Oscillating minimizers of a fourth order problem invariant under scaling

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By variational methods we prove the inequality

$$\int_{\Re} (u")^2 \, dx - \int_{\Re} u" u^2 \, dx \geq I \int_{\Re} u^4 \, dx,$$

for all $u \in L^4(\Re, dx)$, with $u" \in L^2(\Re, dx)$, for some $I \in (-9, 64, -1/4)$. This inequality is connected to Lieb–Thirring type problems and has interesting scaling properties. The best constant is achieved by sign changing minimizers of a problem on periodic functions, but it does not depend on the period. This is joint work with I. Catto, J. Dolbeault, R. Monneau.