(PARAM_APROX) – PARAM_APROX

Contact information

Address: Main researchers:

- JUANA SENDRA PONS

  juana.sendra@upm.es

- SONIA LUISA RUEDA PEREZ

  sonialuisa.rueda@upm.es

Other authors:

- SoniaPérez Díaz Universidad de Alcalá de Henares
- Juan RafaelSendra Pons Universidad de Alcalá de Henares

Technological Offers type

Software

Research and innovation areas

- Tecnologías digitales, Inteligencia Artificial, ciberseguridad, 5G, robótica

Where?

Non-linear Mathematical Models

Software description

1. Brief Description:
A research group with members from the Universidad Politécnica de Madrid and the Universidad de Alcalá de Henares, developed an approximate parametrised algorithm for flat algebraic curves and implemented a program to run it. These types of geometric objects are hugely applicable in many branches of science and technology, such as physics, chemistry, biology, architecture and engineering. Currently, the greater part of the applied potential of these geometric objects as become a reality due to the existence of increasingly powerful computers. It is also worth mentioning that curves are mainly managed using CAD (Computer Aided Design), CAM (computer-aided manufacturing), and, in particular, CAGD (Computer Aided Geometric Design) systems. Nevertheless, to boost the applicability of the objects, it is important to have alternative representations of the curves, other than implicit equations. In particular, it is of interest to have parametric representations and, more particularly, rational parametrisations. This compelled the development of a research area devoted to obtaining algorithms for conversion from a parametric representation to an implicit one (implicitation algorithm) and vice versa (parametrisation algorithms) where it is theoretically feasible.

In many applications, due to the fact that the input may have suffered an approximation error or prior disruption, it is to be expected that the existing exact parametrisation algorithms are of little use. In fact, this phenomenon (which, incidentally, appears in many other applied algebraic/geometric contexts) has aroused growing interest in the development of approximation/symbolic hybrid algorithms. The initial approach to these types of problems is as follows:

Due to the body of the problem applied, or the experiment being carried out, it is known that a certain real flat algebraic curve C verifies a certain property P (in our case, P is the parametric character). Nevertheless, due to errors in the process, the input data is not C, but a small ¿ disruption of C, which then does not verify the P property and, therefore, cannot be parametrised. The problem, given a ¿>0 working tolerance (error permitted), consists of determining a new ¿ curve ¿near¿ to ¿, which can be parametrised and calculating a rational parametrisation of it, which we call ¿approximate parametrisation¿ of ¿.

In this context, we developed a program that:

¿ Given: a flat algebraic curve ¿, and a tolerance of ¿>0,

¿ Decides if the ¿ curve is ¿-rational and, if affirmative
¿ Calculates a rational parametrisation of a ¿ curve, ‘near’ to ¿.

2. Programming Language and Operating Environment:

The Maple symbolic computation software has its own programming language. Using this language, we put a package of executable functions in place in Maple version 11.

3. Source Code and Program Executable:

The source code contains a list of functions that make up a package that, in order to be used, must be uploaded from Maple 11. Therefore, in our case, generating an executable is not appropriate. The CD-ROM contains the source code and an example of use.

4. File contained:

The file the program contains is called PARAM_APROX.

Reference

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