

## Finite element calculation of a supporting structure

### Effective combination of measurement and theory

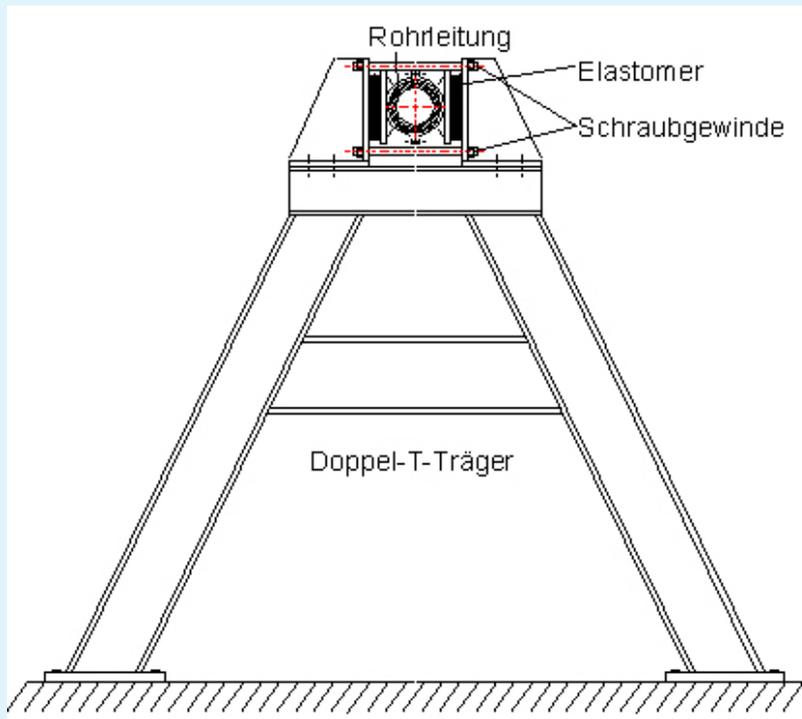
To work out purposeful reduction measures for vibration problems is one of the most important factors for a successful “trouble-shooting” from KÖTTER Consulting Engineers.

The metrological investigation of the current situation is the condition for being able to reveal the mechanism of action behind and to analyse it. Afterwards, the problem must be transferred in an effective mathematical model. Effective means that a preferable simple model must illustrate the vibration phenomenon in the best possible way. Therefore, model and measurement have to fit together so that in the calculation model different reduction measures can be tested and worked out accurately.

Within a gas compressor plant excessive pipeline vibrations were observed depending on the operating conditions. KCE’s metrological analysis revealed that these vibrations were caused by the resonance behaviour of a lateral mode of the pipeline. In a first step, a “simplified” finite element model (FE-model) was adjusted according to the lateral mode shape of approx. 60 Hz (figure 2). In a next step, the support structure was discretised as FE-model and adapted. The objective was to shift the natural frequency to approx. 80 Hz and to achieve a sufficient damping by an elastomer (figure 3).

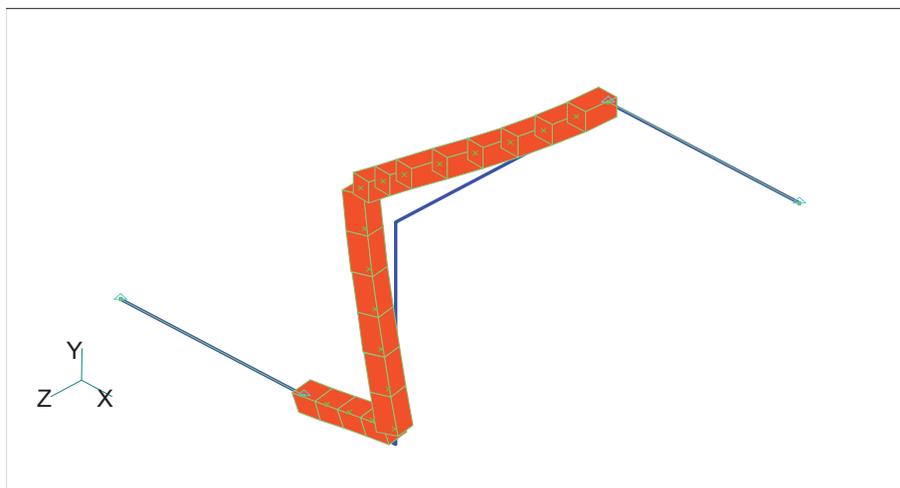
Finally, a control measurement was carried out confirming the success of this proceeding. The measured natural frequency lay at approx. 83 Hz and the occurring vibrations during operation were reduced by a factor of 10.

MACHINE DYNAMICS



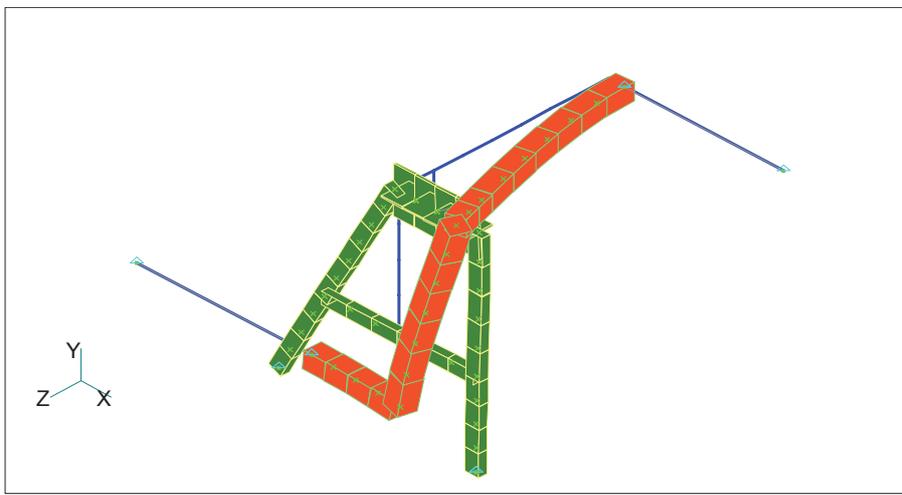
Constructed supporting structure

# 1. Ursprünglicher Rohrleitungsbogen abgestimmt auf Messergebnis $f = 60,7$ Hz



Mode shape of the original pipeline

## 2. Modifikation mit zusätzlicher Stützenkonstruktion Berechnet $f = 79,4$ Hz



Mode shape of the constructed support with pipeline



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