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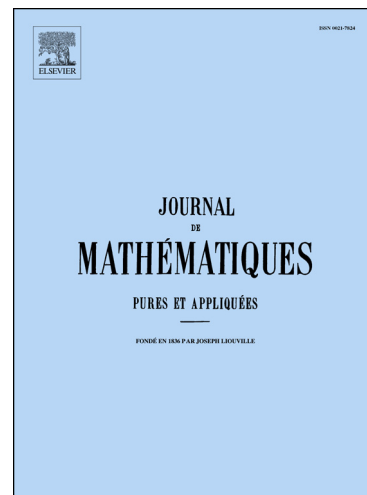
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PERTURBATION PROBLEMS IN HOMOGENIZATION OF HAMILTON-JACOBI EQUATIONS

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ABSTRACT. This paper is concerned with the behavior of the ergodic constant associated with convex and superlinear Hamilton-Jacobi equation in a periodic environment which is perturbed either by medium with increasing period or by a random Bernoulli perturbation with small parameter. We find a first order Taylor's expansion for the ergodic constant which depends on the dimension d . When $d = 1$ the first order term is non trivial, while for all $d \geq 2$ it is always 0. Although such questions have been looked at in the context of linear uniformly elliptic homogenization, our results are the first of this kind in nonlinear settings. Our arguments, which rely on viscosity solutions and the weak KAM theory, also raise several new and challenging questions.

RÉSUMÉ. Nous étudions le comportement de la constante ergodique associée à une équation de Hamilton-Jacobi avec un hamiltonien convexe dans un environnement périodique, lorsque le hamiltonien est perturbé soit par une perturbation périodique avec une période tendant vers l'infini, soit par une perturbation de type Bernoulli avec un petit paramètre. Nous donnons un développement de Taylor de la constante ergodique qui dépend de la dimension. Lorsque $d = 1$, le premier terme est non trivial, tandis que si $d \geq 2$, il est toujours nul. Bien que des questions similaires aient été étudiées dans le cadre de l'homogénéisation d'équation elliptiques linéaires, notre résultat est le premier de cette nature dans un cas non-linéaire. Nos arguments, qui reposent sur des techniques de solutions de viscosité et de théorie KAM faible, soulèvent de nombreuses questions nouvelles et stimulantes.

KEYWORDS. Homogenization. Hamilton-Jacobi equations. Viscosity solutions. Weak KAM theory. Random media.

MSC CLASSIFICATION 2010. 49L25, 35B27.

1. INTRODUCTION

The paper is concerned with the behavior of the ergodic constant associated with convex and superlinear Hamilton-Jacobi (HJ for short) equations in a periodic environment which is perturbed either by medium with increasing period which is a multiple of the original one or by a random Bernoulli perturbation with small parameter. The result is a first-order Taylor's expansion for the ergodic constant which depends on the dimension d . Our results are the first of this kind for nonlinear problems. The arguments, which rely on viscosity solutions and the weak KAM theory, also raise several new and challenging questions.

The motivation for this work came from the recent studies by Anantharaman and Le Bris [2, 3], Mourrat [26] and Duerinckx and Gloria [11], who considered similar questions for linear

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