

**Kada, Osamu; Suzuki, Tomonari; Takahashi, Wataru**

**Nonconvex minimization theorems and fixed point theorems in complete metric spaces.**

(English) [Zbl 0897.54029](#)

Math. Jap. 44, No. 2, 381-391 (1996).

Let  $(X, d)$  be a metric space. The authors first introduce the concept of  $w$ -distance, it is a generalization of metric  $d$  on  $X$ . They establish some properties of  $w$ -distance and prove a nonconvex minimization theorem which improves a result of Takahashi. They also improve Caristi's fixed point theorem and Ekeland's  $E$ -variational principle. They also prove a fixed point theorem in a complete metric space and apply this theorem to prove Subrahmanyam's fixed point theorem, Kaman's fixed point theorem, and Ćirić's fixed point theorem. The results of this paper seem useful, interesting, and original.

Reviewer: [L.-J.Lin \(Changhua\)](#)

**MSC:**

[54H25](#) Fixed-point and coincidence theorems (topological aspects)

[49J45](#) Methods involving semicontinuity and convergence; relaxation

[49J40](#) Variational inequalities

Cited in **27** Reviews  
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**Keywords:**

$w$ -distance; Ekeland's  $E$ -variational principle; Caristi's fixed point theorem