

SPDES: A Step-wise Partial Differential Equations Solver for STEM Education

José L. Galán-García, Gabriel Aguilera-Venegas, Pedro Rodríguez-Cielos, María Á. Galán-García, Yolanda Padilla-Domínguez, Pablo Rodríguez-Padilla, Iván Atencia
University of Málaga

jlgalan@uma.es, gabri@ctima.uma.es, prodriguez@uma.es, magalan@ctima.uma.es,
ypadilla@ctima.uma.es, rodriguezpadillapablo@uma.es, iatencia@ctima.uma.es

Abstract

STEM (Science, Technology, Engineering and Mathematics) students normally find difficulties when studying Partial Differential Equations (PDE). To help both, the students and teachers, the use of CAS (Computer Algebra Systems) are adequate tools. But not always the use given to CAS is the right one to achieve the goal of easing the teaching and learning process of PDE. We strongly believe that programming with a CAS can help in this task since the developed programs can provide all the intermediate steps to get the solution. This way, students can compare their solutions done by hand with the steps provided by the programs and can find the step or steps where they made a mistake.

In this talk, we introduce SPDES, a Stepwise Partial Differential Equation Solver (an extension of SFOPDES introduced in [1]) developed in the CAS DERIVE. SPDES includes new programs to deal with some second order PDE in addition to the first order PDE considered in SFOPDES. SPDES can be used as a self tutorial for PDE since it solves, step by step, the typical exercises within the topic. The type of PDE that SPDES can solve are: Pfaff Differential Equations, Quasi-linear PDE, Lagrange-Charpit Method for first order PDE and the three classical second order PDE: Heat equation, Wave equation and Laplace's equation.

We will show the programs developed in SPDES through out solving different examples of typical exercises on PDE providing optionally the solution step by step.

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* 78(9), 2019, 3152-3164. Doi: 10.1016/j.camwa.2019.05.010.