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Mathematical modelling with Fourier series and PDEs

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Fourier Analysis provides a set of techniques for solving partial differential equations (PDEs) arising in Mathematical Physics, defined over bounded or unbounded domains. In this talk we will present a Maxima package for dealing with PDEs on bounded domains, where separation of variables can be applied. The package is capable of solving the heat, wave and Laplace equations for quite general boundary conditions defined by arbitrary piecewise-continuous functions (this is the kind of condition that guarantees the convergence of the resulting series). Let us stress that the equations are solved symbolically, that is, the complete Fourier series of the solution is computed (of course, the series can be truncated to make numerical computations). As an additional feature, we show how to generate high-quality graphics and animations of the corresponding solutions.

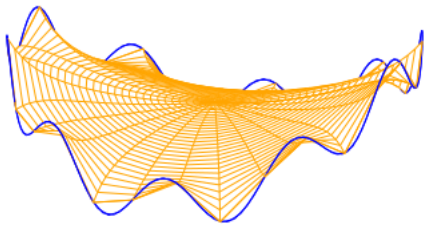

Figure 1: A solution of Laplace equation on the disk with periodic boundary conditions.

We will illustrate the use of the package with several examples of interest in Physics, leaving aside the technical details of the implementation.

Keywords
Fourier Analysis, Partial Differential Equations, Mathematical Software.