

# THE NEUMANN SIEVE PROBLEM AND DIMENSIONAL REDUCTION: A MULTISCALE APPROACH

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ABSTRACT. We perform a multiscale analysis for the elastic energy of a  $n$ -dimensional bilayer thin film of thickness  $2\delta$  whose layers are connected through an  $\varepsilon$ -periodically distributed contact zone. Describing the contact zone as a union of  $(n - 1)$ -dimensional balls of radius  $r \ll \varepsilon$  (the holes of the sieve) and assuming that  $\delta \ll \varepsilon$ , we show that the asymptotic memory of the sieve (as  $\varepsilon \rightarrow 0$ ) is witnessed by the presence of an extra interfacial energy term. Moreover we find three different limit behaviors (or regimes) depending on the mutual vanishing rate of  $\delta$  and  $r$ . We also give an explicit nonlinear capacity-type formula for the interfacial energy density in each regime.