Seminario de análisis matemático y aplicaciones
Analisi matematikoa eta aplikazioak mintegia

An approximation problem with invariant spaces

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ABSTRACT: We consider the following approximation problem: Given a Hilbert space $\mathcal{H}$, a finite set of data $\mathcal{F} \subset \mathcal{H}$ and a class $\mathcal{C}$ of closed subspaces of $\mathcal{H}$, find an element $S^* \in \mathcal{C}$ that best fits $\mathcal{F}$.

In this talk we study this approximation problem for the case of multiplicatively invariant spaces. To be more precise, let $\mathcal{H}$ be Hilbert space and (Ω, μ) be a σ-finite measure space, multiplicatively invariant (MI) spaces are closed subspaces of $L^2(\Omega, \mathcal{H})$ that are invariant under point-wise multiplication by functions in a fix subset of $L^\infty(\Omega)$. Given a finite set of data $\mathcal{F} \subseteq L^2(\Omega, \mathcal{H})$, in this talk we prove the existence and construct an MI space M that best fits $\mathcal{F}$, in the least squares sense. Then we show that MI spaces are related to shift invariant (SI) spaces via a fiberization map. This allows us to solve an approximation problem for SI spaces in the context of locally compact abelian groups.

Also, we introduce the notion of decomposable MI spaces, that is, MI spaces that can be decomposed into an orthogonal sum of MI subspaces, and solve the approximation problem for the class of these spaces. These spaces are in one-to-one relation to SI spaces with extra invariance. So, we also solve our approximation problem for this class of SI spaces.

The results are based on a joint work with Carlos Cabrelli and Victoria Paternostro.

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DÍA Y HORA / EGUNA ETA ORDUA:
11/07/2016, 12:00