Variational analysis of evolution systems

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This talk is devoted to optimal control problems governed by evolution/differential inclusions in finite-dimensional and infinite-dimensional spaces and also by semilinear partial differential inclusions. We pursue a twofold goal: to develop the method of discrete approximations for such problems and to derive necessary optimality conditions of the Euler-Lagrange type under natural assumptions. First we consider a generalized optimal control problems for differential inclusions with endpoint constraints. One of the principal differences between finite-dimensional and infinite-dimensional dynamic systems is the lack of compactness in infinite dimensions. Constructing well-posed discrete approximations and using advanced tools of variational analysis and generalized differentiation, we derive necessary conditions for discrete-time problems and then, by passing to the limit, for continuous-time evolution inclusions. A similar procedure is developed for optimal control problems of the Mayer type governed by constrained semilinear inclusions with unbounded operators generating compact semigroups. This particularly covers parabolic partial differential inclusions whose solutions are understood in the conventional mild sense.