E. Balas, Honorary D. Math Citation

Honorary D. Math Citation for Egon Balas
University of Waterloo
Convocation, June 18, 2005

Egon Balas has been a leading researcher in discrete optimization and operations research for more than forty years. His most important contributions have been to integer programming. Almost every significant aspect of that subject has been influenced by his pioneering work. He has shown great foresight and taste; in several cases his ideas received limited attention initially, but wide acceptance of their importance came with time. Professor Balas has also made significant contributions to the solution of real world problems in the steel, forest, and energy industries, among others.

Professor Balas's accomplishments are the more remarkable in view of the obstacles he overcame in their achievement. A native of Romania, he was imprisoned under a Fascist regime during World War II and then under a Stalinist one during the 1950's. His careers as a diplomat and economist were destroyed by communist party politics. Throughout all these experiences one thing nobody could stop him from doing was creative thinking! Therefore, Balas turned his attention completely to mathematics. The fascinating story of this early part of his life is told in his 1999 book, Will to Freedom.

Since 1968 Dr. Balas has been a Professor of Applied Mathematics and Industrial Administration at Carnegie Mellon University, where he is currently University Professor and Thomas Lord Professor of Operations Research. He spearheaded the founding of CMU's Algorithms, Combinatorics, and Optimization program, in which two current Waterloo faculty members received their doctoral training. Balas has personally supervised more than twenty-five doctoral students. Among many previous honours, he is the 1995 winner of the John von Neumann Prize, the leading award in operations research.

Mr. Chancellor, in recognition of his outstanding contributions to discrete optimization and operations research, I request that you confer the degree, Doctor of Mathematics, honoris causa, upon Egon Balas.

E. Balas Spring 2005 Convocation Address

University of Waterloo
Faculty of Mathematics
June 18, 2005

Mr. Chancellor, Faculty and Students of Mathematics, Parents and Friends:
I feel deeply and genuinely honored by the degree of Doctor of Mathematics honoris causa awarded to me by the University of Waterloo, a world leader both in the training of mathematicians and in fostering research in the mathematical sciences. More specifically, in my own field of discrete optimization, this university has been the birthplace of the technique known as polyhedral combinatorics: it was here that in the early sixties Jack Edmonds showed us how to describe a combinatorial structure through a system of linear inequalities.

This address is about being a mathematician. This is the most beautiful, the most rewarding profession that I can think of. It allows you to pursue arcane interests in aesthetically pleasing discoveries about the fundamental nature of things, if that is what you enjoy; or to establish practically useful connections and relationships between entities that occur in various settings and see through their application in science, engineering or other areas of human activity. It also offers you the pleasure of initiating a young generation of future scientists and engineers in the acquisition and development of this most essential skill that provides the key to so many doors.

Never before in the history of mankind has mathematics had such a huge impact on society as in our days. Through its central role in the development of science and technology, mathematics is at the heart of the tremendous speedup we have been witnessing in the rate of change in every area of human activity. Sixty years ago, in the wake of the Second World War, two new mathematical developments hit the world scene. One was the stored program electronic computer, the other was linear programming or optimization under constraints. Everybody knows about the first one: the computer, whether mainframe, workstation, desktop or laptop, has penetrated every home and workplace and, coupled with the internet, is radically changing our way of life.

Much fewer people know about the second development, constrained optimization. It started with game theory and linear programming and was soon followed by convex nonlinear programming, and then integer and combinatorial optimization. This collection of disciplines, which together with a few others came to be known as operations research, is often referred to as the new applied mathematics. It has revolutionized the way we think about economic activities, be that the production and distribution of goods, the delivery of services, the scheduling of activities and personnel, or the organization of trade and financial transactions.

During my own lifetime I have seen this area of human knowledge develop from the ability to produce toy models which offered insight but were not amenable to actual implementation and practical use, to these days' optimization models involving millions of variables and hundreds of thousands of constraints, which can be solved on a tiny laptop in a matter of seconds or minutes, providing answers to miriads of practical questions.

It is a great privilege to be a mathematician, today more so than ever before. Among all mathematical activities, to me research is the most exciting. Nothing can provide greater satisfaction, than the discovery of a new mathematical result. No state of mind is more elated, then the contemplation of the possible consequences of your discovery. However, mathematical research is not the kind of merry and playful activity that some people imagine. The life of the mathematical researcher is characterized by frequent periods of tension: whenever a new discovery is on the horizon, a tremendous amount of effort and concentration is needed in order to snatch the secret from nature by digging deeper and deeper. One day the new result seems at hand, you just have to write it down. Next day it all seems to have been an illusion, nothing seems to work when you want to put it together. When you finally manage to crystallize your findings into a theorem that you think you have proved, then upon going the third or fourth time through the logical steps of your proof you suddenly discover a minor, insignificant-looking crack. But when you set out to repair it, the crack widens into a gaping hole. It turns out that what you thought was true, is only true under certain circumstances. Maybe there is something of the same flavor that is true under more general conditions; but it is not what you had originally thought it was. So now you nail down your result for the more limited situation for which it is true, and you go on groping for a more general result that holds beyond those specific circumstances. And so on...This is the flavor of mathematical discovery. It is an uneven process that often becomes hectic, with periods of sleepless or half-sleepless nights. It requires the kind of passionate concentration in the grip of which you forget about everything else for a while. It is extremely frustrating when it fails, but there is nothing like it when it succeeds.

Egon Balas