

# SIGMA

Ingenieurgesellschaft mbH

## SOFTWARE

ROHR2	ROHR2FESU	SINETZ
Development	Sales	Support

## ENGINEERING

Pipe Static and Dynamic Engineering - FE-Analysis  
 Pressure and Temperature Loss - Component Analysis

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CAE-System for Component Analysis, Engineering and Structure-Analysis of Complex Piping Systems

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Calculation of Flow Distribution, Pressure Drop and Temperature Drop in Piping Networks

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Training, Update-Service, Maintenance

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## The Company

As a specialist in the field of pipe stress analysis and plant construction SIGMA Ingenieurgesellschaft offers a wide range of engineering services as well as software development, system integration, sales and maintenance services.

SIGMA Ingenieurgesellschaft mbH was founded 1989. After sixteen years in Dortmund-City our growing business requires more room. We moved to our new company office in Unna/Germany in November 2005.

The combination of modern working methods, actual CAE-Software and the Know-How of more than 30 years of pipe and plant business guarantees a reliable engineering and project consulting in

- Static and dynamic analysis of various projects as power plants, district heat networks, chemical plants, pump stations, refineries, ships, bridges, cranes, and other units in plant construction
- Calculation of Flow Distribution, Pressure Drop and Temperature Drop in Piping Networks,
- Finite -Element Analysis

Our qualified software engineers develop the programs

- ROHR2, ROHR2STOSS
- SINETZ, SINETZfluid
- CAD/CAE -Interfaces and
- Additional software according to the customers needs

With our technology and service conceptions we globally support you reaching your targets and strategies.

An extended vocational training of our staff guarantees service on the on the highest level.

The staff of our user support are qualified engineers and program developers too to ensure a quick solution for each problem for the deployment of SIGMA software with highest efficiency. Part of our concept is the product- and project-oriented training of the program users.

The result of a continuous knowledge transfer between program developers and project engineers is a software product, developed according to the needs of the customers.

We are building software from engineers to engineers. Our team of engineers at the headquarter in Unna stands for a qualified and on time processing of your orders.

## SIGMA Engineering

Our Range of Service

### Project Consulting

### Engineering on the spot

### Support in case of capacity bottlenecks

#### Pipe static analysis

Static analysis according to I. and II. order theory with linear and nonlinear boundary conditions, as well as special fields of pipe static analysis like

- continuous elastic foundation for soil restraint pipes
- nonlinear bedding
- hanger displacement and friction,
- jacket piping
- Plastic piping with stress analysis (PE, GRP)

#### Pipe dynamic analysis

dynamic analysis acc. to modal response or direct integration method with linear and nonlinear boundary conditions  
eigen frequencies, mode shapes, earthquake, fluid hammer  
arbitrary time dependent loads

#### Stress analyses

ANSI/ASME B31.1, B31.3, B31.4, B31.5, B31.8  
EN 13480, FDBR, AGFW, KTA3211.2, KTA3201.2  
ASME-Code Section III NB/NC/ND, Stoomweezen D1101  
Plastic pipes acc. to ISO14692, BS7159, KRV

#### Calculation of steel structural sections

Supports and pipe racks according to DIN 18800

#### Pressure and temperature loss

Calculation of pressure and temperature loss in intermeshed pipe systems with compressible and incompressible media  
Calculation of insulation thickness of pipes  
Pressure and temperature loss calculation of district heat networks  
Dimensioning and analysis of sprinkler systems

#### Internal pressure calculation

AD-2000, TRD, DIN 2413, EN 13480

#### Design strength analysis of integrated components

Nozzles, cams, claws  
Flanges and screws

#### Stability analysis

AD-standard, AD-S-standard

#### Vibration analysis

#### Finite Element Analysis

Components, e.g. branches under internal pressure and additional loads

On request, our project consulting service supports you in organizing and structuring your projects on the spot and develops possibilities of standardization and streamlining in integrated project teams together with you.

In case of capacity bottlenecks, our experienced engineering team supports you.

## SIGMA Engineering

### References (extract)

AE Energietechnik, Graz, Wien  
AGENS Engineering, München, Klagenfurt  
Alstom Power Austria AG, Wien  
Alstom Power, CH-Baden  
Alstom Energy Systems GmbH, Stuttgart, Köln,  
Neumark, Kassel  
Aker Kvaerner, Niederlande  
APL Apparatebau, Dormagen  
Arens Rohrleitungsbau GmbH, Saterland  
Aventis Pharma GmbH, Frankfurt  
Babcock Hitachi, Oberhausen  
Balcke Dürr Austria GmbH, A-Wien  
BARMAG AG, Remscheid  
Basell Polyolefine GmbH, Wesseling  
BASF, Ludwigshafen, Antwerpen  
Bayer Technology Services, Leverkusen, Krefeld, Dormagen  
BP Chemicals, Marl  
Boehling Rohrleitungs- und Apparatebau,  
Hamburg, Karlsruhe, Velbert  
Carantec Engineering GmbH, A-Klagenfurt  
Chemieanlagenbau Chemnitz GmbH, Chemnitz  
Cognis GmbH, Düsseldorf  
Cognis Oleochemicals, Malaysia  
DBE, Peine  
DEA Heide, Wesseling  
Deutsche Shell AG, Wesseling  
Deutsche Voest-Alpine, Düsseldorf  
Didier-M&P Energietechnik GmbH  
DSD Dillinger Stahlbau GmbH, Düsseldorf, Saarlouis, Berlin  
ELF Bitumen, Brunsbüttel  
EnviCon & Plant Engineering GmbH, Nürnberg  
E.ON Anlagenservice GmbH, Gelsenkirchen  
E.ON Engineering GmbH, Gelsenkirchen  
E.ON Kernkraft, Hannover  
E.ON Ruhrgas AG, Essen  
EPC Engineering GmbH, Rudolstadt  
EPI Industrieanlagenplanung, Oer-Erkenschwick  
Essener Hochdruck Rohrleitungsbau GmbH,  
Essen, Dortmund, Kaltenkirchen  
European Gas Turbines, Essen  
Everair Technology GmbH, Hilden  
FASAM GmbH, Brüggen-Bracht  
FAUDI Filter Systems, Stadtallendorf  
Ferchau Engineering GmbH, Köln  
FISIA Babcock Environment GmbH  
Freudenberg Service KG, Weinheim  
GABEG Anlagenbau, Gröbenzell  
GAZ de France GmbH, Lingen  
GET Ges. für Energie- und Trocknungstechnik GmbH, Schwetzingen  
J&P AVAX SA, GR-Athen  
GIP Ges. f. Industrieanlagenplanung, Marl  
GRACE GmbH & Co KG, Worms  
HEAT Wärmetechn. Anlagen GmbH, A-Biedermannsdorf  
HERA Maintenance GmbH, Marl  
Henkel KGaA, Düsseldorf  
Hitachi Power Europe GmbH, Oberhausen  
Hoechst AG, Frankfurt  
Ing.-Gesellschaft Nord, Greifswald  
IKR Engineering GmbH, Schönwalde  
IMOPLAN Hüther GmbH, Ludwigshafen  
INEOS Manufacturing Deutschland GmbH, Köln  
Innovene Deutschland GmbH (Deutsche BP)  
INPLAN Industrieplanung GmbH, Brunsbüttel  
Imtech Deutschland GmbH, Frankfurt  
Jacobs Projects GmbH, Köln, Gelsenkirchen

## SIGMA Engineering

### References

Kasseler Fernwärme GmbH, Kassel  
KCO Cogeneration und Bioenergie GmbH, A-Wolfsberg  
Kiefer & Voss GmbH, Erlangen  
Kiel Engineering, Wesseling  
Koernig Weber GmbH & Co, Pulheim  
Kraftanlagen München GmbH, München, Essen, Hamburg  
Küstners Technologie GmbH & Co. KG, Krefeld  
LOI Thermprocess GmbH, Essen  
Lurgi Lentjes AG, Düsseldorf  
Lurgi Life Science GmbH, Frankfurt  
MAN Turbo AG, Oberhausen, Essen  
MAN Oil & Gas Division  
Messer AGS, Krefeld  
METZ Anlagentechnik GmbH, Bremen  
Meuser + Wirtz RLB GmbH, Jüchen  
MH-Rohr GmbH, Kirchheim/Teck  
Mineralölraffinerie Oberrhein GmbH, Karlsruhe  
M + W Zander GmbH, Kulmbach  
Norddeutsche Affinerie AG, Hamburg  
Paul Wurth Umwelttechnik GmbH, Essen  
Pipeline Engineering, Gelsenkirchen  
PKB Ingenieurgesellschaft mbH, Gelsenkirchen  
PLEcon Pipeline Engineering Consulting GmbH  
PPS Pipeline Systems GmbH, Quakenbrück  
PS Engineering, Quakenbrück  
PUT GmbH, Stuttgart  
RUI Rohr- und Industrieanlagenbau GmbH, Austria  
Schering AG, Bergkamen  
Siemens Axiva GmbH & Co. KG, Frankfurt  
Siemens Power Generation, Erlangen, Duisburg, Mühlheim  
Solvay GmbH, Rheinberg, Bernburg  
SPX Cooling Technologies / Balcke / Hamon Dry Cooling/  
Marley, Ratingen  
Stadtwerke Bochum GmbH  
Stadtwerke Düsseldorf, Solingen  
Standardkessel, Duisburg  
Tebodin Consultants & Engineers, Gelsenkirchen  
Technip GmbH, Düsseldorf, Frankfurt  
TPR Fiberdur GmbH, Aldenhoven  
Thyssen Schachtbau GmbH, Mülheim  
Thyssen Krupp Steel AG, Duisburg  
Uhde GmbH, Dortmund, Bad Soden  
vom hagen mce, Bochum  
Visser & Smit Hanab Boiler Engineering, Kaarst  
Vorwerk-ASA GmbH, Herne  
Westinghouse (ABB) Reaktor GmbH, Mannheim  
Wuppertaler Stadtwerke GmbH

## SIGMA Engineering

### Projects (extract)

The reference list is intended to give an overview on the engineering tasks, SIGMA carried out in the last years. The projects are presented by their original names. We will always be at your disposal to explain and discuss completed projects and engineering potentialities in English.

### Chemical plant engineering

- BYK Chemie, Wesel
- Begleitbeheizte Schmelzeleitung, div. Projekte, MH-ROHR, Kirchheim
- VC-Anlage Vintron, Krupp UHDE
- LDPE -Anlage NANPE, China, Krupp UHDE
- Carberes I, Rüttgers
- Suspensionsanlage Crompton Bergkamen
- Phosgenanlage Bayer Brunsbüttel  
Kapazitätserweiterung PVC, Solvay Rheinberg
- Solvay Bernburg, div. Projekte
- Erweiterung Anilinanlage, Bayer AG  
Ethylbenzol-Dehydrierung, BP Chemicals
- Husky Oil, Canada
- GRACE Worms
- Kata Leuna, BSL, Leuna
- Olefin-Anlage BP Gelsenkirchen
- Aromatenanlage, BP Gelsenkirchen
- Vakuumofen Abhitzesystem, Selas Linde
- Melaminanlage Peisteritz, Lurgi Life Science
- Ethylenstation, Versorgungsleitungen, Infracor Hüls
- Formalinanlage, Bakelite AG
- Schwefelsäurekonzentrierung, Stahl-/Email-Leitung, BTS Dormagen
- FAL-Reboiler, Cognis Malaysia
- Schwefelsäurekonzentrierung, Stahl-/Email-Leitung, Caoging, China
- LDF-line, INEOS Manufacturing Deutschland
- GRP Piping, Saipem
- Schwefelsäureleitung, Norddeutsche Affinerie AG

### Oil and Gas

- STATOIL, Ruhrgas
- Refinery MIRO, Karlsruhe
- DEA Heide, Wesseling
- Shell Godorf, div. Projekte
  
- RWE DEA compressor station Brammer
- Gas long distance pipe EUROPIPE Dornum
- Natural Gas Project, Portugal
- Gas-Speicher Verdichterstation Breitbrunn
- Metering Station EUROPIPE Emden
- Gas-compressor stations:  
Werne, Epe, Bierwang, Porz ME11/12, Mittelbrunn,  
Schwarzach, Etzel, Waidhaus, Wardenburg, Krumhörn
- Interconnector, Compressor Station Zeebrügge
- Gas optimization pipelines Lingen, Werne
  
- Sirte Oil Company, Compressor Station
- B-NET, Stations Vohburg, Neustadt and Münchsmünster

## SIGMA Engineering

Projects (extract)

### Power Plants

- KW Lippendorf
  - KW Weisweiler
  - KW Schwarze Pumpe
  - KW Boxberg
  - KW Schwarzheide
  - KW Schkopau
  - KW Wedel
  - KW Phönix Leipzig
  - KW Robert Frank
  - KW Ibbenbüren Block B
  - GK Mannheim, Block 7
  - HKW Dresden, Nossener Brücke
  - HKW Berkenbrücker Chaussee
  - HKW Troplast, Troisdorf
  - HKW Kassel
  - HKW Kaiserslautern
  - Holtzmann Papier, Varell
  - KW Moorburg, HD-Systeme
  - KW Walsum, HD-Systeme
  - KW Neurath, BoA 2/3, Main Steam, Cold- / Hot Reheat
  - GuD KW Hamm
  - GuD KW Herdecke
- 
- Amercentrale, Niederlande
  - C.T. Alcudia, Foix, Spanien
  - Chandrapur, GUD-URAN, Indien
  - Marmara, Iskenderun Türkei
  - Sines I und II, Lacerda IV
  - Nicola Tesla, Bl. 3, Serbien
  - Nicola Tesla, Bl. 4, Serbien
  - Alunorte, Brasilien, Main Steam
  - Elbistan, Unit II, Turkey Main Steam, Hot / Cold Reheat
  - Turcbilek, Unit IV, Turkey Steam, Hot / Cold Reheat
  - Vasilikos Phase III, Cyprus - Main Steam

### Nuclear Power Plants

- Biblis
- Brokdorf
- Hamm-Uentrop
- Kalkar
- Krümmel
- Philippsburg
- Stade
- Würgassen
- Gösgen, CH
- Leibstadt, CH
- Olkiluoto 3, FN - Feedwater

## SIGMA Engineering

### Projects (extract)

### Other projects

- Kokerei Schwelgern, Thyssen Krupp Encoke
- Kältererzeugung Charité Berlin
- OMV Wien, Aromaten
- ASU Köping, Schweden
- Kronos Titan
- Kühlwassersystem HDPE, KST Wolfsburg
- Versorgungsleitungen Gotthard Tunnel, Sedrun (CH)
- Zentis Aachen, div. Dampf-, Kondens- und Gasleitungen
- Siemens, Mega Test Center
- ThyssenKrupp Steel, Kaltwindverteilung

### Waste-to-Energy plants, e.g.

- Arhus, Dänemark, Feedwater, Main Steam
- Vestforbraending, Dänemark, Feedwater, Main Steam
- Neapel, Italien, Feedwater, Main Steam
- MVA Oberhausen, Feedwater, Main Steam
- MVA Hameln, Feedwater, Main Steam
- MRihimäki, Finnland, Feedwater, Main Steam
- Jönköping, Sweden, Feedwater, Main Steam
- Borlänge, Sweden, Feedwater, Main Steam
- Uddevalla, Sweden, Feedwater, Main Steam

### District Pipe Heating

several projects in Germany , e.g.  
Duisburg, Wuppertal, Gera, Halle, Mainova AG

### FE-Analyses

- Rührwerksauflage, Schering Bergkamen
- Stütze im Bogen, Bayer AG Köln
- Segmentbogen mit Rippen und Stützen, Bayer AG Dormagen
- Behälter auf Prätzen unter Zusatzlasten, PKB Gelsenk.
- Behälter mit Tangentialstützen und Verstärkungsscheibe unter Zusatzlast, PKB Gelsenkirchen
- Spinnköpfe, HD-Formstücke, Barmag AG Remscheid
- Stütze im Bogen, Prätzennachweise, Thyssen Krupp AG
- Behälter mit tangentialem Rechteckstützen unter Zusatzlast, FASAM GmbH
- Übergangsstück rechteckig / rund unter Innendruck und Zusatzlast, Tebodin Gelsenkirchen
- Gummierter Behälter mit Dach, Konus und Mantel, SMS Demag AG
- HP- und LP-Sammler mit Unterstützkonstruktion unter Zusatzlast aus HD-Leitungen, EHR Essen
- Behälter mit Tragpratzen / Ringlagerung, Standsicherheitsnachweise gegen Eigengewicht, Wind und Erdbeben unter Berücksichtigung von Stützenbelastungen, APL Dormagen
- MH-Rohr GmbH, Verteilerstücke /Volumenelemente
- E.O.N. Anlageservice GmbH, Gelsenkirchen, Temperaturverteilung durch die Wand / Volumenelemente
- PSE Engineering GmbH, Behälter mit Auslaufstützen

## Software Development

ROHR2  
ROHR2ISO  
ROHR2FESU  
ROHR2STOSS  
ROHR2-Interfaces

CAE-System for Component Analysis, Engineering and Structure Analysis of Complex Piping Systems

Strict legal provisions for plant engineering lead to steadily increasing documentation expenditure. At the same time, keener competition forces the enterprises to streamline continuously and to shorten planning periods. A close cooperation of all engineering sciences is absolutely required, therefore a smooth communication must be the indispensable consequence.

Integrated engineering systems with components which are specialized in the specific fields of engineering are a central part during project work.

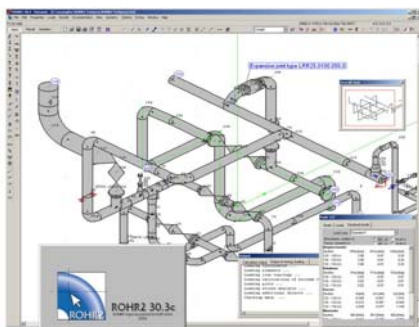
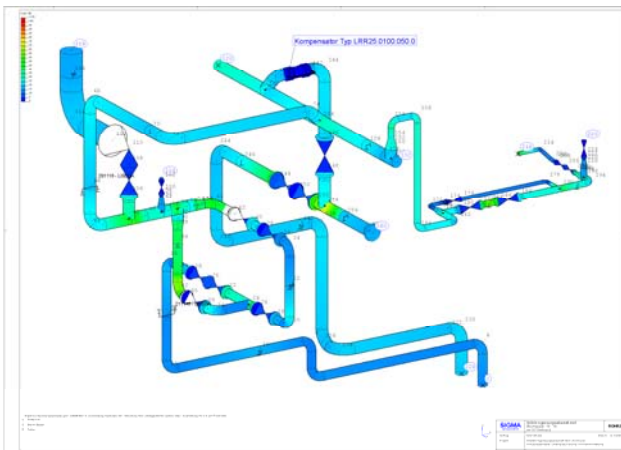
The CAE system **ROHR2** is such a "specialist" for component analysis, engineering as well as static and dynamic structure analysis of complex piping systems.

Static and dynamic analysis of complex piping and skeletal structures.

For more than 30 years, ROHR2 has supported the industry with an extensive application area and permanently revised and updated program releases.

A lot of well-known national and international plant producers, safety standards authorities, a large number of engineering companies, as well as operating companies of the energy-, chemical- and petrochemical industry trust in the quality of ROHR2.

ALSTOM - AIB Vinçotte - AE&E Austria - ANDRITZ AG - AXIMA - BABCOCK BORSIG - BABCOCK & WILCOX - BALCKE DÜRR - BATEMAN - BAYER - BHEL - BHR Bilfinger + Berger - Bioener - Celanese - CIMTAS - CITEC - COGNIS - DONG ENERGI A/S - Doosan Babcock - DSD - ESKOM - ESTEQ - FMT Industrieholding - ENBW - E.ON - FISIA - FOTAV RT - FRAMATOME ANP - GRONTMIJ - HITACHI - IDEA LTD - IHI Corporation - INFOSYS - INFRASERV - Israel Electric - JACOBS - J&P-AVAX - J. Christof - KRAFTANLAGEN Heidelberg - KRAFTANLAGEN MÜNCHEN - LAHMEYER - LENZING TECHNIK - LEWA - LURGI LENTJES - MEYER WERFT MCE ENERGIETECHNIK - NOELL - NORDON INDUSTRIES - OMV AG - OSCHATZ - PAUL WURTH - R&M IKR - RWE - SIEMENS POWER GENERATION - SPX COOLING SYSTEMS - STANDARDKESSEL - THYSSENKRUPP UHDE - TECHNIP - VATTENFALL - VEBA RUHR OEL - VAM - VOESTALPINE Stahl - WESTINGHOUSE - WINGAS



and national technical control boards (TÜV), power stations, local energy supply companies, manufacturers of pipe components, universities and a large number of engineering companies.

Parts of the system are optional available programs like CAD-interfaces for the communication of ROHR2 with CAD-systems, ROHR2ISO (creation of dimensioned isometric drawings and part lists), ROHR2FEM, Finite-Element Analysis of selected components in pipes and ROHR2STOSS, Structure Analysis of Fluid Hammer using Direct Integration.



## Software Services

Training  
Update-Service  
Maintenance

### Software-Training

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
- Trainings for program updates
- Trainings to special topics on demand



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.

### Maintenance and Update service, Program user advice

SIGMA offers Software-maintenance contracts including user support, software development and update service.

All programs are equipped with a detailed application documentation. At questions about the documentation competent contact persons of the ROHR2 hotline supports the user.

The update of the software by extensive updates is a further essential component of the maintenance agreement. The software is developed continuously.

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.

### Developing Software Solutions specified to the customer needs

- Integration of SIGMA Software into networks
- CAD/CAE-Interfaces
- Adaption of SIGMA Software to existing hardware systems