

# ROHR2stoss

Structural Analysis with Dynamic Loads  
using Direct Integration

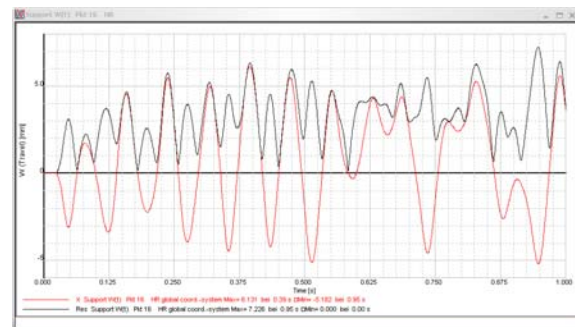
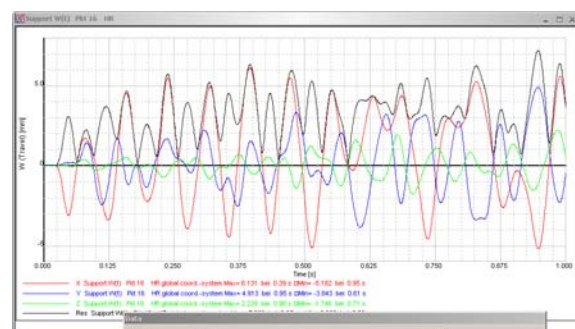
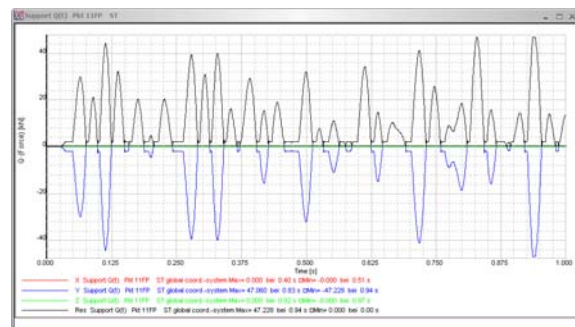
SIGMA Ingenieurgesellschaft mbH

## ROHR2stoss

ROHR2stoss is an alternative dynamic module in the program system ROHR2. The results of ROHR2stoss are integrated into the ROHR2 processing. The task of the program ROHR2stoss is the assessment of temporal varying load such as those induced by fluid hammer in pipe structures using the direct integration method of the differential equation. Linear as well as non-linear boundary conditions are considered.

For linear boundary conditions, this method is an alternative to the modal time history calculation of the ROHR2 standard calculation process. The possibility to include non-linear elements allows the design of new elements, which cannot be analyzed by modal time history calculation:

- Support with gap
- Shock absorbers with activation limits
- Geometric non-linearity of angulating supports,
- Constant supports with friction,
- Supports and springs with hysteresis,
- Visco-Dampers with resistance proportional to velocity,
- Springs with dampers,
- Soil damping,
- Friction supports, with or without guides,
- Expansion joints with friction,
- Shock
- Analysis of impacts between pipes.

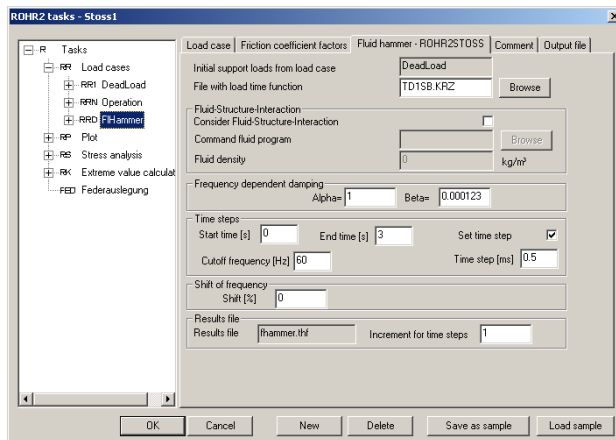


The real damping of structures only can be described approximately using a global damping coefficient in the wave equation. The choice of the damping coefficient, which is in general unknown, has an important influence on the results. Using more precise non-linear models for the frictional supports, shock absorbers and dampers ROHR2stoss allows to perform detailed analysis of dynamic effects including local damping elements.

### Software Development, Sales and Support

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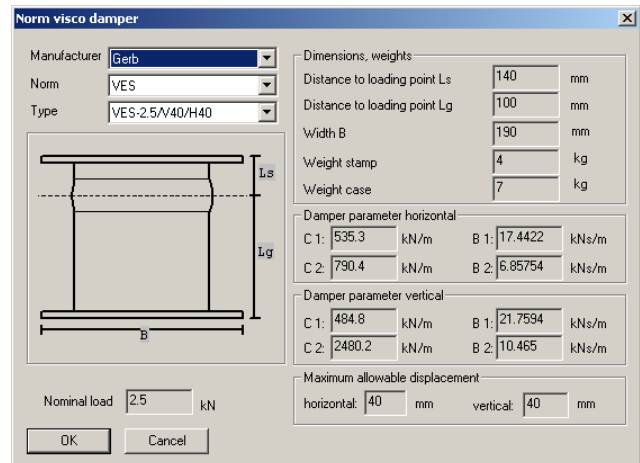
**ROHR2 Integration**

ROHR2stoss is integrated into the ROHR2 environment. This makes it easy to switch between modal time-history analysis and Direct-Integration in Dynamic fluid Hammer load cases.

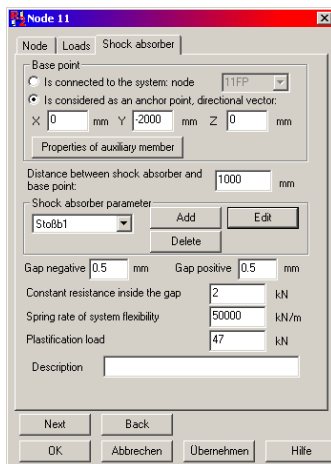
**ROHR2stoss Program features**

Special features of ROHR2stoss are:

- nonlinear boundary conditions like friction, gap of support, visco dampers and shock absorbers.
- Data of GERB Visco dampers are available in a database used to generate a 2-string Maxwell model. Here the complex viscous properties (frequency dependence and phase shift) can be simulated.
- Nonlinear coupling between pipe sections,
- Dynamic loads can be applied in any direction
- Acceleration –time-functions (e.g. earthquake) can be considered as loads
- Analysis of the dynamic load factors (DLF) and the limit frequency for any given load.
- Automatic mass discretization and choice of time steps as a function of the frequency limit.
- Processing of load-time-functions in binary format as well as in ASCII format,



*Input Visco damper*

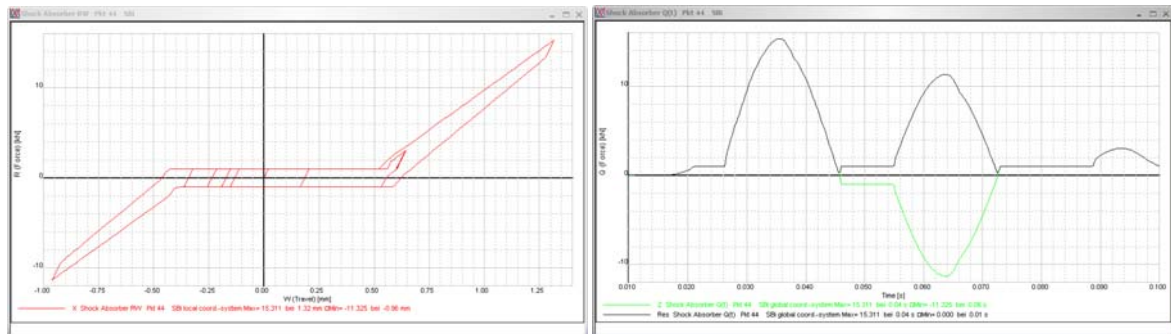


*Input Shock absorber*

- Fluid-Structure-Interaction (FSI) with external Fluid dynamic programs (e.g. INROS, DRAKO)
- Fourier-Analysis of results,
- Fluid masses in axial direction of a pipe can be ignored (e.g. for analysis of fluid structure interaction),
- Time steps for load functions and output may be chosen independently,
- Time step modulation (frequency shift),
- Rayleigh-damping,
- Extensive graphical representation of the dynamic output using the WINDOWS program ROHR2fun (ROHR2stoss function analysis).

## ROHR2fun - ROHR2stoss function analysis

ROHR2stoss includes the program ROHR2fun.  
 ROHR2fun is used for graphical representation and analysis of functions, esp. load inputs and results of ROHR2stoss.



ROHR2fun: Shock absorber with gap

## Program license and system requirements

### Program version, system requirements

ROHR2stoss is available as an additional program to the ROHR2 single user license and to the ROHR2 network license.

ROHR2stoss is an optional ROHR2 module and requires the previous installation of **ROHR2 Dynamic**.

The system requirements correspond to those of the program ROHR2.

Running ROHR2stoss always requires the installation of ROHR2.

Depending on the size of the tasks to be calculated, several GB harddisk capacities is required.

### Scope of delivery and Copy protection

The Program ROHR2stoss includes:

- one program license ROHR2stoss (single user license) or one license per user in network licenses
- the program ROHR2fun

The functions of ROHR2stoss and ROHR2fun are explained in the ROHR2 online manual.

The programs' scope of delivery contains the program data carrier (CD) a USB hardlock module (copy protection plug, dongle). In case of updates/upgrades the hardlock module will be exchanged.

The software does not run without this hardware copy protection.

### Maintenance and user support

Advice about installation and application is done by the ROHR2 user support (hotline). The hotline is part of the service during six month after purchase, during time limited licensing (rent) and as a part of a valid maintenance agreement.

Interfaces and additional programs are integrated into ROHR2. Maintenance of additional programs and interfaces is mandatory in this case