Bucur, Dorin; **Ionescu, Ioan R.**

Asymptotic analysis and scaling of friction parameters. (English) Zbl 1106.35038

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Summary: We consider an eigenvalue problem associated to the antiplane shearing on a system of collinear faults under a slip-dependent friction law. Firstly we consider a periodic system of faults in the whole plane. We prove that the first eigenvalues/eigenfunctions of different physical periodicity are all equal and that the other eigenvalues converge to this first common eigenvalue as their physical period becomes indefinitely large. Secondly we consider a large scale fault system composed on a small scale collinear faults periodically disposed. If β_0^* is the first eigenvalue of the periodic problem in the whole plane, we prove that the first eigenvalue of the microscopic problem behaves as β_0^*/ε when $\varepsilon \to 0$ regardless the geometry of the domain (here ε is the scale quotient). The geophysical implications of this result is that the macroscopic critical slip D_ε scales with $D_c^\varepsilon/\varepsilon$ (here D_c^ε is the small scale critical slip).

MSC:

35P15 Estimates of eigenvalues in context of PDEs
35P20 Asymptotic distributions of eigenvalues in context of PDEs
49R50 Variational methods for eigenvalues of operators (MSC2000)
86A15 Seismology (including tsunami modeling), earthquakes

Keywords:

spectral analysis; slip-dependent friction; wave equation; earthquake initiation

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