Universidad de La Laguna

.

First of all I must tell that, from my point of view, today the so-called “Fractional Calculus, Fractional Models and their Applications” as a research topic is more alive than ever. Also there exist many open problems and after solving them, many branches of the Applied Sciences and Engineering will receive a great push.

I will present in this section a few of such open problems:

1. It is obvious that the well known classical fractional operators (Riemann-Liouville, Liouville, Caputo, …) are not enough to attack many problems that one may think those could be solved through the mentioned operators. Therefore, we think that could be interesting in introducing and studying new fractional operators. For example it could be important to apply suitable corresponding discrete operators to solve many classical problems.

2. Some steps have been given by different authors to give a fractional generalization of the classical Vector Calculus for m-dimensional functions and m-dimensional vector fields, but this problem is very open and needs a quick answer to many none trivial questions so the mentioned topic can produce a significant advance in many applied fields.

3. As a particular case of the above point is the open problem to give suitable special m-dimensional operators. As an example we could define the fractional Laplacian operator, etc.

4. The numerical methods that have been introduced till today in the literature are clearly, in general, not enough. For example, such methods are not enough to solve a simple fractional initial value type problem which defines the Mittag-Leffler function in a large enough interval. Also it is open to introduce numerical methods suitable enough to solve problems involving m-dimensional fractional differential operators. Therefore, it is necessary to advance significantly this research issue.

July 2014

Juan J. Trujillo.