This Week's Citation Classic

Rosenbrock H H. An automatic method for finding the greatest or least value of a function *Comput. J.* **3**: 175-84, 1960.

The greatest or least value of a function of several variables is to be found when the variables are restricted to a given region. A method is developed for dealing with this problem and is compared with possible alternatives. The method can be used on a digital computer. [The *SCI*® indicates that this paper has been cited 326 times since 1961.]

Howard H. Rosenbrock
Control Systems Centre
University of Manchester
Institute of Science and Technology
Manchester, England

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"The origin of this paper is clear in my mind In 1954 I was lent by John Brown & Company, for whom I was working, to Constructors John Brown, to do some stress calculations on the containment sphere for a nuclear reactor These were done with a Brunsviga hand calculator, but about that time I also began to use the early digital computers

"One of my colleagues asked me if I could help him with a problem which had been posed by his client. The Company was building a gas-gathering network on an oilfield. At each well-head the gas was separated, and a certain maximum quantity was available from each well. The gas was pumped into a grid of pipelines having a tree structure, and was delivered from the base of the tree to a transmission iine At each well the gas pumping pressure could be controlled up to a given maximum value. The pressure at the delivery point to the transmission line was not allowed to fall

below a certain minimum value In each line of the gathering network the gas flow was governed by a nonlinear equation what the client wanted to know was the maximum amount of gas he could obtain from the field

"At first sight it seemed that the maximum gas flow would be obtained by pumping at the highest permitted pressure at every well But this, I was told, is not so: a well near the base of the tree can then establish a high pressure there and restrict the flow from all the others. So I attempted to solve the problem, using a digital computer and taking established methods from the literature These were devised for hand computation, and I soon found that they could not deal with my problem, even when the constraints on pressure and flow were omitted.

"The problem became a challenge, and I began to experiment with new, simple and rather crude methods. Six or eight months later I had obtained an answer, and enquired with some feelings of self-satisfaction for my colleague, whom I had not seen for some weeks. This, they told me, was because he had left the Company, so the answer was never used.

"For several years I experimented with the method, improved it, and applied it to a range of problems, publishing a brief, unnoticed account in 1958.[1] By 1960, the method was well-developed and reliable, but clearly not the last word on the subject. This probably explains the wide citation, together with a particular test function used in the paper and widely adopted It is usually referred to as 'Rosenbrock's banana-shaped valley,' which may add to the pleasure of the citer."

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1. **Rosenbrock H H.** Use of digital computers in chemical engineering
    Process Control Automat. **5**: 466-71, 1958