Report on Sabbatical Leave Fall 2007

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Summary of Results 0401124

I continued to practice a new research methodology, that can be loosely called *rigorous experimental mathematics*. It has something in common with both "mainstream" experimental mathematics, as preached by the Borwein brothers, David Bailey, Victor Moll, and their collaborators, and *automated theorem proving* but is definitely distinct from them. It is based on what I call *the ansatz ansatz*.

One "teaches" the computer how to "conjecture an answer" to a problem, and then "teaches" that very same computer to prove its own conjectures rigorously. The novelty is that *both* the conjecturing and the proving are automatically done by the computer. This does not mean that human mathematicians are superfluous. Quite the contrary! Someone has to "teach" the computer, i.e. design algorithms and meta-algorithms for both proving and conjecturing. In my experience, this act of "teaching" the computer how to do mathematics is at least as challenging as doing mathematics "by hand", and in my humble opinion, time much better spent, since the vast potential of the computer is still very underutilized and underrated, and it is important to have mathematicians, like myself and my students, who are dedicated to that activity, that I believe will soon revolutionize mathematics.

In particular, The so-called WZ theory was further extended and applied, in collaboration with my Chinese colleagues, whom I visited during my sabbatical leave 2007.