Numerical Inversion of the Laplace Transform and Its Applications to Evolution Equations

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Project Contact: Dr. Patricio Jara
pjara@tnstate.edu
(615) 963-5857

Collaborators: Andrea Cortis, Lawrence Berkeley National Laboratory
Sarah McAllister, State University of New York
Rainer Nagel, University of Tuebingen (Germany)
Frank Neubrander, Louisiana State University
Koray Ozer, Roger Williams University

INVESTIGATOR

Patricio Jara, Ph.D.
Dr. Patricio Jara is currently an assistant professor in Mathematics in the Department of Physics and Mathematics at Tennessee State University.

SUMMARY

The research in this project concerns the theory and applications of the numerical inversion of the Laplace transform. One of the objectives is to extend the investigator’s results for the numerical inversion of the Laplace transform, which can handle the numerical inversion of the Laplace transform of continuous and exponentially bounded vector-valued functions for the noise free case to the noisy case for inverting the Laplace transform. Another goal is to show that the inversion of the Laplace transform together with the theory of finite elements provide a solid foundation for the numerical approximation to the solutions of evolution equations of parabolic and hyperbolic type. Evolutionary partial differential equations arise in many scientific problems, such as fluid flows, image processing, mechanical systems, relativity, mathematical finance, and mathematical biology. The proposed parallel methods for approximating solutions of evolution equations take full advantage of the parallel implementations developed by the finite element method.

This research will support graduate students and undergraduate students.
Patricio Jara, Ph.D.
Assistant Professor in Mathematics, Department of Physics and Mathematics

Dr. Patricio Jara holds the Ph.D. in Mathematics and M.Sc. in Mathematics from Louisiana State University; and he received the M.Sc. in Mathematics and the B.Sc. in Mathematics from the University of Santiago. He joined Tennessee State University (TSU) in August 2009 as an assistant professor in Mathematics. Since then, Dr. Jara has been awarded a research grant under the Division of Mathematical Sciences of the National Science Foundation (NSF) for his project, “Numerical Inversion of the Laplace Transform and its Applications to Evolution Equations” and a U.S. Department of Education/Tennessee State University grant under the SAFRA Act for his project, “Increasing Success of General Education Courses and Applied Mathematics Courses at Tennessee State University.” He is a member of the American Mathematical Society (AMS) and the Society for Industrial and Applied Mathematics (SIAM). During the last 5 years, Dr. Jara has been invited to present his research at Vanderbilt University, Tuebingen University (Germany), University of Karlsruhe (Germany), the Delft Technological University (The Netherlands), and the University of Santiago (Chile).

Dr. Jara’s recent publications in the last three years include: