2.2 ROHR2 Interfaces

A comprehensive number of interface modules is part of the ROHR2 standard package. Optional interfaces are available to integrate ROHR2 into your workflow. Please refer to the ROHR2 Interfaces brochure or contact us for further details.



*ROHR2 Interfaces, Standard equipment and optional modules*

Regarding the optimization of your workflow our staff of specialists will advise you individually upon request, especially regarding the data import and export to ROHR2.



ROHR2 available interfaces - Overview	Import / Export	Standard package	Optional available interfaces
Support data Interface	EXP	X	
LICAD / CASCADE / FLEXPORTE	EXP	X	
Neutral Interface ROHR2	IMP+EXP	X	
CAESAR II	IMP	X	
	EXP		X
PIPESTRESS	IMP	X	
KWUROHR	IMP		X
PCF	IMP		X
	EXP		X
PDMS	IMP	X	
	EXP	X	
PDS	IMP		X
PASCE	IMP		X
Autoplant	IMP		X
SDNF	IMP		X
SINETZ Pressure loss calculation	EXP	X	
PIPENET Fluid flow calculation	IMP	X	
	EXP		X

Standard package, see 2.3

Part of the standard delivery of ROHR2 Static/Static and Dynamic and integrated into ROHR2.

Optional interfaces, see 3.4

Optional available interface modules. Not part of the ROHR2 standard package.

The integration of ROHR2 is completed by third-party interface products.

## 2.3 Integrated Interfaces

Several interfaces for the data import and export are part of the "standard" ROHR2 program

### CAD-Interfaces

The basis of the ROHR2 CAD Interfaces is the **Neutral CAD Interface ROHR2**

The **Neutral CAD Interface** enables

- direct data import from CAD and plant engineering systems like AVEVA PDMS via AVEVA Pipe Stress Interface - R2, CADISON (ITF) , RC-Planet (Planet GmbH), MPDS4 (CAD Schroer), HICADnext (ISD GmbH), etc. (additional module can be required for CAD system)
- data import by optional available interfaces or third-party products
- data export (results) to AVEVA PDMS

ROHR2

connecting

CAD/CAE

with

Calculation

### CAE-Interfaces

ROHR2 currently supports CAE-systems by:

#### Interface SINETZ Fluid flow calculation

Export interface to SINETZ, Program for the calculation of pressure drop and temperature loss analysis in piping systems (Product of SIGMA Ingenierugesellschaft mbH)

#### Interface Import CAESAR II - ROHR2

The program system ROHR2 includes the interface to import CAESAR II calculation data. Intergraph Corporation Files in Caesar II neutral file format (format \*.CII, Version 4.3 or higher) may be imported.

#### Interface Import PIPESTRESS - ROHR2

Schnittstelle zur Übernahme von Berechnungsdaten aus PIPESTRESS (DST Computer Services S.A.). Data from PIPESTRESS in file format \*.fre can be imported.

#### Interface PIPENET Import

Interface for the import of load-time functions from PIPENET into ROHR2. (Sunrise Systems Ltd, www.sunrise-sys.com). PIPENET is a software tool for rapid flow analysis of pipe and duct networks and dynamic fluid hammer forces to be used as loads for dynamic fluid hammer calculations of the ROHR2 framework.

#### Interface Fluid dynamic programs

Import of time-dependent fluid hammer forces from fluid dynamic software. This format is supported e.g. by the programs DRAKO and INROS.

#### Interfaces ROHR2-LICAD, ROHR2-CASCADE, ROHR2-FLEXPETE

Export of support data from ROHR2 into the hanger and support design systems LICAD (LISEGA GmbH), CASCADE and FLEXPETE (Witzenmann GmbH)

## 2.4 Licensing

### **Single user license**

The single user license allows using the program on one PC-system of the licensee.

### **Network license /Floating license**

The network license enables the access to the program system by any PC in the network, limited by the number of users. This depends on the acquirement of a network license for one or more users

### **Unlimited license**

Program license for an unlimited period of time including maintenance and support during six month after purchase.

### **Time-limited license:**

Program license including maintenance and support, monthly. Minimum rental period is three month. Fees may be taken into account by 80 % up to three month in case of purchase.

## 2.5 Scope of supply and copy protection

The programs' scope of delivery contains

- the program data (on ROHR2 CD or by download)
- the program documentation (pdf - manuals)
- the ROHR2 license key (USB - copy protection module, hardlock, dongle).

The software does not run without the license key.

In case of updates/upgrades the license module will be replaced or updated.

## 2.6 System requirements

The system requirements of all ROHR2 program versions are as following:

### ***System requirements of single user licenses and PC-workstations in the network***

- PC with min. 2 GB RAM
- Windows 8, Windows 7 (32-/64-bit), Windows VISTA or Windows XP (SP3)
- Screen resolution minimum 1024 x 768 pixels
- Connection via Internet for activation of the program license \*)and program updates

\*) License activation by phone/email or internet

### ***System requirements of the network server***

Installation of the HASP license manager on a Server PC accessible by all users in the network, running under

Windows 8, Windows 7 (32-/64-bit), Windows VISTA or Windows XP (SP3),  
Windows Server 2003/2008.

In case of integrating ROHR2 into companywide or country wide networks please contact us.

### 3 ROHR2 Optional available programs

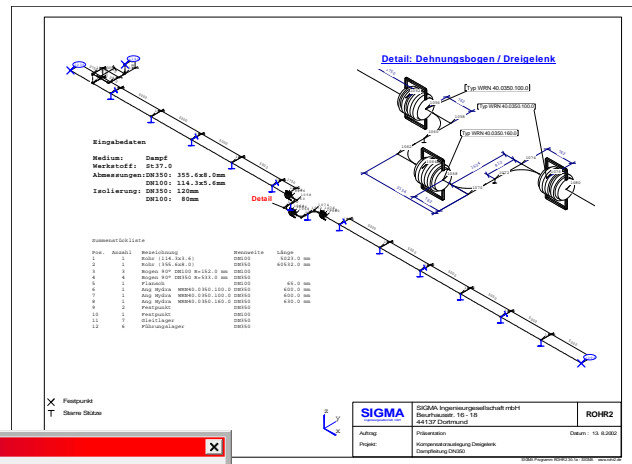
The ROHR2 Static and Dynamic program system may be supplemented by additional program modules. We like to provide detailed information with working examples to the following program modules for you.

#### 3.1 ROHR2iso

**Program module to create dimensioned isometric graphics**

ROHR2iso completes the graphical user interface ROHR2win by isometric drawing functionality. ROHR2iso creates scaled and not-scaled pipe isometrics. The program allows adding dimensions, welding nodes and additional parameters like height data or user defined texts and graphics. The creation of single- and cumulative part lists is implemented.

After entering data, the static or dynamic ROHR2 calculation may be carried out with the full scope of service of ROHR2win.



Filter:	Pos.	Number	Description	Nom. dia...	Length [mm]	Weight [kg]	Insulation ...	Surface [m <sup>2</sup> ]	Material	Nom
Number	1	1	Rohr 114.3x5.6mm	DN100	681	10.22	70.00	0.5483	ST35.8	DIN 2448
Description	2	1	Rohr 114.3x5.6mm	DN100	623	9.35	70.00	0.5016	ST35.8	DIN 2448
Nom diameter	3	1	Rohr 114.3x5.6mm	DN100	29	0.44	70.00	0.0234	ST35.8	DIN 2448
Length [mm]	4	1	Rohr 114.3x5.6mm	DN100	37	0.56	70.00	0.0298	ST35.8	DIN 2448
Weight [kg]	5	1	Rohr 114.3x5.6mm	DN100	348	5.22	70.00	0.2802	ST35.8	DIN 2448
Insulation [mm]	6	1	Rohr 114.3x5.6mm	DN100	1096	16.45	70.00	0.8825	ST35.8	DIN 2448
Surface [m <sup>2</sup> ]	7	1	Rohr 114.3x5.6mm	DN100	2	0.03	70.00	0.0016	ST35.8	DIN 2448
Material	8	1	Rohr 114.3x5.6mm	DN100	961	14.43	70.00	0.7738	ST35.8	DIN 2448
Nom	9	1	Rohr 114.3x5.6mm	DN100	896	13.45	70.00	0.7215	ST35.8	DIN 2448
Remarks	10	1	Rohr 114.3x5.6mm	DN100	218	3.27	70.00	0.1357	ST35.8	DIN 2448

Using ROHR2iso means:

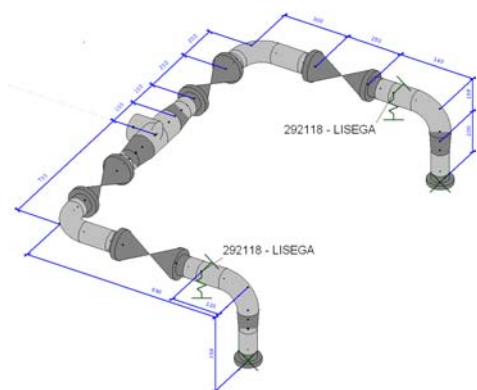
**Minimal effort to the training of the users**

The separate available program module ROHR2iso is integrated into ROHR2win. Multiple inputs are not required: each data entry is made for calculation and isometric drawing

**Significantly reduced effort of data input and editing**

Enormous advantages arise at the system optimization or system changes. If there are changes in geometry or in technical requirements, the calculation and isometric may be adapted in one step.

- Automatic creation of simply dimensioned isometrics.
- Adapt isometrics to the user's needs.
- Creation of single- and cumulative part lists with general system information "at the touch of a button".
- Export of graphics and part lists in various file formats



Please refer to special ROHR2iso brochure.

### 3.2 ROHR2fesu

#### **Finite Element Analysis of Sub-structures in ROHR2**

ROHR2fesu is an additional module in the program system ROHR2 for detail analysis of local segments in pipes and vessels.

ROHR2fesu offers the easy-to-use modeling of sub-structures from shell elements, fully integrated in the ROHR2 framework. This enables to carry out detail analyses of critical segments while maintaining the framework of the entire model.

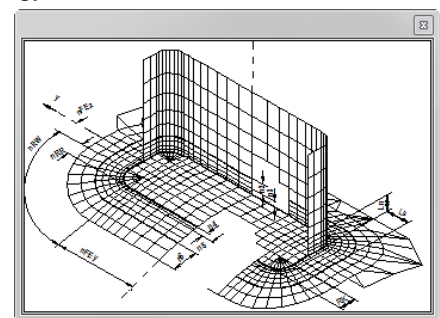
The shell analysis is carried due to FE-method.

The mesh generator of ROHR2fesu automatically integrates intersections of branches, trunnions, nozzles with and without reinforcement. ROHR2fesu enables to control the mesh resolution in a simple way.

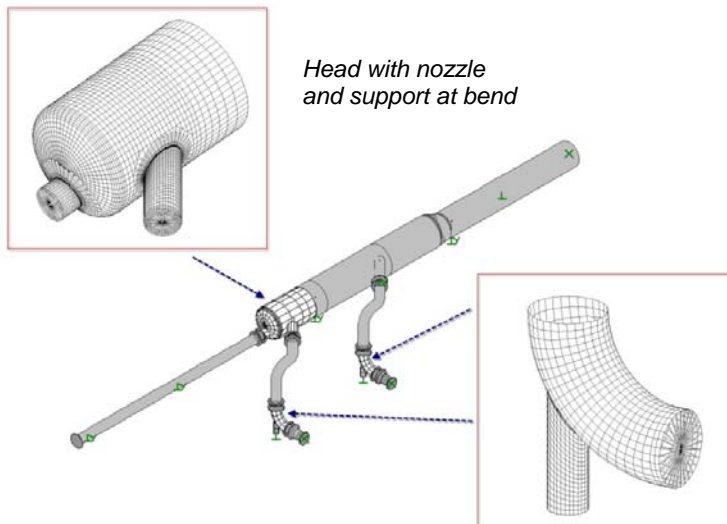
ROHR2fesu has been certified extensively due to the state of technology.

ROHR2fesu offers:

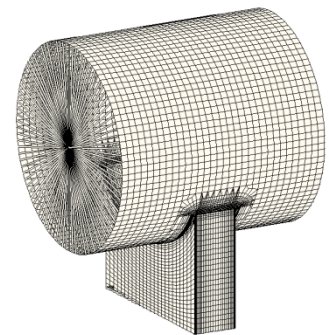
- Complete integration of the FE structure(s) into the connecting frame work
- easy-to-use parameter controlled model generation and meshing
- short calculation time
- automatic stress analysis and documentation
- stress analyses following **EN 13445**, Appendix C, **ASME Section VIII**, Div. 2, Part 5 and **AD S4**



#### **ROHR2 model with non-regular components**



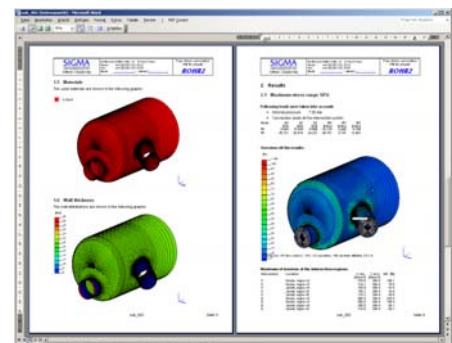
ROHR2fesu model rectangular lug



#### **ROHR2fesu Documentation**

The ROHR2fesu documentation can be modified by the user. Input data and results are taken into a report template by text and graphics.

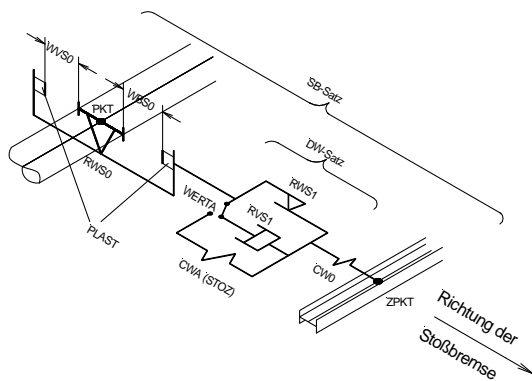
A detailed ROHR2fesu program description is available.



### 3.3 ROHR2stoss

#### Structure Analysis of Fluid Hammer using Direct Integration

ROHR2stoss is a program for **dynamic analysis** of framework structures especially pipe structures. It can deal with **linear** as well as **non-linear** boundary conditions and couplings. The optional available ROHR2stoss license integrates an additional calculation method into ROHR2 Static and Dynamic



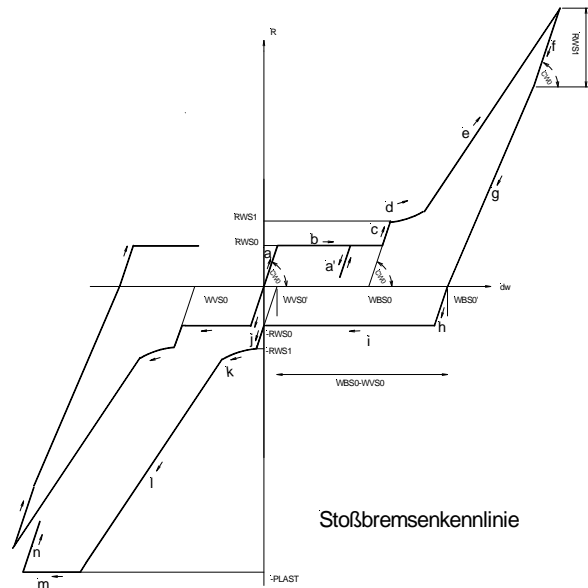
Stoßbremsen-Schaltbild

Shock Absorber - Diagram

ROHR2stoss is an alternative dynamic module, integrated in ROHR2. The results can be used either independently of ROHR2 or integrated into further calculations in ROHR2.

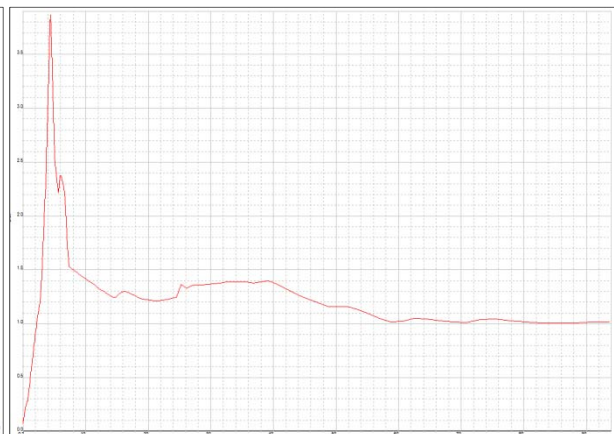
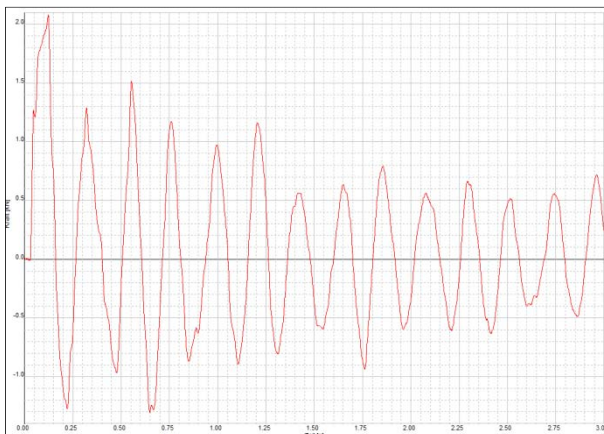
Shock Absorber - Load displacement function

This method is an alternative to the modal Time-History-Analysis. It allows integrating the full range of non-linear piping components like shock absorbers or dampers into the dynamic analysis.



Stoßbremsenkennlinie

ROHR2fun is included for the graphical representation of functions.

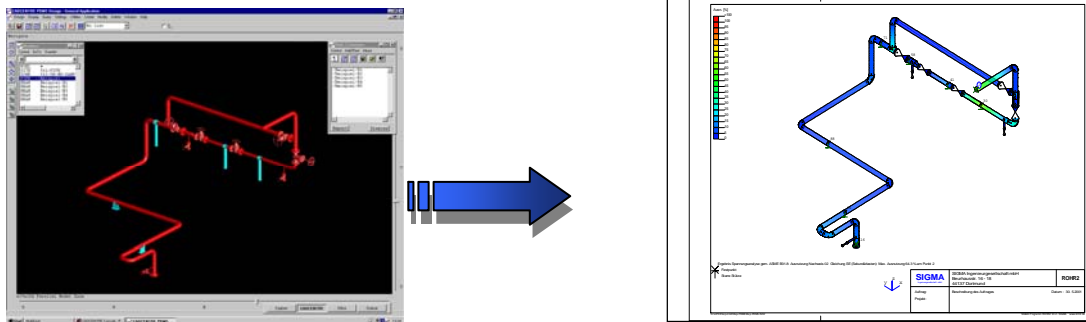


### 3.4 Optional Interfaces - Integration of ROHR2

ROHR2 offers a great number of additional interfaces for the transfer of data from and to CAD and CAE-systems in addition to several interfaces in the ROHR2 standard version (see 2.32.2).

For a detailed description please refer to the **ROHR2 Interface brochure**.

#### Interfaces to CAD-Systems



Several interfaces are integrated in the ROHR2 standard version like PDMS, CADISON, RC-Planet, HICADnext ). The following CAD-systems are currently supported by ROHR2.

	File format	
INTERGRAPH - PDS Stress interface	N	
INTERGRAPH - SMARTPLANT	PCF	*)
AUTOPLANT	PXF	
PASCE AEA Technology Engineering Software	NTL	
PCF Format,	PCF	
SDNF Format (Steel Detailing Neutral File)	SDNF	

The transfer from CAD systems can be carried out via PCF - ROHR2 Interface (e.g. from Pro/ENGINEER, TRICAD MS, AutoCAD PLANT3D, AutoCAD Inventor, if the systems are equipped with an ISOGEN module.

\*) Intergraph Germany, direct integration is available, detailed information by Intergraph

#### Interfaces to CAE-Systems

In addition to the CAE interfaces included in the ROHR2 standard version (CAESAR II, PIPESTRESS, LICAD, CASCADE, FLEXPORTE, see 2.2 ) the following CAE-systems are supported by ROHR2:

KWUROHR (Siemens)	KWU	
PIPENET (sunrise-sys.com)	SDF	

#### Third Party Interfaces

The integration of ROHR2 is supported by third-party interface products. In case of questions or information requests, please contact the manufacturer. We will be pleased to advise you regarding the data import and export to ROHR2.

For current information and links to software companies, pls. refer to [www.rohr2.com](http://www.rohr2.com) or ROHR2 Interface brochure

## 4 ROHR2 - Input of the piping system, results and documentation

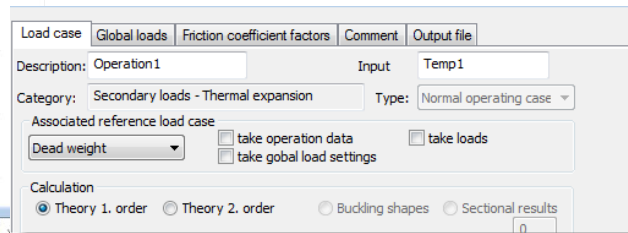
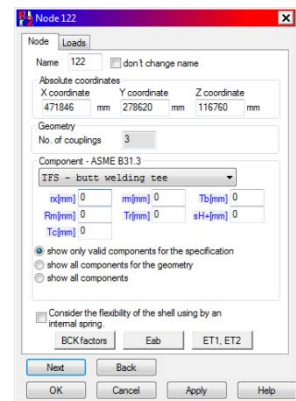
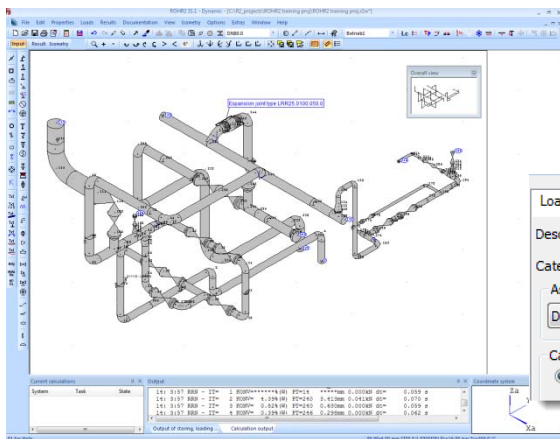
The graphical user interface **ROHR2win** is the pre- and postprocessor of ROHR2. All inputs can be made using ROHR2win.

A wide range of control functions enables the user to check the input data easily. All results can be displayed and checked, reports are generated.

### 4.1 System and load case input

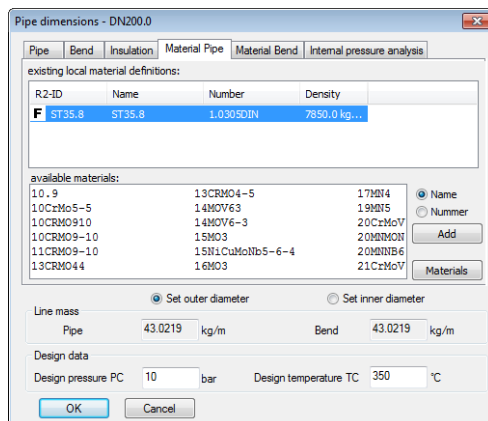
ROHR2win creates input data for the calculation kernel.

- All data required for the analysis are put in by the user by mouse or dialog windows.
- ROHR2win offers the full interactive access to data via graphic.
- All inputs are shown graphically
- All control records, the line topology and superpositions of load cases are created automatically by the program

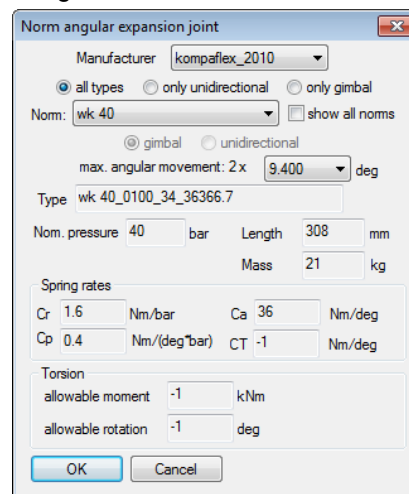


### Databases

During the process the user is supported by comprehensive integrated databases.



Material database



Database angular expansion joints

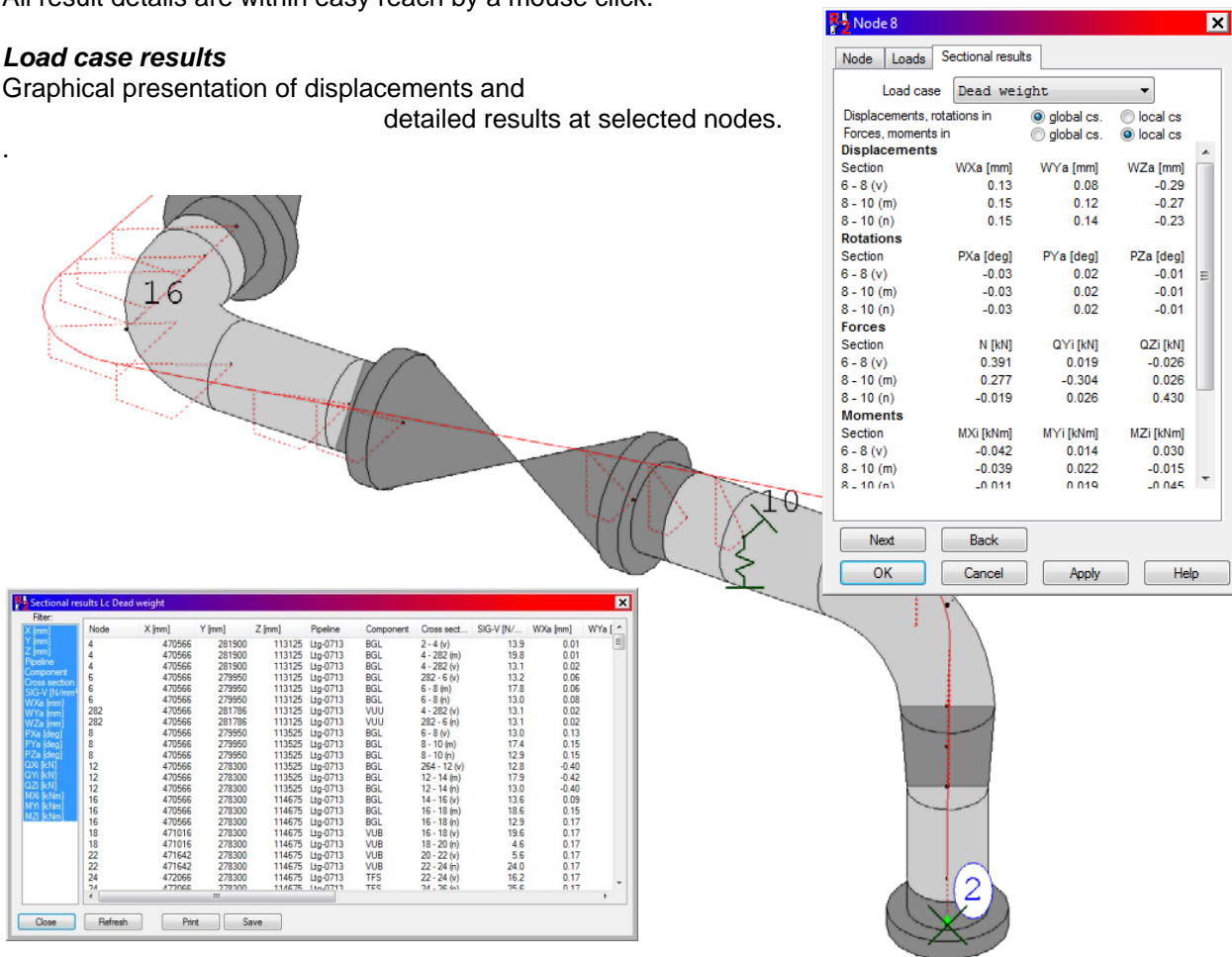


## 4.2 Documentation and presentation of the results

Analysis results are shown tabulated and graphically.  
All result details are within easy reach by a mouse click.

### Load case results

Graphical presentation of displacements and detailed results at selected nodes.

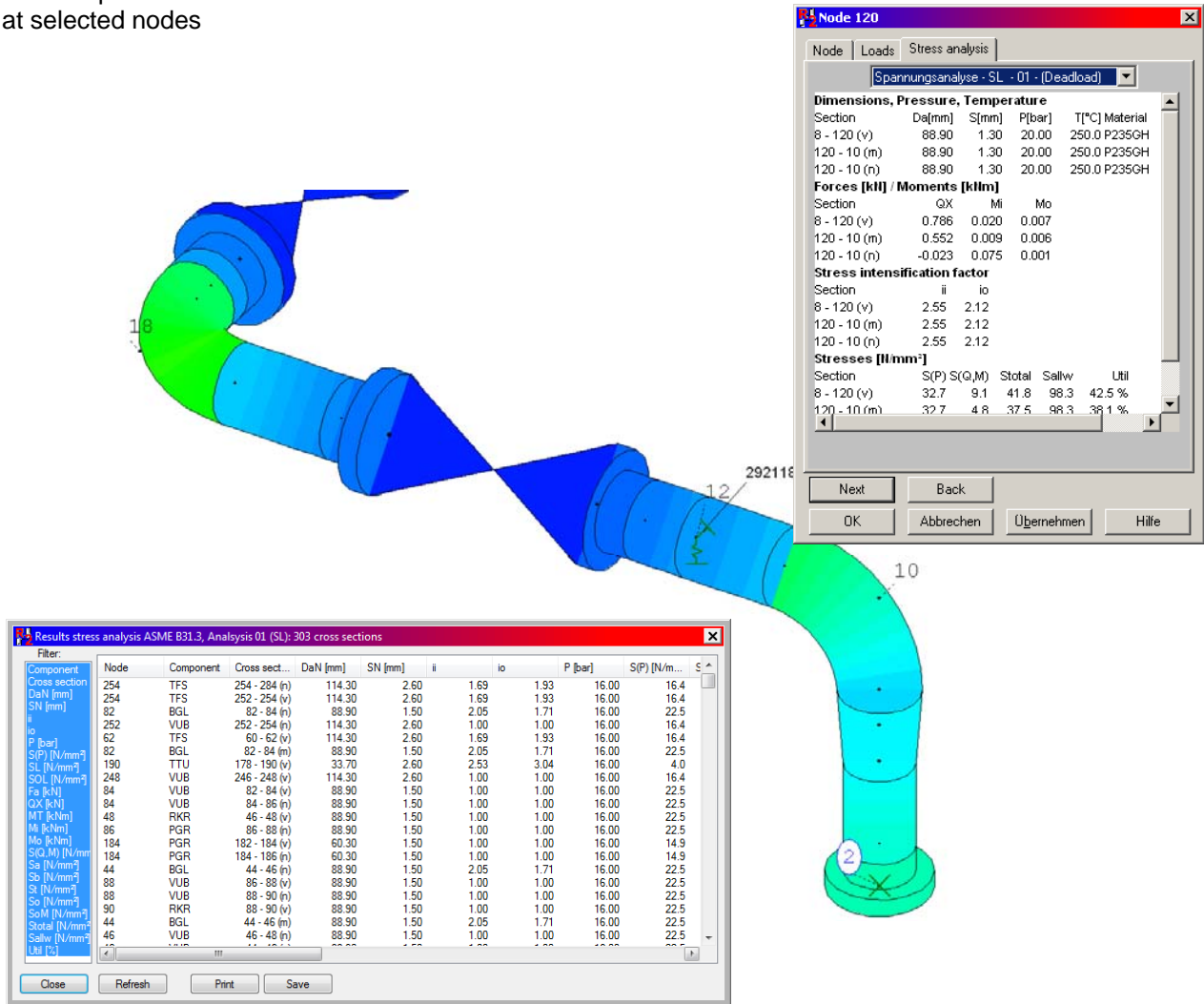


Tabulated overview of displacements

- Graphical representation of displacements, rotations, forces, moments and equivalent stresses for calculated load case and load cases created by superposition
- spatial presentation only for x, y or z direction
- zoom, pan and rotate-function available
- graphical representation of results is scalable
- detailed results for a selected node by mouse-click
- results in global or local coordinate system
- results can be printed out or saved in rtf-, html or csv format (e.g. MS Office)
- tabulated overviews can be modified by user using filter function
- sort results by a click on the table header
- Interaction between table and graphic, selected node in graphic is highlighted in table and vice versa

### 4.3 Stress analyses

Colored presentation of stress utilization and detailed results at selected nodes

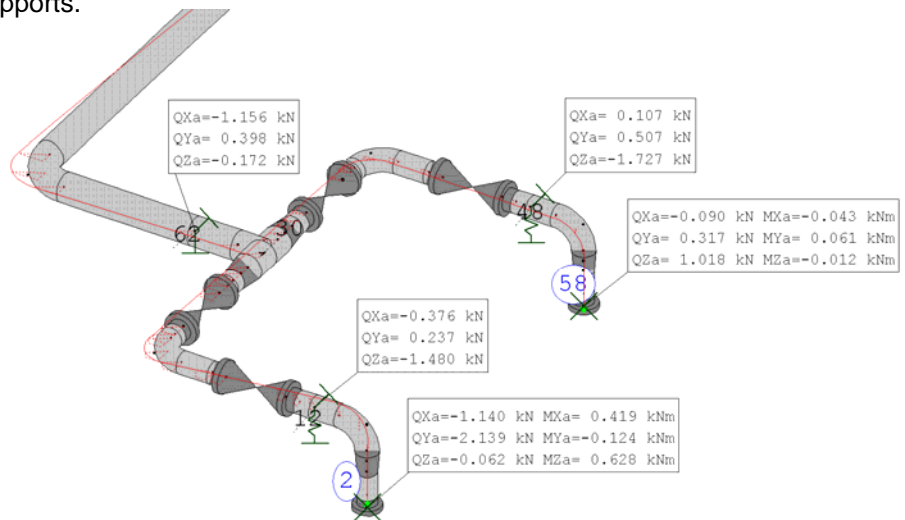


Tabulated overview of stresses

- graphical representation of stresses for the selected equation, equations are defined automatically depending from the defined load cases
- stress analysis according to different specifications for parts of the calculation system
- stress analysis limited only to selected parts of a calculation system
- detailed results for a selected node by mouse click
- results can be printed out or saved in rtf-, html or csv format (e.g. MS Office)
- tabulated overview can be modified by user using filter function
- sort results by click e. g. acc. to utilization or node number
- interaction between table and graphic, selected node in graphic is highlighted in table and vice versa

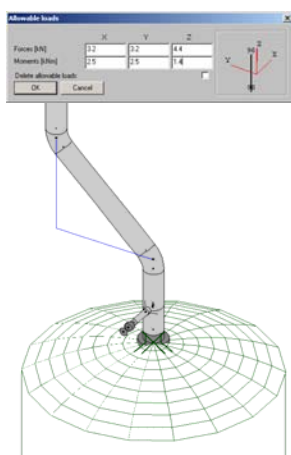
### 4.4 Loads on nozzles and supports

Graphical presentation of loads on nozzles and / or supports and detailed results at selected supports.



### Nozzles at vessels

- Define allowable loads at nozzles
- Consider vessel spring in pipe stress calculation
- Nozzle with support conditions, spring rates, allowable loads and specific coordinate system



Filter:	Node	X [mm]	Y [mm]	Z [mm]	Support	HL [mm]	Coordinat...	Text	Pipeline	WX
X [mm]	66	471406	276900	115953	Spring sup...		global		Ltg-0713	
Y [mm]	2	470566	281900	112675	Anchor point		global		Ltg-0713	
Z [mm]	32	472806	278300	115100	Axial stop ...		global		Ltg-0713	
Support	126	473696	278620	116760	Guide sup...		global		Ltg-0687	
HL [mm]	120	470396	278620	116760	Anchor point		global		Ltg-0687	
Coordinate	240	469874	280250	114442	Guide sup...		global		Ltg-0712	
Text	228	470180	281900	112677	Anchor point		global		Ltg-0712	
Pipings	10	470566	279350	113525	Guide sup...		global		Ltg-0713	
WX [mm]	70	472496	276900	116879	Sliding sup...		global		Ltg-0713	
WY [mm]	216	473166	280679	116111	Anchor point		global		Ltg-071b	
WZ [mm]	86	471406	277900	115183	Sliding sup...		global		Ltg-0713	
PX [deg]	116	470356	277345	116708	Lateral sto...		global		SIV	
PY [deg]	14	470566	278300	114100	Spring hian...		global		Ltg-0713	
PZ [deg]	184	473882	278900	115970	Rigid supp...		global		Ltg-071b	
QX [kN]	192	473882	280906	115970	Sliding sup...		global		Ltg-071b	
QY [kN]	246	470324	279300	115427	Sliding sup...		global		Ltg-0712	
QZ [kN]	274	474014	279370	115970	External fl...		global	AM23	Ltg-071b	
MX [kNm]	256	472196	279300	115427	Guide sup...		global		Ltg-0712	
MY [kNm]										
MZ [kNm]										
DWX [mm]										
DWY [mm]										
DWZ [mm]										
DPX [deg]										

Tabulated overview of loads

- graphical representation of loads for the selected load case
- graphical presentation for all or for selected supports
- detailed results for a selected node by mouse-click
- documentation in global, local or user defined coordinate system
- results can be printed out or saved in rtf- or csv format (MS Office)
- tabulated overview can be modified by user using filter function
- sort results by click e. g. acc. to load in any direction or movement in any direction
- interaction between table and graphic, selected node in graphic is highlighted in table and vice versa

### 4.5 Additional results

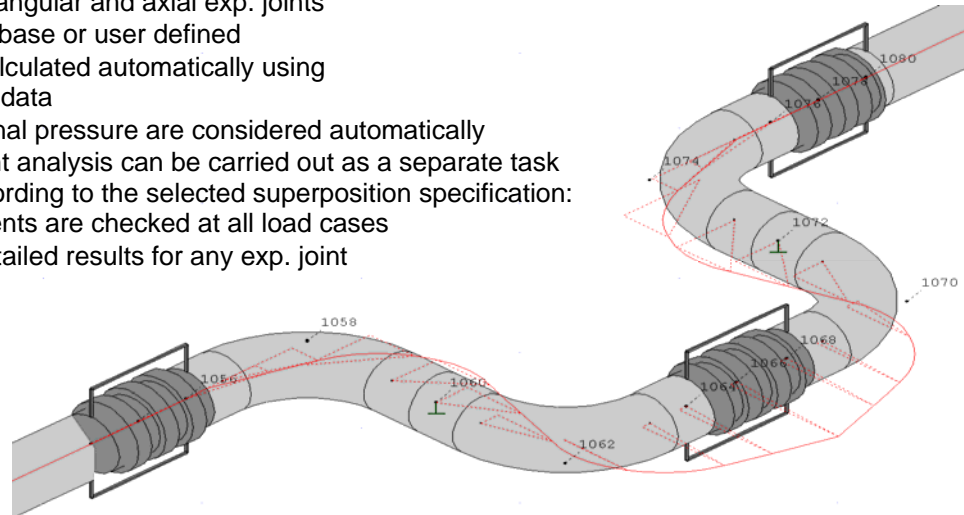
Besides the analysis of stresses and loads at support and connections, ROHR2 gives out, among others, the results of:

- Expansion joint analysis
- Internal pressure design
- Spring design

#### Expansion Joints

Database with lateral, angular and axial exp. joints

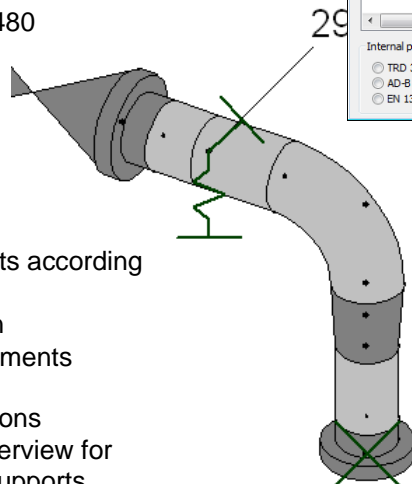
- data input by data base or user defined
- spring rates are calculated automatically using the manufacturers data
- forces due to internal pressure are considered automatically
- The expansion joint analysis can be carried out as a separate task automatically according to the selected superposition specification: Allowable movements are checked at all load cases
- data sheet with detailed results for any exp. joint



#### Internal pressure analysis

- Pipes, bends acc. to EN 13480, ASME B31.1, B31.3, AD-B9
- Tees reinforced / not reinforced acc. to EN 13480, ASME B31.1, B31.3, AD-B9
- Reducers acc. to EN 13480

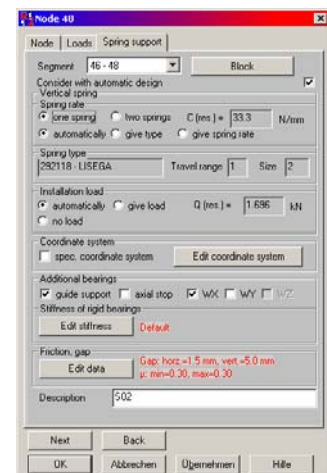
Nom. dia...	C1	C2	V	C1 (bend)	C2 (bend)	V (bend)	PA
DN80.0	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	16.00bar
DN100.0	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	16.00bar
DN25.0	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	16.00bar
DN50.0	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	16.00bar
DN80-...	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	25.00bar
DN200.0	12.50%	1.00mm	1.00	12.50%	1.00mm	0.80	10.00bar
DN80-...	10.00%	1.00mm	1.00	12.50%	1.00mm	0.80	25.00bar



#### Spring design

Database with spring supports according to manufacturer's data

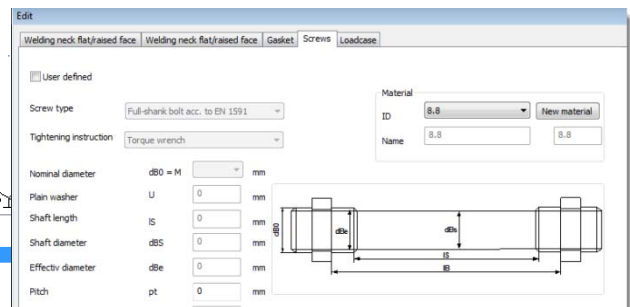
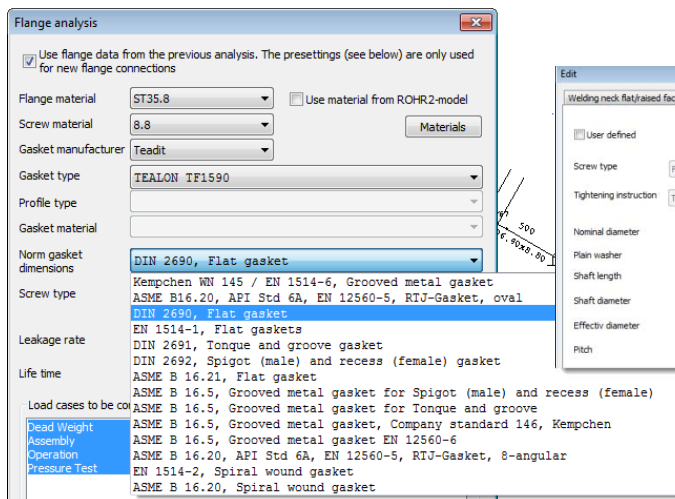
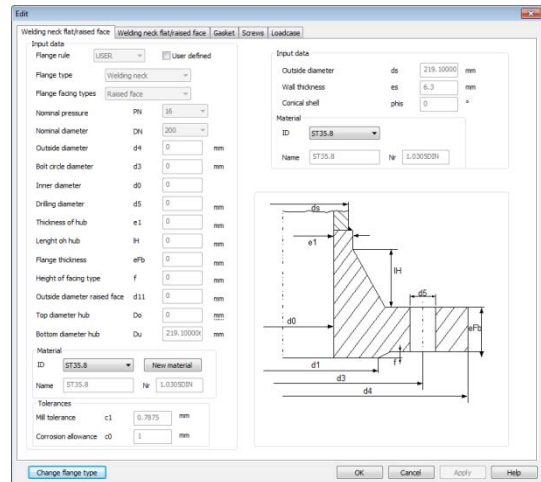
- spring design, estimation
- check of allowable movements for all load cases and for load case superpositions
- data sheet with result overview for all spring and constant supports



Definition of spring support,  
Calculation with given spring data or auto spring design

### 4.6 Flange analysis

- Flange analyses acc. to
  - EN 1591-1:2011,
  - EN 13445-3:2010 Annex G,
  - ASME VIII, Div.1:2010
- Automatic analysis of all flanges in the system under consideration of all load cases. The number of load cases can be reduced by the user.
- Automatic generation of load case combinations required for the analyses.
- Simple pre-settings of the flange parameters by means of standard values for flanges, screws and gaskets.
- The flanges can be modified individually and in details



- Report of the calculation results in a list

Node	PN	DN	Fl1-Type	Fl1-Material	Fl2-Type	Fl2-Material	Gasket name	Gasket m...	Screw	Material screw	max. Util.	Sealing p...	Rotation...
138	100	250	Welding neck	15MO3	Welding neck	16MO3	B2SA-Graphit	Kempchen	M36	40CrMolV4-6-5	78.99 %	52.52 %	0.16 °
168	100	250	Welding neck	16MO3	Welding neck	16MO3	B2SA-Graphit	Kempchen	M36	40CrMolV4-6-5	78.73 %	52.52 %	0.16 °
126	100	40	Welding neck	10CrMo5-5	Blind flange	10CrMo5-5	C-4300 40bar	Klinger	M20	21CrMoV5-7-5	88.68 %	88.68 %	0.03 °
38	100	250	Welding neck	10CrMo5-5	Welding neck	10CrMo5-5	UNISEAL W5 340...	IDT	M36	21CrMoV5-7-5	85.78 %	53.85 %	0.16 °
34	100	250	Welding neck	10CrMo5-5	Welding neck	10CrMo5-5	Jungtec Revolution	Jungtec	M36	21CrMoV5-7-5	82.88 %	33.33 %	0.13 °
82	100	250	Welding neck	10CrMo5-5	Welding neck	10CrMo5-5	Sigma 500	Flexitallc	M36	21CrMoV5-7-5	73.97 %	33.54 %	0.08 °
94	100	40	Welding neck	10CrMo5-5	Blind flange	10CrMo5-5	C-4300 40bar	Klinger	M20	21CrMoV5-7-5	88.69 %	88.69 %	0.03 °
78	100	250	Welding neck	10CrMo5-5	Blind flange	10CrMo5-5	Jungtec Revolution	Jungtec	M36	Festigk.-6.8	39.98 %	39.98 %	

- Automatic generation of a calculation report in German or English

## 4.7 Documentation

### ROHR2 Standard Documentation

#### Text

- Individual size of output files, results tables can be included/excluded by the user
- Output files in ASCII format
- Data can be stored in pdf or rtf format , e.g. for further processing in MS Word
- Header and footers can added
- Data export for further processing in a spreadsheet program like MS Excel

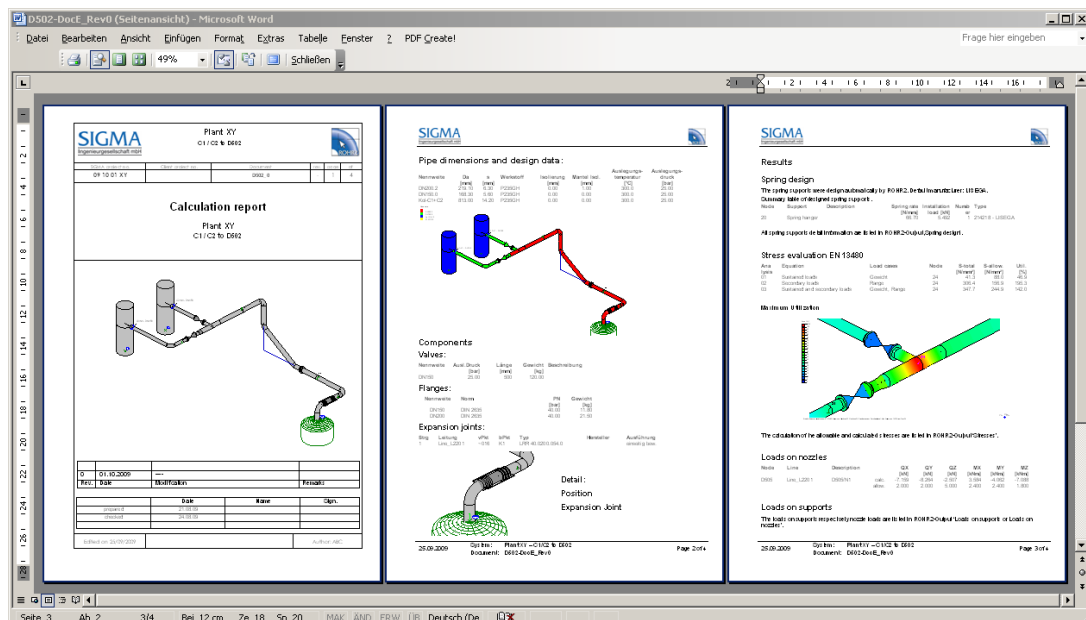
#### Graphic

- Select from various views
- Graphic representation of the entire system, of system parts or of specified pipes
- Framework graphic or volume model
- Assigned parameters like dimensions, materials, operation data can be shown graphically (colored representation)
- Graphical results representation e.g. deformations or stresses
- Loading plot

### ROHR2 Report generation

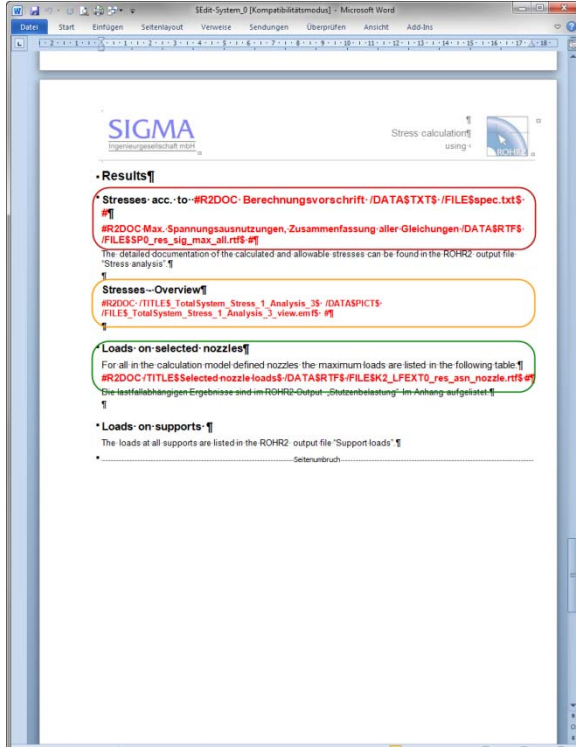
The report generation module creates a calculation report including input data and results on the basis of factory templates or user defined samples including input data and results. An additional appendix to the report can be defined e.g. for printing complete calculation results

The report capabilities include free formatting of ROHR2 text modules and the refreshing of the report when calculation changes.



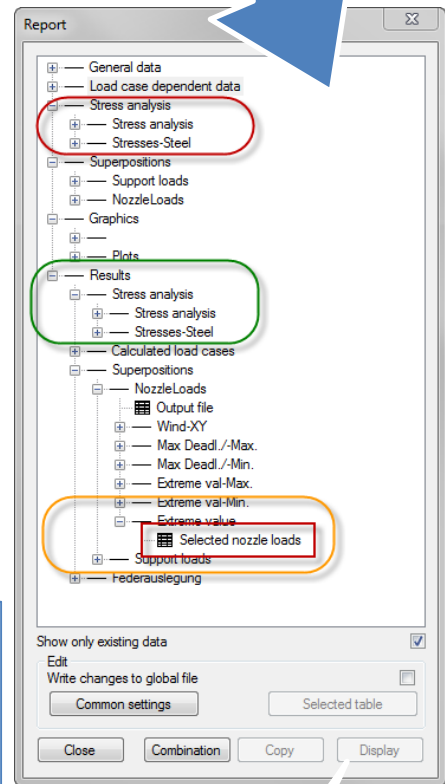
ROHR2 Report generation

**Creating a ROHR2 report**

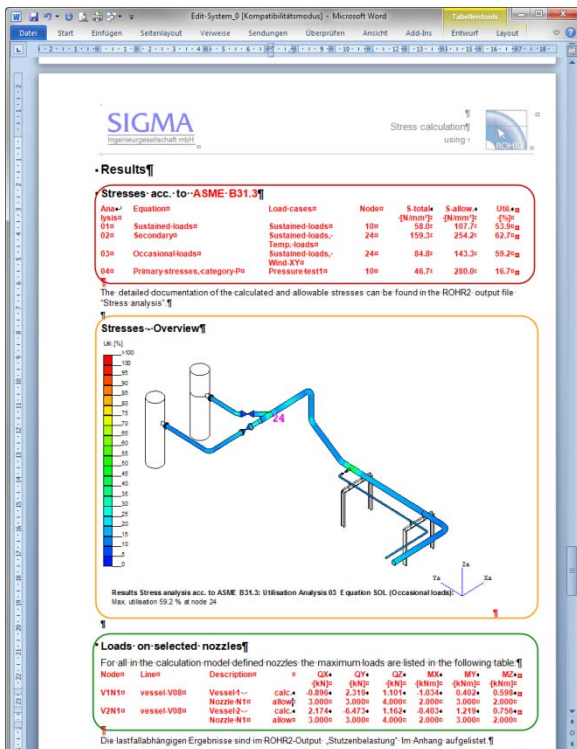


The report template includes links to ROHR2 text and graphic output of

- general data
- load cases
- stress analyses
- extreme value calculations
- results
- graphics



After re-calculating the piping system the modifications of the current analysis are taken over into the report.



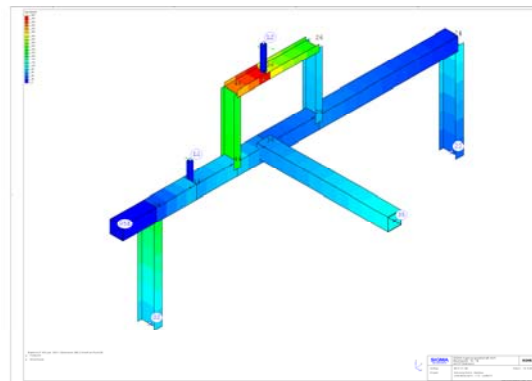
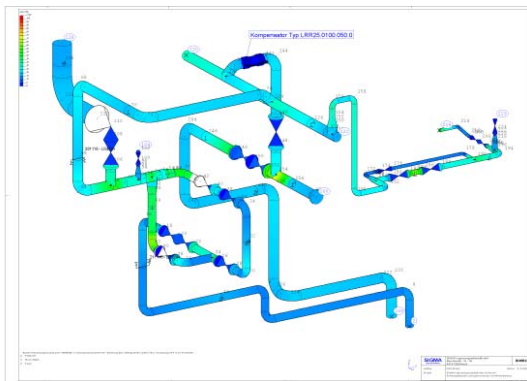
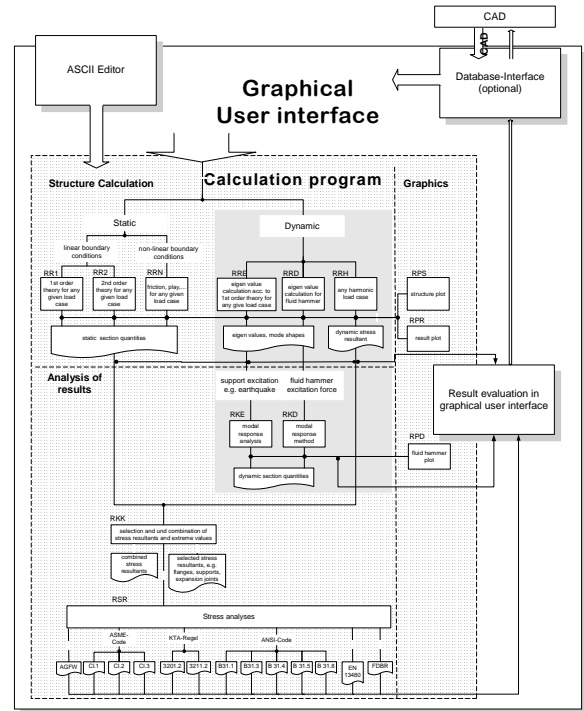
Automatically refreshed after re-calculation

## 5 ROHR2 - Detailed features

### 5.1 Overview

All ROHR2 program versions include

- ROHR2WIN            Graphical user interface
  - ROHR2                Calculation program
  - HPGLWIN            HPGL-file Graphic-interpreter
  - ROHR2FED          Spring hanger design
  - ROHR2flange        flange design
- 
- Internal pressure analysis can be carried out in accordance e.g. with ASME and EN codes for straight pipe, pipe bends, reducers and tees
  - Neutral Interface to communicate with CAD-systems
  - The graphical user interface is available in German or English
  - The results may be printed out in German, English or French.



Equivalent stresses are calculated at common beam elements.



## 5.2 Input features

### System input

- Input of system geometry by mouse and keyboard
- Zoom, pan and rotate functions
- UnDO and ReDO
- Quick access to frequently used commands by context menu

### Detailed Input features

- Definition and assignment of boundary conditions and loads with the mouse by means of dialog windows.
- Support conditions can be entered by definition of sliding support, guide support, axial stop, anchor point. The support directions are determined automatically.
- Input of internal supports and hangers (i.e. Supports and hangers where the base point is a system node). Internal spring hangers and supports are analyzed like “normal” spring hangers and –supports.
- Input of angulating supports with any characteristic curve.
- Special coordinate systems for boundary conditions are produced automatically if required.
- Free input of dimensions of pipes and structural steel sections, the data can be taken from the enclosed databases. The line masses of pipes, insulation and medium are determined.
- Sectional data of the common structural steel sections are determined automatically or read from a sectional data file (DIN).
- Material properties like Young´s modulus,  $\alpha_t$  and allowable stresses may be taken from the ROHR2 database MATDAT (may be extended by the user)
- For EN13480, ASME B31.1 and ASME B31.3 a reduction factor for allowable stresses at welds can be considered (e.g. “Weld Joint Strength Reduction Factor“ acc. to ASME B31.3).
- Input of components like instruments, expansion joints and flanges.  
The increased stiffness of the instruments is considered by  $3 \cdot s$  of the associated diameter.
- Stiffness of supports, controlled by the user. Data can be taken from database (VDI 3842/2004) or manually entered
- Management of pipe names
- Modeling of soil restrained with non-linear properties
- Modeling of jacket piping, considering the couplings

## Databases

### Component databases, included in ROHR2

Databases with data e. g. of pipes, bends, flanges or expansion joints according to technical standards or according to manufacturer's data. Databases are extendable by the user himself.

The ROHR2 standard version includes:

Pipes:	ASME B36.10, EN 10220, DIN 2448, DIN 2458
Bends:	EN 10253-2, ASME B16.9, DIN 2605 part 1, DIN 2605 part 2
Flanges:	EN 1092-1, ASME B16.5, DIN 2627 - DIN 2638
Blind flanges:	EN 1092-1
Reducers:	EN 10253-2, DIN 2616 part 1, DIN 2616 part 2, ASME B 16.9
Tees:	EN 10253-2, DIN 2615 part 1, DIN 2615 part 2, ASME B 16.9
Expansion joints:	HYDRA (Witzenmann), BOA (IWK), KOMPAFLEX
Heads:	EN 10253-2, DIN 28011, DIN 28013, DIN 2617
Visco dampers:	GERB, Baureihe VES, RHY
Spring hangers supports:	ANVIL INTERNATIONAL GB-China, Grinnel, Hesterberg, LISEGA, Petrochemical-CN, PipeSupportsGroup, Pipingtech, PSS, Seongwha, SSG, Witzenmann (HYDRA)

- Stiffness of supports according to VDI 3842/2004
- Databases for rigid supports, couplings (jacket pipes) and instruments can be created by the user himself.

### Material databases, included in ROHR2

- Material database containing material acc. to EN / ASME / DIN etc.
- Temperature and wall thickness depending values for Young's moduls, coefficient of expansion, tensile strength, yield strength and code depending stresses
- The material database ca be extended by the user
- Material database allows the administration of various norms and revisions
- Control the form of manufacturing
- Consideration of creep range parameters
- Automatic determination of allowable stresses depending on the life cycle
- Automatic determination of reduction facators at cryogenic temperature acc. to AD 2000 W10 or ASME B31.3
- For EN13480, ASME B31.1 and ASME B31.3 a reduction factor for allowable stresses at welds can be considered (e.g. "Weld Joint Strength Reduction Factor" acc. to ASME B31.3).

## Load cases and loads

- Definition of load cases in dialog boxes.
- Load case superpositions for stress analysis and extreme value calculation are created automatically depending on the selected stres code.
- Load case superpositions of extreme value scombinations are created automatically and can be modified by the user).
- Automatic determination of wind loads according to DIN 1055 part 4, DIN 4133, EN1991, NV65, UBC, ASCE 7, IS875 or by user defined wind pressure tables
- Automatic determination of snow loads and ice loads according to DIN 1055
- Automatic determination of seismic loads acc. to EN 1998,1997, UBC, 1997 and ASCE 7, 2010
- Automatic determination of fluid hammer loads (Joukowsky)

## 5.3 Documentation

- Display of assigned parameters, loads and results in the graphics and dialog boxes.

### **Tabulated outputs**

- standard calculation outputs with
  - easily understandable result tables with table header
  - result tables can be enabled or disabled for user defined documentation
  - variable documentation size
- output of calculation files and results in fixed format into a universal file (for transfer to database)
- additional and user defined extreme value calculation for sections as you like, selection by filters selection of this sections by direct access via graphics
- wide range of options to display input data, loads or results in listings and to create individual outputs by printing out this listings
- selection of data by filters
- results may be printed in any coordinate system.

### **Graphical presentation**

- line- or volume presentation, user defined colored presentation
- display options to modify the view by enabling or disabling the different options
- selection of partial structures using a wide range of filter functions
- predefined isometric views, additional top, front and side-view
- arbitrary views using zoom, pan and rotate-functions

### **Input data**

- graphical representation of the structure
- Inputs in SI or US-units
- colored display of the assigned properties (dimensions, pressure, temperature, material, ...)
- color presentation of the assigned loads
- clear labeling of names of lines and nodes (supports, valves, ..)
- stress analysis of partial systems enabled by the inclusion / exclusion of selected lines

### **Results**

- entering of any texts and additional graphics into the graphics
- results in SI or US-units
- results (deformations, rotations, forces, moments, stresses) of any calculated load case can be displayed in the graphics
- deformations from eigen value calculations and dynamic fluid hammer calculations are displayed as an animation time dependently
- the stress distribution can be displayed in colors
- creation of structure plots and result plots of the entire system or details

### **Export of results**

- output of graphics and text by printer and plotter (large format printers up to DIN A0)
- Export graphics in PDF, HPGL, DXF or metafile format.
- export text in PDF or RTF format
- export selected data (dialog boxes, listings) into RTF, HTML or CSV format (csv for use with spreadsheet programs, e.g. Microsoft Excel)
- Automatic report, plus appendix basing on individual configurable templates.

## 5.4 ROHR2 calculation program

The ROHR2 calculation program contains static and dynamic calculation capabilities. ROHR2 Static and Dynamic beyond the features of ROHR2 Static includes the possibility to calculate dynamic effects like earthquake (frequency-dependent) or fluid hammer / pressure surge (time-dependent).

### **Core Module - Static**

- Calculation of structures considering any static loads following the standard rules of linear static theory
- It may be considered
  - shear deformation,
  - continuous elastic foundation.
- Automatic construction of the equation system with an optimum line topology path (band width optimization). This enables problem-free transfer of data from other CAD-systems.
- Input by graphical user interface or text editor
- General properties of components such as constant hangers, spring supports or dampers may be altered by simple switching.
- stress analyses according to von Mises yield criterion
- Stiffness calculation for vessel connections (BS5500/WRC 297)
- consideration of pre-stressed springs
- spring hangers and spring supports can be designed automatically
- check of the movement of the expansion joint and overloading in consideration of the reducing coefficients for compression, temperature and number of load cycles
- check of difference movements for jacket piping

### **Nonlinear Boundary Conditions**

- Calculation of pipe structures with nonlinear boundary conditions such as
  - friction
  - gap in supports and uplift
- Consideration of restoring forces due to skewing and internal friction for rigid hangers, springs and constant hangers.
- Analysis of the nonlinear behavior of braced expansion joints

### **Second Order Theory**

- Calculation of spatial frameworks in general, with consideration of any static loads, according to the standard rules of linear or non linear static second order theory
- Calculation of buckling load and stress resultants according to the second order theory for analysis in accordance with DIN 4114 and DIN 18800 part 2

### **Superposition module**

- Different options for the selection, combination and calculation of extreme values of results. Superposition of any static and dynamic load cases and output of resultant loads.
- nearly complete automatic superposition of defined load cases with additional customizing options

**Check of input data / verification**

- Error check during data input
- Graphical presentation of assigned parameters for verification
- Calculation includes formal error checking with listing of input files
- Additional safeguards for input data are provided by printing control values such as
  - absolute coordinates, angles of bends, lengths in space, overall length, total weight, overall center of gravity and sum of support loads
- listing and error messages with link to the concerning nodes or sections in the graphics for easy analysis
- context sensitive link to user manual
- warnings / warning levels for advanced check of input data

**Internal pressure analysis**

- Acc. to TRD 301, AD B-9, EN 13480, ASME B31.1, B31.3
- Straight pipes, bends • Tees with or without reinforcing pad
- Internal pressure analysis at reducers acc. to EN 13480

**Flange analysis**

- Acc. to EN 1591-1:2011, EN 13445-3:2010 Annex G, ASME VIII, Div.1:2010
- Automatic analysis of all flanges in the system under consideration of all load cases. The number of load cases can be reduced by the user
- Automatic generation of load case combinations required for the analyses
- Simple pre-settings of the flange parameters by means of standard values for flanges, screws and gaskets
- The flanges can be modified individually and in details
- Generation of a calculation report in German or English

**Core Module - Dynamics**

The core module Dynamics includes additionally:

- Calculation of natural frequencies and mode shapes for any pipe structures also for any framework structures
- Modal analysis for support excitation, which is defined in terms of floor response spectra (e.g. earthquake spectra). Higher mode shapes are taken into consideration by means of a residual mode approximation
- The dynamic model is based on point masses. ROHR2 includes the automatic mass distribution due to the defined cut off frequency

**Excitation Forces**

- Consideration of any dynamic excitation forces (particularly fluid hammer) according to the modal time-history-method
- The influence of higher mode shapes is taken into account by use of residual mode approximation. Inaccuracy in the dynamic model may be covered by using the frequency shift method

**Harmonic excitation**

- Special solution for the calculation of any harmonic loading in conjunction with the pipe static core module. Results are harmonic stress resultants

## 5.5 Stress codes in ROHR2 Static and Dynamic

ROHR2 program features for all stress specifications:

- Checking that pipe components conformity
- Processing of flexibility factors in accordance with the structure calculation.
- Stress analyses.
- Comparison of stresses
- Listing of components with the most efficient stress utilization.

<b>Title</b>	<b>Content, keywords and source</b>	<b>Edition</b>
EN 13480 <sup>1)</sup>	DIN EN 13480-3 Metallic industrial piping - Part 3: Design and calculation; German Version EN 13480-3:2012	2012
FDBR	Power Piping Fachverband Dampfkessel-, Behälter-, und Rohrleitungsbau e.V., Essen	1/1987
Stoomwezen D1101	Stress Analysis according to Stoomwezen D1101 /78-10	7/2003
AGFW	Stress Analysis of District heat Piping AGFW "Richtlinien für die Festigkeitsberechnung von Fernwärmeleitungen"	1988
AGFW401	Stress Analysis of District heat Piping AGFW / FVGW Regelwerk Arbeitsblatt FW401 - Teil 10 - Verlegung und Statik von Kunststoffmantelrohren (KMR) für Fernwärmenetze	12/2007
EN 13941	Design and installation of preinsulated bonded pipe systems for district heating	12/2010
CODETI	Code de Construction des Tuyauteries Industrielles	2007
ASME B31.1	Power Piping ASME Code for Pressure Piping, The American Society of Mechanical Engineers, New York	2012
ASME B31.3	Chemical Plant and Petroleum Refinery Piping ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2012
ASME B31.4	Liquid Transportation Systems Piping ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2012
ASME B31.5	Refrigeration Piping ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2010
ASME B31.8	Gas Transmission and Distribution Piping Systems ASME Code for Pressure Piping The American Society of Mechanical Engineers, New York	2010

Title	Content, keywords and source	Edition
KRV	GRP-pipes Verlegerichtlinien für Rohrleitungen aus textilglasfaserverstärkten Reaktionsformharzen -„Planungs- und Konstruktionshinweise“, Ausgabe Juli 1993 des Kunststoffrohrverbandes e.V., D-53113 Bonn	7/1993
WAVI-STRONG	Engineering Guide for Wavistrong glass fiber reinforced pipe systems	1994
BS 7159	Stress Analyses for GRP pipes according to British Standard 7159	1989
ISO 14692	Stress analysis for GRP pipes acc. to DIN EN ISO 14692-3	2002
VGLSP	Stress Analyses for Skeletal steel structures (VGLSP)	2004
VGLSR	Stress Analyses for pipes (VGLSR), according to General stress hypothesis von Mises/Tresca	---
EN 13445-3 <sup>2)</sup>	Stress Analysis of FESU structures acc. to EN 13445-3 Appendix C	2010
AD 2000 S4 <sup>2)</sup>	Stress Analysis of FESU structures acc. to AD 2000- S4	2008
ASME VIII Div 2 <sup>2)</sup>	Stress Analysis of FESU structures acc. to ASME VIII Div 2 Part 5 (Elastic Stress Analysis Method)	2013
ASME CL1 <sup>3)</sup>	NB-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION NB CLASS 1	2011
ASME CL2 <sup>3)</sup>	NC-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION NC CLASS 2	2011
ASME CL3 <sup>3)</sup>	NC-3600 "PIPING DESIGN" in ASME-BOILER AND PRESSURE VESSEL CODE SECTION III SUBSECTION ND CLASS 3	2011
KTA 3201 <sup>3)</sup>	Nuclear Safety standards commission (KTA) Komponenten des Primärkreises von Leichtwasserreaktoren Sicherheitstechnische Regel des KTA, Edition 6/96	6/96 Draft 2010
KTA 3211 <sup>3)</sup>	Nuclear Safety standards commission (KTA) Druck-und aktivitätsführende Komponenten von Systemen außerhalb des Primärkreises Teil 2: Auslegung, Konstruktion und Berechnung Sicherheitstechnische Regel des KTA3211.2, Edition 6/92	6/92 Draft 2010
RCC-M CL1 <sup>3)</sup>	B-3600 "DESIGN" in RCC-M SECTION I SUBSECTION B CLASS 1	2002
RCC-M CL2 <sup>3)</sup>	C-3600 "PIPING DESIGN" in RCC-M SECTION I SUBSECTION C CLASS 2	2002
RCC-M CL3 <sup>3)</sup>	C-3600 "PIPING DESIGN" in RCC-M SECTION I SUBSECTION D CLASS 3	2002

<sup>1)</sup> EN 13480: stiffening from internal pressure is considered in the calculation of k-factor and i-factor according to EN 13480 DRAFT 2011.

<sup>2)</sup> Requiring optional available program ROHR2fesu

<sup>3)</sup> Not available in program version ROHR2 Static



## 6 Software Services

### 6.1 Program maintenance and updates, User support

The program system ROHR2 and the additional programs come with detailed application documentation. For any questions about ROHR2 you may contact the ROHR2 hotline to get direct supports from our hotline staff which is composed of ROHR2 developers and engineers using ROHR2 every day. You can send the project file you are currently working on, to discuss your questions with our development and engineering team with 40 years of pipe stress analysis experience.

This direct link the hotline guarantees an effective use ROHR2 and assures that you are not left alone with your problems.

ROHR2

continuously analysis

developed

software

Updating the software by periodical releases is an essential component of the maintenance agreement. The software is developed continuously in order to incorporate the ongoing changes in the stress calculation codes and norms but also to improve the user interface and extend the capabilities of ROHR2 according to the user's needs. The material and component databases are regularly extended and adapted to include upcoming changes in specifications. The technical regulations for the calculation of pipes are subject to a permanent change. These changes are pursued and converted in the program system ROHR2 by the development department. Updates are available by internet download.

This makes use of the software possible for the user due to the current stand of technology which is demanded by the legislator in the current norms and laws.

The programming technical development as well as the customization to technical prerequisites such as operating systems are also component of the update service. Through this a long-term safeguarding of the investment submits to software and hardware.



## 6.2 ROHR2 trainings

In order to boost the efficiency of the ROHR2 users, SIGMA proposes a concept of user trainings, which have proven their effectiveness for many years.

Possible training units are:

- Basic Trainings
- Trainings for users with experience in other pipe calculation software.
- Expert training, advanced courses
- Trainings for program updates
- Trainings to special topics on demand

Basis of the trainings may be our field-tested education examples or pipe systems suggested by the user.

Both, the theoretical part with explanation of the graphic user interface and information about the ROHR2 environment as well as the practical part at the computer with working at selected examples, check of input files and evaluation of the results get an adequate time period within the course.



### **SIGMA trainings**

#### **Individual Program Training**

The small group size of 1 to 6 persons per course allows an effective personalized training. The training can be adapted to your personal need, e.g. for the clarification of open questions arising in your everyday work with ROHR2. We encourage you to bring the project examples you are currently working on and make them the subject of your training so that the questions relevant to your situation are discussed.

Training language is German, English or French. Training dates may be arranged individually.

Place of the training may be the trainees company office or our corporate center in Unna

#### **ROHR2 Group training**

Basic program training in groups of up to 6 participants, coming from different companies. The participants list is filled by appointment. The small group size allows an effective personalized training.

Place of the training may be the trainees company office or our corporate center in Unna.

The training language is English or German.

The training dates are published on the website [www.rohr2.de](http://www.rohr2.de) or may be inquired by the program support.

#### **ROHR2 Internet training sessions**

In case of urgent questions or project related needs which do not justify the organization of a complete one or two-day training we propose internet based training. All you need to do is to install a local viewer client (VNC) and log into our training PC. Using the telephone line and the internet connection you will follow the training session on your screen, interact using your mouse and discuss the difficulties and questions with our training staff. You can also send your example and we discuss the problems using this example.

Please call our support hotline in order to arrange for an internet training (which usually can be arranged within hours). The main benefits of Internet based training are cost and time savings.

#### **ROHR2fesu trainings**

ROHR2fesu introduction course:

Training:	max. 6 participants
Date:	upon agreement or fixed dates
Duration:	one day (10 a.m. to 4 p.m.)
Location:	SIGMA GmbH, 59423 Unna, Germany
Language	German or English

**Please ask for an individual training offer.**