A Review of *Network Economics: A Variational Inequality Approach* **by Anna Nagurney, published by Kluwer Academic Publishers: Dordrecht, The Netherlands, 1993, ISBN 0-7923-9293-0.**

The Economic Journal, 1994

This book by Anna Nagurney is the first volume in a new series titled *Advances in Computational Economics.*

The focus of the book is on network analysis. Network analysis is usually associated with transportation problems, electrical power transmission, telecommunications etc. However, its methods apply not only to physical networks, where the nodes and the links have tangible embodiments, but also to a much wider class of problems where these concepts need have no physical counterparts.

The book establishes connections between a variety of economic network problems both of a spatial and a non-spatial nature. The mathematical concepts are organised under the general notion of variational inequalities. This formulation subsumes both constrained and unconstrained optimisation problems. The problems of economic equilibria, which are virtually coextensive with those of optimisation, are also subsumed under this notion.

The book has five sections. The underlying mathematical theory is presented in Part I at an impressive level of generality and abstraction. It is here that the classical mathematical issues such as the optimisation problem, the fix-point problem and the problem of the existence and uniqueness of solutions of nonlinear equations are organised under the theme of variational inequalities. Familiar material acquires new aspects. Also presented are some quite general algorithmic methods for computing equilibria, together with their associated conditions for convergence.

Part II deals, on a more practical level, with spatial price equilibrium models wherein trade flows satisfy the condition that the demand price equals the supply price, which includes the cost of transportation. It also treats traffic network problems and problems of migration. In all of these connections, close attention is paid to the matter of computing the equilibria.

Part III, which is relatively brief, deals with an oligopoly model in which there are m firms in n demand markets which are spatially separated. Here attention is turned to game-theoretic issues. The foundations of the Nash equilibrium are presented, and they formulated in terms of a variational inequality problem.

In Part IV, the book reaches what some might be tempted to regard as its climax. Here the Walrasian general equilibrium problem is shown to be isomorphic to a network equilibrium problem with a special structure in which there is no evident spatial connotation. Algorithms for computing the equilibrium are presented together with numerical examples.

The final section of the book, which is Part V, provides a unified approach to constrained matrix problems in which the optimal value of a matrix, such as the matrix of an input–output table, is computed subject to constraints on the solution set. An indication is also given of the sheer computational intensity of some of the recently-emerged problems and methods of Computational Economics.

These is no easy way to appraise this book. It represents an impressive and thorough-going account of an exciting and highly technical area of mathematical economics. The presentation is remorselessly technical; which implies that the book is to be recommended only to those who are already well-versed in its methods. The book bears testimony to a major assault which is currently underway upon a set of time-honoured economic problems. The assailants come from outside the traditional network of academic economics, and they are armed with tools and weapons of considerable sophistication. It is likely that some of the economic problems which are being tackled will be substantially redefined as a result of the encounter.

D.S.G. Pollock