

BOOSTING THE INVERSE INTERPOLATION PROBLEM BY A SUM OF DECAYING EXPONENTIALS USING AN ALGEBRAIC APPROACH*

MARCO PALUSZNY[†], MIGUEL MARTÍN-LANDROVE[‡], GIOVANNI FIGUEROA[§], AND
WULIAN TORRES[¶]

Dedicated to Víctor Pereyra on the occasion of his 70th birthday

Abstract. An algebraic method is proposed to solve the inverse interpolation problem for data fitting by a linear combination of decaying exponentials. The method transforms the interpolation question into a problem of finding the roots of a single polynomial. The method is validated by numerical simulations using noiseless synthetic data with excellent results. The method is applied to medical data coming from magnetic resonance images of tumoral lesions in brain to obtain relaxation rate distribution functions, with results that are trustworthy and fast when compared with inverse Laplace methods.

Key words. de Prony's method, continuation methods, Gröbner bases, exponential equations, polynomial equations, nonlinear algebraic equations.

AMS subject classifications. 15A15, 15A09, 15A23

*Received April 18, 2008. Accepted April 16, 2009. Published online on December 9, 2009. Recommended by José Castillo.

[†]Escuela de Matemáticas, Universidad Nacional de Colombia, Medellín, Colombia, and Profesor Jubilado of Laboratorio de Computación Gráfica y Geometría Aplicada, Escuela de Matemática, Universidad Central de Venezuela (marcopaluszny@gmail.com).

[‡]Centro de Física Molecular y Médica, Universidad Central de Venezuela Ciudad Universitaria, Paseo Los Ilustres, Los Chaguaramos, Caracas, Venezuela and Centro de Diagnóstico Docente, Las Mercedes, Caracas, Venezuela (mmartin@fisica.ciens.ucv.ve).

[§]Laboratorio de Computación Gráfica y Geometría Aplicada, Universidad Central de Venezuela Ciudad Universitaria, Paseo Los Ilustres, Los Chaguaramos, Caracas, Venezuela (giofigue@yahoo.com).

[¶]Fundación Instituto de Ingeniería, Sartenejas, Caracas, Venezuela and Laboratorio de Computación Gráfica y Geometría Aplicada, Universidad Central de Venezuela Ciudad Universitaria, Paseo Los Ilustres, Los Chaguaramos, Caracas, Venezuela (wuiliantor@gmail.com).