Control of parabolic problems and block moment method

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The null controllability of a parabolic problem is equivalent to the resolution of a moment problem. I will start this talk giving this moment problem and briefly recalling its classical resolution using biorthogonal families.

This strategy has proved to be very efficient in some situations where other tools cannot be applied (boundary control of coupled parabolic systems, appearance of a minimal control time). Yet, the use of biorthogonal families does not give optimal results when there is condensation of the eigenvectors of the evolution operator's adjoint.

To overcome this difficulty we introduced with Assia Benabdallah and Franck Boyer the block resolution of moment problems. The goal of this talk is to give an overview of this block moment method and its applications to the study of null controllability for certain parabolic problems in recent years.

I will

- present the method focusing on the case of scalar control problems,

- relate it to known results (Komornik-Loreti, Avdonin-Ivanov) on the hyperbolic setting concerning Riesz bases

of divided differences of time exponentials,

- and, if time allows, explain why it is an important tool in the construction of biorthogonal families in higher-dimensional tensorized settings.

This talk is related to different works in collaboration with F. Ammar Khodja, A. Benabdallah, F. Boyer, M. González-Burgos, M. Mehrenberger and L. de Teresa.

Bibliography

[1] A. Benabdallah, F. Boyer and M. Morancey, *A block moment method to handle spectral condensation phenomenon in parabolic control problems*. Ann. H. Lebesgue. 3, 2020.

[2] F. Boyer and M. Morancey, *Analysis of non scalar control problems for parabolic systems by the block moment method*. Comptes Rendus. Mathématique 361, 2023.

[3] F. Ammar Khodja, A. Benabdallah, M. González-Burgos, M. Morancey and L. de Teresa, *New results on biorthogonal families in cylindrical domains and controllability consequences*. Submitted.
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