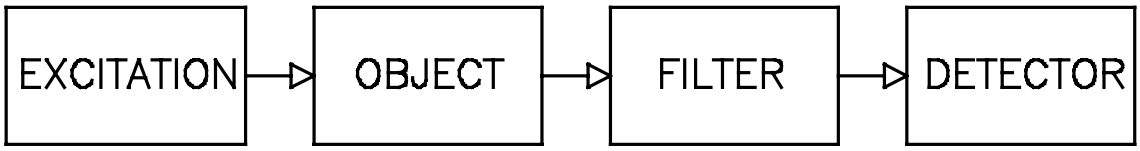
6. USING NOISE IN SYSTEM MEASUREMENTS

Analyzing noise: information about the system

6.1. Noise as a diagnostic tool

Using external noise:

General measurement process:



Excitation also can be noise:

- can be presented already in the system
- can be better than determinictic excitations ($\delta(t)$ vs. white noise)

Using internal noise:

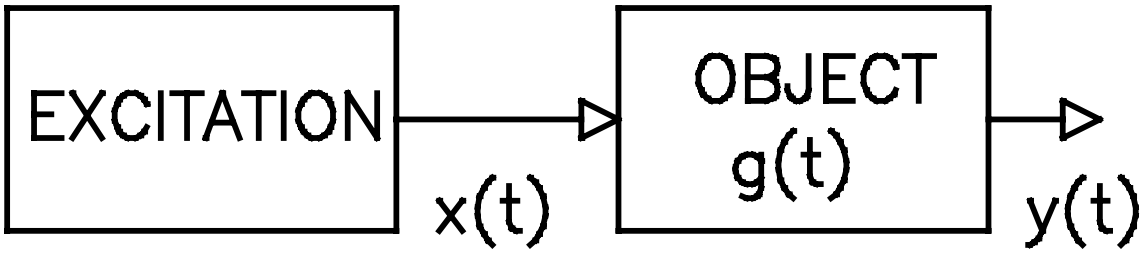
When canát use excitations:

Internal noise of a system: description of state

$$\Delta\text{state} \rightarrow \Delta\text{noise (amplitude, type)}$$

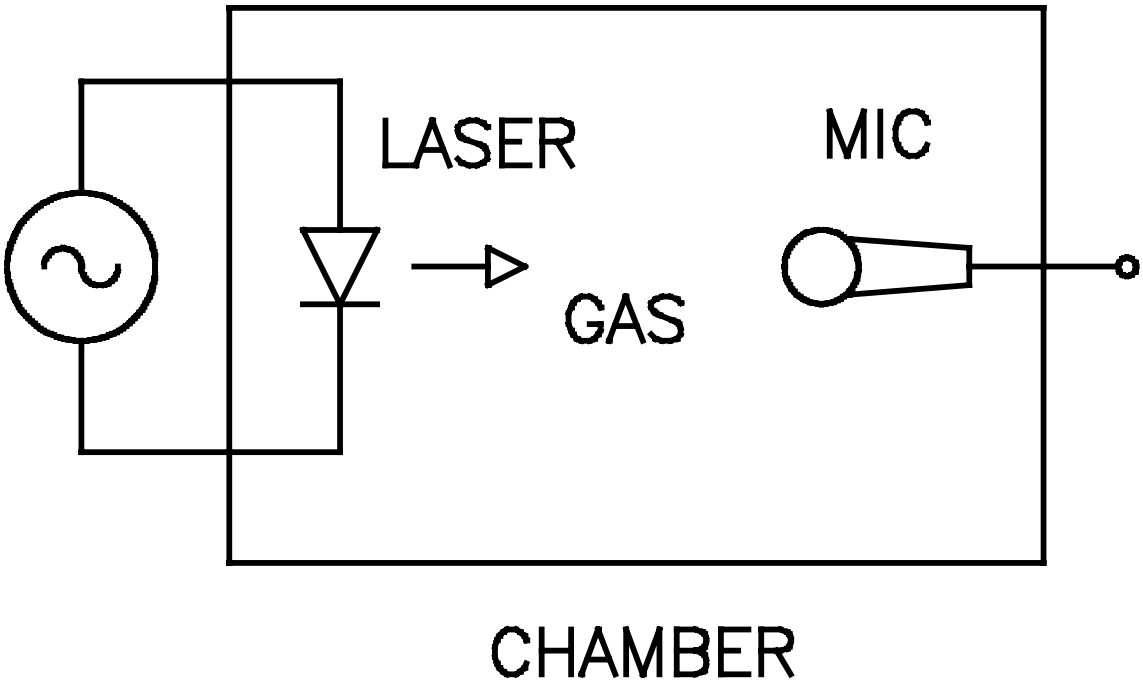
- temperature, magnetic susceptibility
- *non-destructive* reliability testing of ICs, etc.

6.2. Random excitations for measurements of transfer functions



Example:

Detection of gases by a photoacoutic system



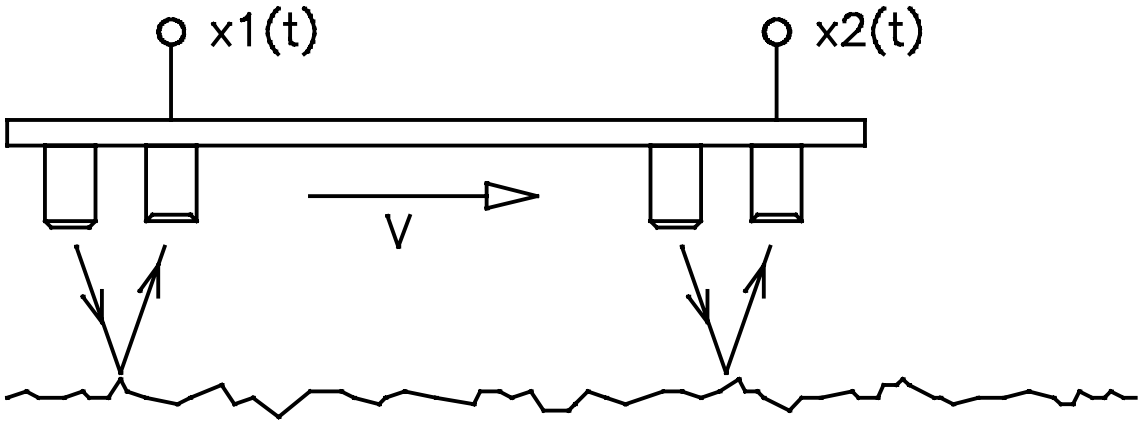
6.3. Applications of cross-correlational analysis

6.3.1. Measurement of speed

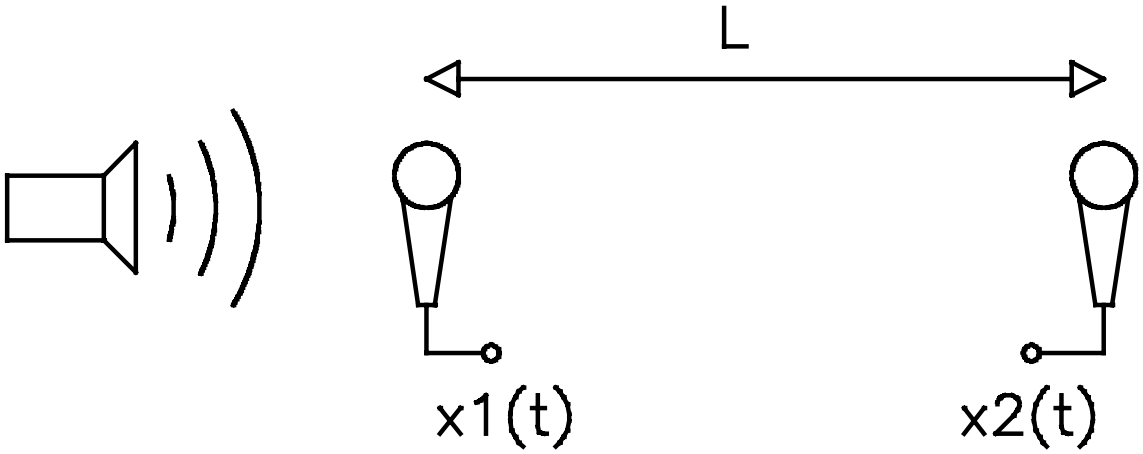
Measurement of speed and position using noisy signals

Examples:

- speed of a vehicle

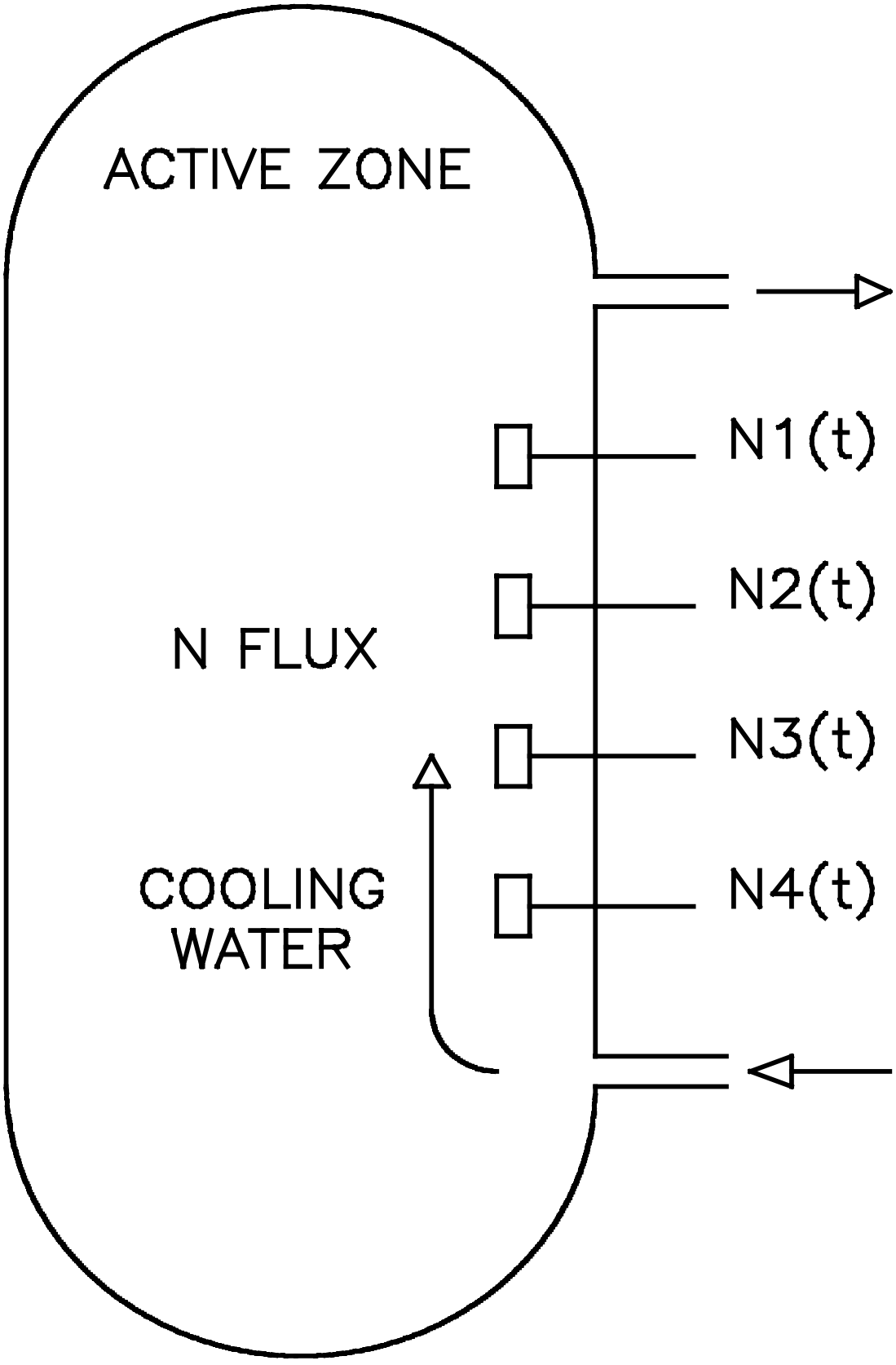


- speed of sound



6.3.2. Reactor diagnostics

- monitoring of neutron flux fluctuations
- measurement of speed
- detection of mechanical vibrations
- detection of boiling (bubbles)


ACTIVE ZONE
N1(t)
N2(t)
N FLUX
N3(t)
COOLING
WATER
N4(t)

6.4. Dithering

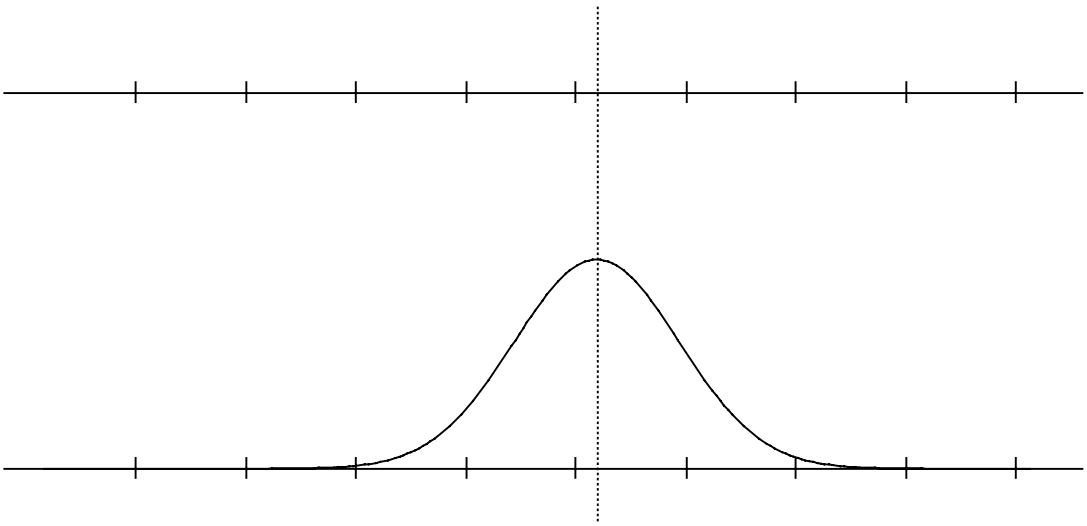
Dithering:

Adding noise to improve the measurement

(???)

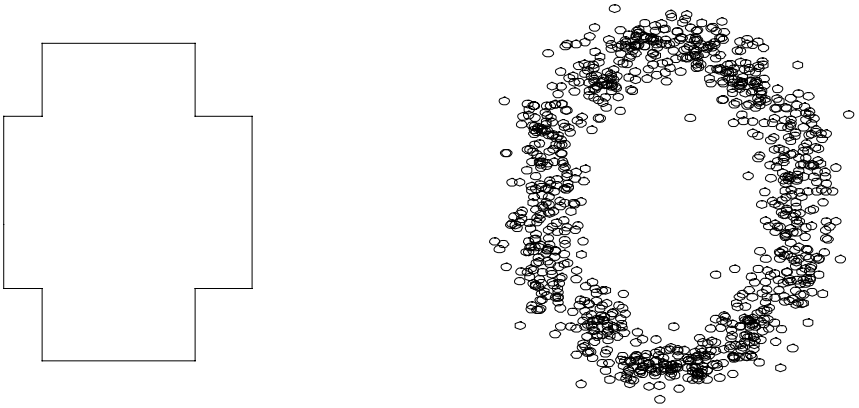
Example #1:

Improving the resolution of a digitizer



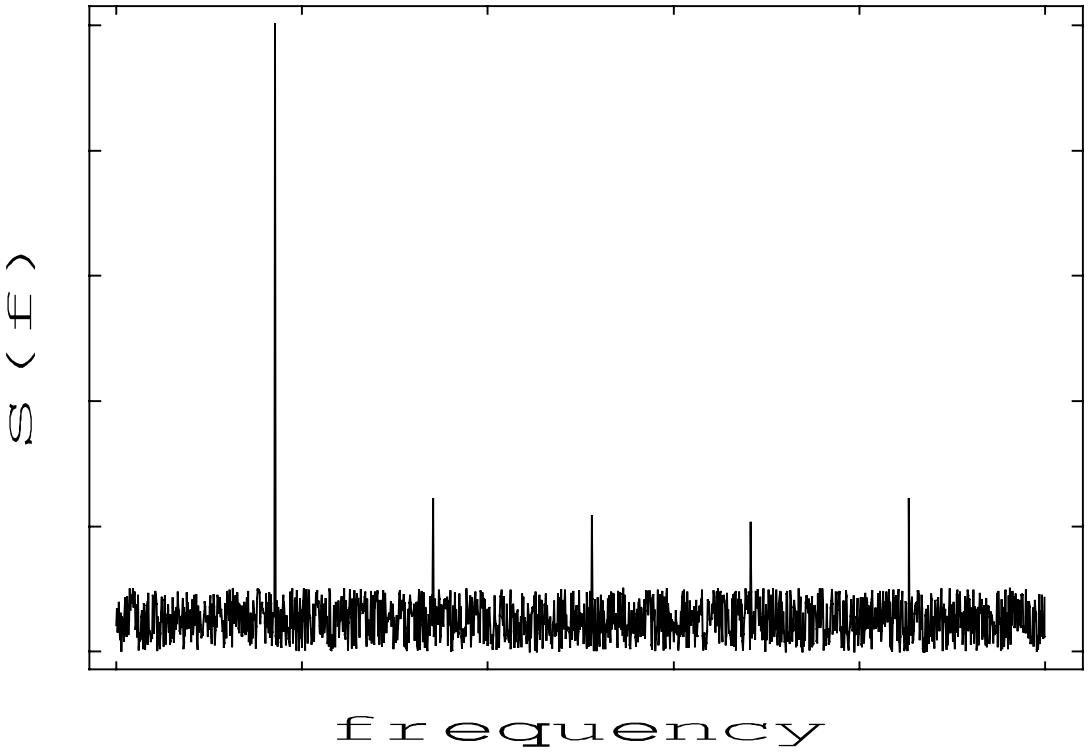
Example #2:

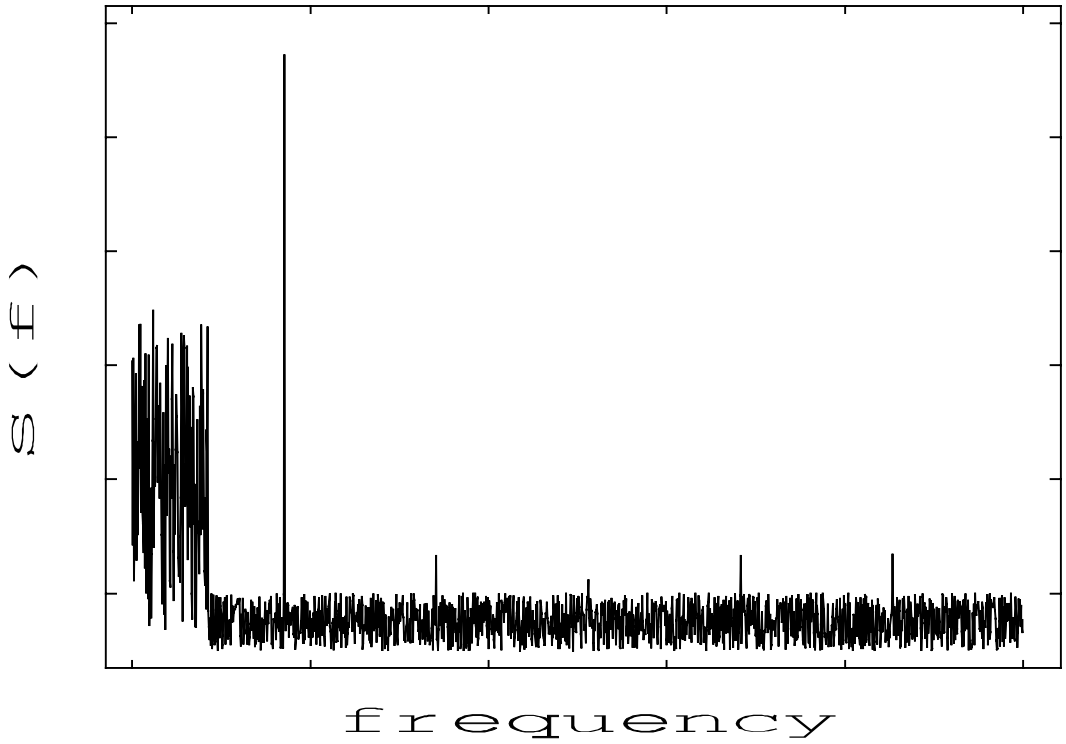
Improving the quality of a digitized images



Example #3:

Reducing A/D non-linearities with adding out-of-band noise


S(f)
frequency


S(f)
frequency