

# Revisiting the notion of approximating class of sequences for handling approximated PDEs on moving or unbounded domains

Monday, 20 January 2025 16:00 (2 hours)

In the current talk we consider sequences of matrix-sequences  $\{\{B_{n,t}\}_n\}_t$  of increasing sizes depending on a parameter  $n$  and equipped with an additional parameter  $t > 0$ . For every fixed  $t > 0$ , we assume that each  $\{B_{n,t}\}_n$  possesses a canonical spectral/singular values symbol  $f_t$  defined on a measurable set  $D_t \subset \mathbb{R}^d$  of finite measure,  $d \geq 1$ . Furthermore, we assume that  $\{\{B_{n,t}\}_n\}_t$  is an approximating class of sequences (a.c.s.) for a matrix-sequence  $\{A_n\}_n$  and that  $\bigcup_{t>0} D_t = D$  with  $D_{t+1} \supset D_t$ . Under such assumptions and via the notion of a.c.s., we prove results on the canonical distributions of  $\{A_n\}_n$ , whose symbol, when it exists, can be defined on the, possibly unbounded, domain  $D$  of finite, or even infinite, measure.

We then extend the concept of a.c.s. to the case where the approximating sequence  $\{\{B_{n,t}\}_n\}_t$  has possibly a different dimension than the one of  $\{A_n\}_n$ . This concept seems to be particularly natural when dealing, e.g., with the approximation both of a partial differential equation (PDE) and of its (possibly unbounded, or moving) domain  $D$ , using an exhausting sequence of domains  $\{D_t\}_t$ .

The theory in the present talk seems to have promising developments both in terms of theoretical results and, particularly, in terms of numerical applications. Some of these possible developments will be discussed in the talk.

Few numerical tests and visualizations are presented in order to corroborate the theoretical aspects.

1. Adriani, A., Furci, I., Garoni, C., Serra-Capizzano, S.: Block multilevel structured matrix-sequences and their spectral and singular value canonical distributions: general theory and few emblematic applications. Preprint (2024).
2. Adriani, A., Schiavoni-Piazza, A.J.A., Serra-Capizzano, S.: Block structures, g.a.c.s. approximation, and distributions. Special Volume in Memory of Prof. Nikolai Vasilevski (2024), to appear.
3. Adriani, A., Schiavoni-Piazza, A.J.A., Serra-Capizzano, S., Tablino-Possio, C.: Revisiting the notion of approximating class of sequences for handling approximated PDEs on moving or unbounded domains. Electronic Transactions on Numerical Analysis (2024), to appear.
4. Barakitis, N., Ferrari, P., Furci, I., Serra-Capizzano, S.: An extradimensional approach for distributional results: the case of  $2 \times 2$  block Toeplitz structures, {it Springer Proceedings on Mathematics and Statistics} (2024), to appear.
5. Furci, I., Adriani, A., Serra-Capizzano, S.: Block structured matrix-sequences and their spectral and singular value canonical distributions: a general theory. In arXiv:2409.06465 (2024).

**Primary authors:** SCHIAVONIPIAZZA, Alec Jacopo Almo (SISSA); ADRIANI, Andrea (University of Roma Tor Vergata); Prof. TABLINO-POSSIO, Cristina (Department of Mathematics and Applications, University of Milano - Bicocca); SERRA-CAPIZZANO, Stefano (Università degli studi dell'Insubria)

**Presenter:** ADRIANI, Andrea (University of Roma Tor Vergata)

**Session Classification:** Poster Session