# Approximation of hypersingular integral transforms on the real axis

Maria Carmela De Bonis, Donatella Occorsio*

In this talk we propose some numerical procedures for approximating hypersingular integrals of the type

$$\mathbf{H}_p(fw_{\alpha,\beta},t) \quad = \quad \text{⨍}_{-\infty}^{+\infty} \frac{f(x)}{(x-t)^{p+1}} w_{\alpha,\beta}(x)dx, \quad t \in \mathbb{R}, \tag{1}$$

where $w_{\alpha,\beta}(x) = |x|^\alpha e^{-|x|^\beta}$ is a generalized Freud weight with $\alpha \geq 0, \beta > 1$ and $0 \leq p \in \mathbb{N}$.

This topic is of interest, for instance, in the numerical solution of hypersingular integral equations, which are often models for physics and engineering problems (see [5, 2, 4]). To our knowledge, most of the papers available in the literature deal with the approximation of Hadamard integrals on bounded intervals (see for instance [4] and the references therein) and the case on the real semiaxis has been considered recently in [1, 3]. We propose here different procedures, which are differently convenient, according that the computation of the integral is required in "many" or "few" values of the parameter $t$. The convergence and stability of the proposed methods are proved and error estimates are given. Some numerical tests are shown in order to compare their performances.

## References

[1] A. Aimi, M. Diligenti, *Numerical integration schemes for hypersingular integrals on the real line,* Communications to SIMAI Congress, ISSN 1827-9015, Vol. 2 (2007).

[2] Y. Chan, A. C. Fannjiang, G. H. Paulino, B. Feng, *Finite part integrals and hypersingular kernels*, Advances in Dynamical Systems, **14** (2007), 264–269.

[3] M. C. De Bonis, D. Occorsio, *Approximation of Hilbert and Hadamard transforms on* $(0, +\infty)$*,* submitted.

[4] G. Monegato, *Definitions, properties and applications of finite-part integrals*, J. Comput. Appl. Math., **229** (2009) 425-439.

[5] I.K. Lifanov, L.N. Poltavskii, G. M. Vainikko, *Hypersingular Integral Equations and their Applications*, Chapman & Hall CRC, 2003.

*Department of Mathematics, Computer Science and Economics, University of Basilicata, Viale dell'Ateneo Lucano 10, Potenza, ITALY
mariacarmela.debonis@unibas.it, donatella.occorsio@unibas.it