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Report on Cécile Bécarie's thesis

In her thesis Cécile Bécarie extends, in a very significant way, algorithms and methods initiated in seminal work by Beauzamy and Bombieri, and continued by Beauzamy and his former students.

The theory of the Bombieri norm and inner product (that should be renamed Beauzamy-Bombieri norm, since it was the former who realized its great scope and potential use), is a budding field of research with immense potential, that has already found several impressive and significant applications. It is reminiscent of duality methods in Fourier Analysis, pioneered by Bécarie's academic grandfather, Laurent Schwartz, and continued by Leon Ehrenpreis and many others. But in the spirit of mainstream 20^{th}-century mathematics, this work was only concerned with *existence*, *uniqueness* and general properties. It was unwilling, and *unable* to produce explicit results. There was a large gap between theoretical researchers in PDE and applied scientists, whose methodology was essentially developed in the 19^{th} century.

The increasing prevalence of electronic computers changed all this, and mainstream 21^{st}-century mathematics is very concerned with explicit results. The time-lag between theoretical advances and implementation is continuously shrinking, and is no longer centuries but decades. But even in today's standards, Bécarie's thesis stands out in the rapidity in which a theoretical breakthrough became a very efficient, completely programmed, algorithm, ready to be run on state-of-the-art computers, and taking full advantage of the *parallel computation* revolution.

The first chapter contains a very efficient algorithm for solving the system of inhomogeneous equations of PDEs $P_i(D)Q = R_i$, where P_i are R_i are given polynomials, and D is multi-differentiation. Bécarie wrote the complete solution, and implemented the resulting algorithm on a *Connection Machine*.

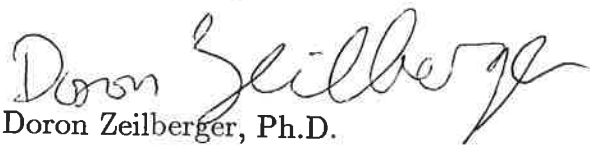
She then went on to extend it to systems of PDEs in which the polynomials P_i are not homogeneous, thereby extending the scope of the method. Bécarie then went on and

found an efficient way to split the PDEs into regions and to study each region separately, *in parallel.*

To sum up, this would have been a very good thesis if it only contained theory, and it would have been an excellent applied thesis if it would have only contained the implementation part. It is all the more exceptional since it contains *both*, so beautifully interfaced!

I very strongly recommend that she will be granted the *Ph.D.*. If you have any further questions, I will be glad to answer them. My phone numbers are (609)921-7873 (home), (215)204-7841 (office), and my e-mail address is `zeilberg@math.temple.edu` .

Sincerely,



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