# A fresh look at Harmonic Analysis

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## Overview

Harmonic Analysis is concerned with the decomposition of functions, signals respectively distributions over locally compact Abelian groups, such as $R^d$, or in the classical case over the torus (Fourier series expansions of periodic functions) or for modern applications over cyclic groups of order N respectively their products (for example, for image processing applications), using discrete Fourier transform methods. The building blocks are the pure frequencies (or plane waves, etc.) which are eigenvectors for the translation operator. Because translation invariant operators arise very naturally in many applied situations (mechanical system, transmission systems), their all important description as convolution operators and the fact that the corresponding Fourier transform allows to turn convolution into pointwise multiplication are at the core of Fourier Analysis, which is by now a very mature and sophisticated field. In the last 30 years a mathematical theory, called time-frequency analysis arose, which is based on the idea of a localized Fourier transform using typically a finite length window. So instead of having an infinitely fine frequency domain with no time information Time Frequency analysis provides a picture (very much like a musical description using a score) showing how the (!discrete) harmonic decomposition of a signal changes over time. This theory, often called Gabor Analysis requires new tools and gives rise to new and interesting mathematical questions. It turned out, that a specific Banach space of continuous and integrable test functions (which can be defined over any locally compact Abelian group, specifically on $R^d$) together with its dual space provide an appropriate framework for the description of both the classical situation as well as the new setting. In the course the participants will be lead from linear algebra, with some functional analysis to these modern foundations of a classical field.

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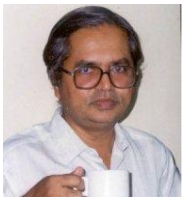
| **Modules** | January 8 - January 20, 2018 (2 weeks): 24 hrs lectures and 8 hrs Tutorials<br><br>**Number of participants for the course will be limited to sixty.** |
| **You Should Attend If…** | ▪ If you are a final year Master's degree student in Mathematics, then you can apply<br>▪ If you are a researcher (Ph.D. scholar or PDF or a Faculty) in Mathematics or Physics, then you can apply<br>▪ If you are an engineer with a background in first course in Functional Analysis, then you can apply |
| **Fees** | The participation fees for taking the course is as follows:<br>**Participants from abroad : US $200 /-**<br>**Industry/ Research Organizations: Rs. 6000 /-**<br>**Academic Institutions: Faculty : Rs.3000 /- and other Researchers : Rs.1000 /-**<br>The above fee includes all instructional materials, computer use for tutorials and assignments, 24 hr free internet facility. The participants will be given accommodation along with boarding on payment basis. |

Prof. H.G. Feichtinger, a leading world class mathematician, Founder of the NuHAG group at University of Vienna, editor in chief to Journal of Fourier Analysis and Applications, working in the fields of harmonic analysis, time frequency analysis and functional analysis.

# The Faculty

Prof.H.G. Feichtinger, a leading world class mathematician, founder of the NUHAG group at University of Vienna, editor in chief to Journal of Fourier Analysis and Applications,working in the fields ofharmonic analysis, time frequency analysis and functional

Prof.R.Radha, a host facultyfrom IIT Madras, working in the fields of harmonic analysis, time frequency analysis and theory of wavelets.



Prof. S.H.Kulkarni, a host faculty from IIT Madras, working in the fields of functional analysis, numerical analysis and operator theory.

# Course Co-ordinators

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