SPDES: A Stepwise Solver for Teaching Partial Differential Equations

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Abstract

Partial Differential Equations (PDE) are an important topic within the Engineering Degrees syllabus. In addition, many students find some difficulties in the learning process of this topic. Therefore, the use of didactical tools to improve the teaching and learning process of PDE is very helpful.

In this talk, we introduce the solver SPDES (Stepwise Partial Differential Equation Solver), an extension of SFOPDES introduced in [1] where only first order PDE were considered. This new solver SPDES deals also with some second order PDE. It can be used as a self tutorial for PDE since it solves, step by step, the typical exercises within the topic. Specifically, the type of PDE that SPDES can solve are:

1. Pfaff Differential Equations.
2. Quasi-linear PDE.
3. Lagrange-Charpit Method for first order PDE.
4. Heat equation.
5. Wave equation.
6. Laplace's equation.

where the first three types where considered in SFOPDES and the last three types are new in SPDES.

SPDES has been developed using the programming capabilities of a Computer Algebra System (CAS), displaying step by step the solution of the problem to be solved. This way, we potentiate the use of the CAS as a Pedagogical CAS (PeCAS). This fact makes SPDES to be an important tool for students which can use it as a tutorial for their learning process.

References

1. José Luis Galán-García and Gabriel Aguilera-Venegas and Pedro Rodríguez-Cielos and Yolanda Padilla-Domínguez and María Á. Galán-García. SFOPDES: A Stepwise First Order Partial Differential Equations Solver with a Computer Algebra System. Computers and Mathematics with Applications. Volume 78(9), 2019, 3152-3164. doi: 10.1016/j.camwa.2019.05.010.