

# Software Library

## Beamforming, Dereverberation

By using a microphone array it is possible to separate speech and background noise (e. g. in vehicles) or the speech signals of several simultaneous speakers (e. g. during a telephone conference). It is also possible to eliminate interfering room influences (e. g. reverberation).

The signals from the individual microphones are processed by means of static or adaptive algorithms (Beamforming or Beamsteering). The number and spatial arrangement of the microphones influence their directivity and directional effects.

voice INTER connect has numerous beamforming algorithms that are combined in the Multichannel Speech Enhancement Suite (vicMSES). They are used whenever single-channel noise suppression methods have limitations. Our acoustics experts will help you design application-specific microphone arrays by capturing requirements, simulating directivity characteristics and validating your solution by acoustic measurements.

### Product Features

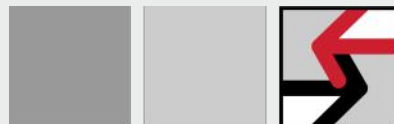
- Complete library for beamforming, dereverberation and source separation
- Acoustic source localisation to determine the position of dynamic speech sources
- Platform-independent, proven code with high portability for embedded platforms (ADSP Blackfin, SHARC; TI C6000; i.Mx6; ARM)
- Simulation and measurement tools for designing customer-specific microphone arrays
- Graphic parameterisation and evaluation tools

### Applications

- Hands-free kits for cars and commercial vehicles
- On-board communication (tram, bus, train, ship, airplane)
- Communication between control stations and emergency vehicles
- Acoustic room monitoring
- Conferencing technology
- Building communication
- Telecommunication equipment, smartphones and tablets

**vicMSES**

**Multichannel Speech Enhancement Suite.**



**voice INTER connect**

# Functional Principle and Technical Data

## Functional Principle

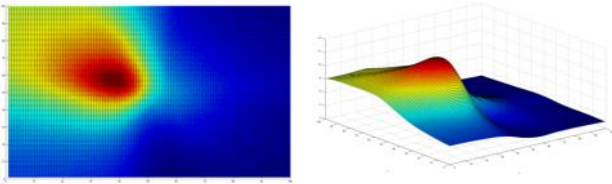


Figure 1: Beamforming

- Change of directivity characteristics by overlapping and filtering of different microphone signals
- Amplifying signals in preferred direction while at the same time attenuating the room reverb and noise coming from the side
- Postfilter for adaptation or improvement of selectivity
- Static or adaptive methods (beamforming and beamsteering)
- Nullsteering for selective suppression of directed noise sources
- Dynamic source tracking and source separation
- Reliable, continuous adaption and convergence even under rough noise conditions

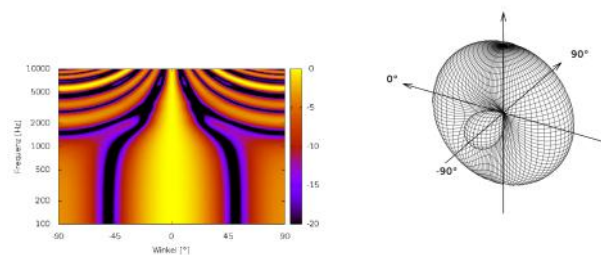


Figure 2: MVDR-Beamformer, 4 microphones

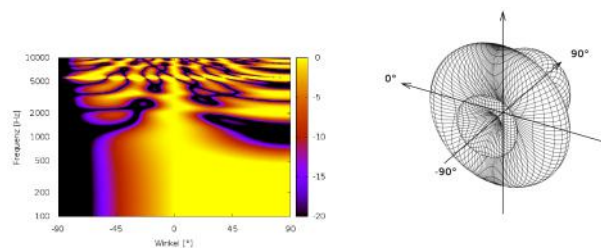
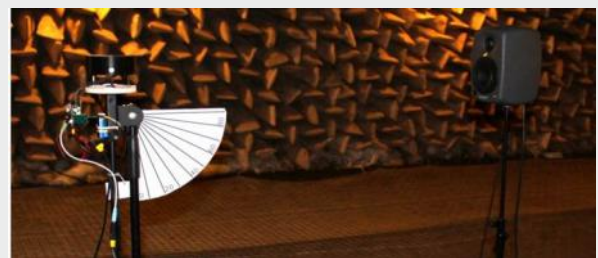


Figure 3: Nullsteering, 4 microphones

## Services

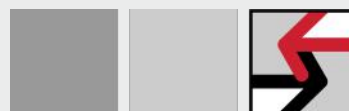
- Application-specific array design (number, arrangement, directivity and selection of microphones)
- Development of algorithms
- Simulation of beamformers with different algorithms and optimisation of directivity
- Simulation of acoustic operation conditions
- Acoustic measurement and objective evaluation of attenuation values, total directivity index, speech quality
- Synthesis of audio examples for subjective evaluation
- Construction and dimensioning of hard- and software (microphone, processors, algorithms)
- Measurement and evaluation of prototypes and final products



Pict. 1: Acoustic laboratory - validation of directivity

## Compatibility

- ANSI C algorithms, proven on different platforms
- Support of PCs with Windows and special multi-channel audio interface
- Embedded platforms like ADSP Blackfin, SHARC; TIC6000 DSPs; ARM Cortex A9
- Special microphone bus for realising different microphone-topologies
- In combination with handsfree processing: available as an add-on for VICs handsfree library vichSES
- Delivery as:
  - Object code for specific DSP environments
  - DLL or Static Library for Windows



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