

## Lecture 1

1. Our object of interest
  - (a) Four scenarios:  $L^2(\mathbf{R})$ ,  $L^2(\mathbf{R}_T)$ ,  $l^2(\mathbf{Z})$  and  $l^2(\mathbf{Z}_N)$ ,
  - (b) Scaling, Translation, Periodization, Sampling
  - (c) generalized functions: Distributions
2. Fourier transform (FT)
  - (a) Definition: Fourier transform (FT)
  - (b) Plancherel's th., Convolution th., Scaling property of FT
  - (c) FT in distributional sense, Dirac distrib., Comb distrib.
  - (d) Periodization, Sampling and FT
3. Haar system
  - (a) The generating Haar function and the corresponding Scaling function
  - (b) Generation ON-families by Scaling and Translation.
  - (c) Projection operators.
  - (d) the Haar expansion of functions.
  - (e) the Haar wavelet filters, and the wavelet filter tree.
  - (f) Local rotations on  $l^2(\mathbf{Z})$
4. Translations invariant ON-sets in  $l^2(\mathbf{Z})$