

Equilibrium problems of variational type: models, methods and algorithms

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The study of a wide class of problems regarding both the project and the management of flow networks has led to the formulation of mathematical models very similar each to others. A common characteristic that comes from the analysis of the above problems lies in the variational feature of the characterizing equilibrium conditions. It has been stated, in fact, that the equilibrium concept can be expressed by means of a variational model and shows a strict connection to the real problem. This is shown, in particular, in the traffic network where variational inequalities permit us to establish the well-known Wardrop principle in a mathematical setting and in economic framework where variational inequalities permit us to establish the Nash equilibrium theory. But while the classical differentiable VI in finite dimensional spaces has been largely developed in literature both from the theoretical point of view and the applicative one, we observe in the last period that more refined variational models are much considered. So, we will analyze the case in which the operator is non differentiable, the case of generalized variational inequalities where the operator is point-to-set and the case of quasi variational inequalities in which the domain depends on the solution. We will study these models from two viewpoints: the former consists in studying the existence and uniqueness of solutions, the latter is devoted to solution methods. We will show the importance of the concept of gap function which allows us to transform the problems in a global optimization problem. The algorithms mainly developed in literature for these classes of models are linked to monotonicity assumptions on the operator. Our target is to check if we can weaken the monotonicity assumptions.

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