20. The computation of previously inaccessible digits of π^2 and Catalan's constant (2013)

Paper 20: David H. Bailey, Jonathan M. Borwein, Andrew Mattingly and Glenn Wightwick, "The computation of previously inaccessible digits of π^2 and Catalan's constant," *Notices of the American Mathematical Society*, vol. 60 (2013), p. 844–854. Reprinted by permission of the American Mathematical Society.

Synopsis:

An earlier selection (paper #14 in this collection) presented what is now known as the BBP formula for π, which permits one to calculate binary or base-16 digits of π beginning at an arbitrary starting point. The original BBP paper presented a similar formula for π^2, permitting arbitrary binary digits of π^2 to be calculated by this same general process. Since the publication of that paper, additional BBP-type formulas have also been found, among them one that permits arbitrary base-3 digits of π^2 to be calculated, and another that permits arbitrary binary digits of Catalan's constant $= \sum_{n=0}^{\infty}(-1)^n/(2n+1)^2 = 0.9159965594\ldots$ to be calculated.

This paper outlines the history of computing π and other constants through the ages, and then gives details on three new computations: base-64 digits of π^2, base-729 digits of π^2 and base-4096 digits of Catalan's constant, in each case beginning with position ten trillion. These computations, which required a total of approximately 1.5×10^{19} floating-point arithmetic operations, and which ran for tens of "rack-days" on an IBM Blue-Gene computer, are comparable in total cost, say, to that of generating a state-of-the-art animated movie.

Keywords: Computation, History, Normality, General Audience

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