

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Industrial Engineering and Operations Research (IEOR) aims to equip tomorrow's technology leaders with expertise and hands-on know-how in managing complex engineering and service systems, offering degree programs in Industrial Engineering, Operations Research, Management Science and Engineering, and Financial Engineering. IEOR's research focuses on developing approaches—optimization, computation, deterministic and stochastic/random modeling—to manage risks and inform decision-making in a rapidly-shifting world. Applications for IEOR's work include extracting intelligence from massive amounts of data; optimizing risk-return tradeoffs of large portfolios like pension funds; modeling financial contagion and containing amplification effects; managing scarce and expensive hospital resources like doctors, nurses, and operating rooms to improve quality and efficiency of healthcare delivery; and maximizing performance in large-scale networks like power/utility grids, global supply chains, and the Internet.



1920 Walter Rautenstrach, a longtime member of the Mechanical Engineering faculty, creates and chairs a new department of Industrial Engineering, one of the first of its kind in the country.

1947 Sebastian B. Littauer MA'28 joins the IE faculty. First as a professor and later as department chair, he establishes and promotes operations research at Columbia Engineering.



1954 Statistician Cyrus Derman PhD'54 begins teaching operations research. In four decades at Columbia Engineering, he makes historic contributions to performance analysis and optimization of stochastic systems. He is awarded the INFORMS John von Neumann theory prize in 2002 for fundamental contributions to probability theory.

1961 Recognizing advances in the field and its own scholarship, Industrial Engineering becomes the Department of Industrial and Management Engineering, and establishes one of the country's first degree programs in operations research.

1976 The Department of Industrial and Management Engineering partners with Columbia Business School to offer a joint MS in Operations Research and MBA.

1978 As Operations Research becomes ever-more indispensable to managing complex enterprises, the department is renamed the Department of Industrial Engineering and Operations Research (IEOR).

1993 David D.W. Yao and Karl Sigman launch the interdisciplinary Center for Applied Probability along with Columbia faculty from the Business School and Departments of Mathematics and Statistics. In 1996, the Center wins a prestigious Group Infrastructure grant from the National Science Foundation (NSF).

The Department institutes a popular concentration in financial engineering within the Operations Research master's program, later branching into a master's program that quickly becomes one of the top ranked quantitative finance programs in the world.

1999 Garud Iyengar, a second hire in Financial Engineering, and Donald Goldfarb develop the Robust Portfolio Selection Method to systematically combat the sensitivity of the optimal portfolio.

2002 Guillermo G. Gallego, an expert in revenue management and dynamic pricing, becomes department chair and oversees an extensive expansion of professional master's programs. He later becomes the Liu Family Professor of IEOR.

Ward Whitt, a member of the National Academy of Engineering and an authority in stochastic modeling, leaves Bell Labs to join the IEOR faculty. The same year, he is elected a Fellow of the Institute for Operations Research and the Management Sciences, and later becomes the Wai T. Chang Professor of IEOR.

2011 The department collaborates with Columbia Business School to offer an interdisciplinary MS program in Management Systems and Engineering.

2012 Dan Bienstock, Gil Zussman (EE) and Eytan Modiano of MIT, receive support from the Pentagon to prevent cascading failures of the U.S. electric grid in the event of a nuclear incident.

David D. W. Yao becomes the inaugural Piyasombatkul Family Professor of IEOR.

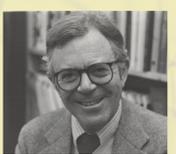
Alumnus Alvin Roth BS'71 wins the Nobel Prize in economics for his work applying Cooperative Game Theory to real-world markets in order to achieve stable allocations in circumstances like matching organ donors to patients and students with schools.

Prof. Maria Chudnovsky wins a 2012 MacArthur "Genius" Award for her fundamental work in graph theory.



1932 Walter Rautenstrach co-founds the short-lived Committee on Technocracy, advocating a more productive and rational society administered by technical experts and engineers.

1951 Seymour Melman PhD'49, trained in economics, joins Industrial Engineering. On the faculty for more than 50 years, he chairs the department and becomes a prominent critic of nuclear weapons and the military-industrial complex.



1959 Morton Klein MS'52, EngScD'57, among the first to apply quantitative methods to industrial engineering research and a giant in operations research, co-authors the seminal text *Probability and Statistical Inference for Engineers*.



1969 Morton Klein and Morton Friedman of the Department of Civil Engineering and Engineering Mechanics collaborate to expand the operations research program, renaming it "Mathematical Methods in Engineering and Operations Research."

$$B_k P_k = -\nabla f(x_k)$$

$$B_{k+1} = B_k + \frac{Y_k Y_k^T}{Y_k^T S_k} - \frac{B_k S_k S_k^T B_k}{S_k^T B_k S_k}$$

Donald R. Goldfarb, co-inventor of the BFGS algorithm for solving nonlinear optimization problems and an expert in network flows, begins a lengthy tenure as chair of IEOR. He is later named the Avanesians Professor and wins the Khachiyan Prize for lifetime achievements in the field of optimization.

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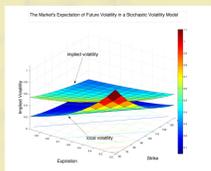
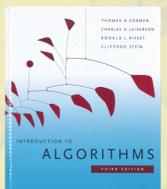
1997 Robert C. Merton '66 wins the Nobel Prize in economic sciences for his applications of option-pricing theory, generating new types of financial instruments and improving risk management.



1998 Steven S.G. Kou MA'92, PhD'95, an authority on mathematical and computational finance, becomes IEOR's first Financial Engineering faculty and goes on to win the Erlang Prize in applied probability from the Institute for Operations Research and the Management Sciences.

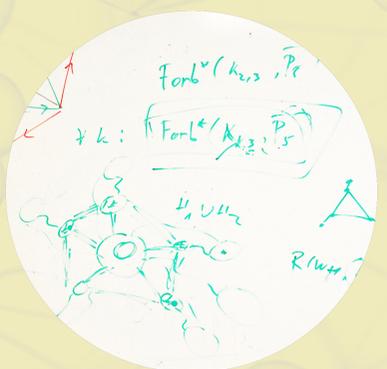
2001 The Department launches the Computational Optimization Research Center (CORC), a joint venture between Columbia University, Cornell University and IBM for advanced studies in large-scale optimization problems.

Cliff S. Stein becomes the first joint appointment between IEOR and the Department of Computer Science. The classic textbook he co-authors, *Introduction to Algorithms*, is translated into 15 languages and goes on to sell over half a million copies.



2003 Emanuel Derman—co-inventor of the Black-Derman-Toy interest rate model and a principal at Goldman Sachs—joins the IEOR faculty. He goes on to help lead the Financial Engineering Program and Columbia's Center for Financial Engineering.

2006 Responding to a groundswell of global interest and demand, the department launches the nation's first BS program in Financial Engineering.



Exploring connections between local and global structures in graphs.



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The Fu Foundation School of Engineering and Applied Science

1864–2014