

**Asymptotic analysis for a weakly damped wave  
equation with application to a problem  
arising in elasticity**

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**Abstract.** The present work is devoted to the study of homogenization of the weakly damped wave equation

$$\begin{aligned} & \int_{\Omega} \rho^{\varepsilon} \frac{\partial^2 u_{\varepsilon}}{\partial t^2}(t) \cdot v dx + 2\varepsilon^2 \mu \int_{\Omega_f^{\varepsilon}} E_{ij} \left( \frac{\partial u_{\varepsilon}}{\partial t}(t) \right) E_{ij}(v) dx \\ & + \varepsilon^2 \lambda \int_{\Omega_f^{\varepsilon}} \operatorname{div} \left( \frac{\partial u_{\varepsilon}}{\partial t}(t) \right) \operatorname{div} v dx + \vartheta \int_{\Omega_f^{\varepsilon}} \operatorname{div} (u_{\varepsilon}(t)) \operatorname{div} v dx \\ & = \int_{\Omega} f(t) \cdot v dx \text{ for all } v = (v^1, v^2, v^3) \in V_{\varepsilon} \text{ (} 0 < t < T \text{),} \end{aligned}$$

with initial conditions

$$u_{\varepsilon}(0) = \frac{\partial u_{\varepsilon}}{\partial t}(0) = \omega \text{ (the origin in } \mathbb{R}^3 \text{).}$$

Convergence homogenization results are achieved using the two-scale convergence theory.

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