

[Dontchev, Asen](#); [Lempio, Frank](#)

Difference methods for differential inclusions: A survey. (English) Zbl 0757.34018
SIAM Rev. 34, No. 2, 263-294 (1992).

In this survey the following initial value problem for ordinary differential inclusions is considered: “Let $I = [t_0, T]$ be a finite interval, $y_0 \in \mathbb{R}^n$, and F be a map from $I \times \mathbb{R}^n$ into the set of all subsets of \mathbb{R}^n . Find an absolutely continuous function $y(\cdot)$ on I such that $y(t_0) = y_0$ and $\dot{y}(t) \in F(t, y(t))$ for almost all $t \in I$, where $\dot{y}(\cdot)$ is the derivative of $y(\cdot)$.” Using difference method there exist various closely connected approaches of approximating solutions $y(\cdot)$. Investigations of convergence properties are presented, and applications to an example with discontinuous right-hand side are given. The classical Euler method is treated as an introductory example. Under the assumption of right-hand sides satisfying a one-sided Lipschitz condition Runge-Kutta schemes can be adapted to differential inclusions, too. The question, of whether the limit function $y(\cdot)$ has additional desirable properties, leads to selection strategies, which are illustrated by an example of a control system. Finally, error estimates and convergence properties of reachable sets are discussed. Many references are cited.

Reviewer: [R.Scherer \(Karlsruhe\)](#)

MSC:

- [34A60](#) Ordinary differential inclusions
- [49M25](#) Discrete approximations in optimal control
- [65L05](#) Numerical methods for initial value problems involving ordinary differential equations
- [34-02](#) Research exposition (monographs, survey articles) pertaining to ordinary differential equations
- [65-02](#) Research exposition (monographs, survey articles) pertaining to numerical analysis
- [65J99](#) Numerical analysis in abstract spaces

Cited in **87** Documents

Keywords:

survey; initial value problem for ordinary differential inclusions; difference methods; approximating solutions; convergence; discontinuous right-hand side; Euler method; Runge-Kutta schemes; control system; reachable sets

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